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Abstract (Cards 10-99, Columns 12-72)

360 GASP III IS A SYSTEM FOR EDUCATIONAL SCHEDULING (TIMETABLE CONSTRUCTION, RESOURCE ALLOCATION, SECTIONING, EXAMINATION SCHEDULING, SIMULATION AND PLANNING). THIS VERSION, DESIGNED WITH MODERN INSTITUTIONS IN MIND, IS ABLE TO COPE WITH MODULAR SCHEDULING, TEAM TEACHING, ABILITY TRACKING, INDIVIDUAL STUDIES, ETC.

IN CONTRAST TO MANY DATA PROCESSING ALGORITHMS, GASP IS BASICALLY HEURISTIC, SEEKING A 'SATISFACTORY' SOLUTION RATHER THAN AN 'OPTIMAL' ONE. THE APPROACH HAS PROVEN BOTH OPERATIONALLY AND ECONOMICALLY FEASIBLE. MAN/MACHINE INTERACTION IS REQUIRED, AND THE SYSTEM IS A SUCCESSFUL AND POWERFUL 'TOOL' WHEN USED PROPERLY AS SUCH. SAVINGS IN ADMINISTRATIVE TIME AND EFFORT HAVE BEEN REPORTED AS HIGH AS 75 PERCENT. COMPUTER TIME IS DIFFICULT TO ESTIMATE AS IT IS RELATED TO THE COMPLEXITY OF THE SCHOOL, BUT IT IS SELDOM PROHIBITIVELY HIGH. A MAJOR ADVANTAGE OF AUTOMATED SCHOOL SCHEDULING LIES IN RELIEF FROM BURDENS OF CLERICAL DETAIL.

THE PHILOSOPHY AND MECHANICS OF THE GASP APPROACH ARE DOCUMENTED IN THE WRITE-UP, AND THE USER MUST BECOME FAMILIAR WITH THESE IN ORDER TO IMPLEMENT THE SYSTEM. MORE DETAILED INFORMATION ABOUT THE AREA AND METHOD OF APPLICATION IS AVAILABLE IN THE WRITE-UP. THE TRANSMITTAL TAPE INCLUDES A LOAD LIBRARY, PROGRAM SOURCE AND OBJECT, AND SAMPLE DATA.

360 GASP III IS SIMILAR TO 7090/94 GASP III (MI GASP, SDA #3455) IN DOCUMENTATION AND EFFECT. (Please attach additional pages, if necessary)

Pages Attached: Key punchable Abstract Continuation (AC) _____

Non-Key punchable Supplement (NK) _____

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360 GASP III Generalized Academic Simulation Programs

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1.1.1 INTRODUCTION AND HISTORY

The first version of the GASP (Generalized Academic Simulation Programs) program was written in 1961-62. The second version was developed by 1963. The first two versions used 709/7090/7094 computers. The third version of GASP (GASP III) was implemented on 7090/94 equipment in 1966 and on 360 computers in 1967. There are major differences between each version and a few minor differences between the 360 and 7090 GASP III programs.

All three versions of the program were developed and written at the Massachusetts Institute of Technology under the auspices of the Office of the Registrar (up to 1964) and the Office of Institutional Studies (1964 on). The International Business Machines Corporation has supported the development of GASP with machine time; the Educational Facilities Laboratories provided financial support for the first two versions of the program.

This documentation is intended as a user's manual for the 360 GASP program. Persons using 7090/94 computers should refer to a similar, but separate publication describing the 7094 GASP III program.

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1.1.2 THE PROBLEM

The user of GASP should think of his school scheduling problem as a four-dimensional job of assigning

- 1) TIME
- 2) INSTRUCTORS
- 3) ROOMS
- 4) STUDENTS

to the CLASSES being offered.

The various ASSIGNMENTS to the classes represent the schedule; it will be the job of GASP to compute as many of the possible assignments for a school as the user desires. (For GASP, it will be said that "Mr. Brown is assigned to the French III class" rather than that "Mr. Brown is teaching French III").

The user specifies the range of possible assignments by giving REQUESTS; a request 'calls on' GASP to make 1 or more assignments. (For example: "assign one of the freshman English sections to Matilda Jones").

Finally, CONSTRAINTS may be placed upon GASP which further limit its computation of assignments. Constraints represent some of the 'rules of the game'. (For example: "don't assign more than 25 students to any Junior physics laboratory").

The user's definition of his school (the specification of the classes, time patterns, instructors, rooms, students) together with the associated requests and constraints will be organized for GASP by the user into a logical FRAMEWORK (which will later be called the GASP FILE).

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1.1.2(2) THE PROBLEM (Continued)

The user may also place fixed or permanent assignments in the framework if GASP is not to be given the job of computing them. GASP uses this framework as a definition of its problem; GASP's job is to 'complete' the framework by inserting the computed assignments it is requested to make into the framework.

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1.1.3 THE METHODS

An algorithm is a procedure which can be applied to a specific problem in order to achieve an exact or optimal solution; e.g. the steps taken to divide two numbers. An heuristic is like an algorithm except that the procedure or set of steps taken to solve a problem do not guarantee a single optimal solution.

Heuristics involve approximation and estimation. Often, heuristics attack a complex problem by dividing it into parts, the solution of each part ignoring some or all of the interactions with other parts. Where large numbers of permutations or combinations are a part of the problem, randomization and/or probability may be a part of the heuristic.

The GASP program uses many heuristics (like those above) and a few algorithms. The results obtained in applying GASP to a particular scheduling problem cannot be guaranteed to be 'best' possible. Experience has shown, however, that the heuristics employed by GASP usually lead to 'good' or 'reasonable schedules'.

Many of the heuristics of GASP are not unlike those of the hand scheduling process; the same trial and error methods used by a scheduling officer with traditional aid of pegboards and tags are often reflected in GASP. There are several steps in the process of building a school schedule; at each step there is communication both to and from the assisting computer. The user describes the characteristics of his school as a framework to be completed eventually into a final schedule. This completion of the framework is a feedback process; that is, GASP is given the framework several times in the process of building a schedule. Ideally these GASP 'runs' are made several days apart and at the end of each run the user may freeze those parts of the schedule with which he is satisfied. He may also find it necessary to change some of the

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1.1.3(2) THE METHODS (Continued)

constraints or to alter the request structure in the framework in anticipation of GASP doing a better job on the next run. The process is therefore an iterative one with the user made a part of each loop. In this manner it is possible for the user to inject his knowhow into the scheduling process; it is the human intuition and knowledge of when and what compromises can be made that "make or break" a schedule.

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1.1.4 TIMING AND COST CONSIDERATIONS

In attempting to estimate timing for GASP, the user should be aware of three factors: PROJECT LENGTH, MANHOURS SPENT, and COMPUTER TIME REQUIRED.

PROJECT LENGTH is seldom shorter than a month and is more likely to cover about three. This aspect is relatively unaffected by implementing GASP where hand scheduling has been used before: approximately the same planning is required in either case.

MANHOURS SPENT with GASP can be expected to represent 50% to 75% savings over the same hand scheduled operation. This aspect represents a significant difference in timing considerations when GASP has been implemented.

COMPUTER TIME REQUIRED is the least predictable of the three factors, since GASP is an iterative process and not a one-shot affair. This factor is dependent to a great extent on the characteristics of the school being scheduled, and from past experience can involve anywhere from 5 to 20 runs, costing several hundred dollars each (based on commercial rates).

The user can consider his computer utilization in four overlapping stages:

- 1) Debugging runs on the data framework to insure a "clean" file (first few runs)
- 2) Initial timetable development (first two-thirds of the runs)
- 3) Final timetable development (last two-thirds of the runs)
- 4) Refinement of resource schedules (final runs)

In the case of a new user of GASP, both machine time and manhours may be somewhat higher in the first year than in subsequent years since a significant amount of training for and practice in the use of GASP is a necessity. Further, it is not a good idea to implement GASP and a completely new scheduling scheme in the same year; one can get a quicker and better feel

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1.1.4(2) TIMING AND COST CONSIDERATIONS (Continued)

for using GASP if one knows what to expect of it in terms of a familiar schedule.

Finally, a very strong case can be made for the use of GASP as a simulating tool during decision making processes concerning basic changes in a school program which involve scheduling. GASP is well suited to test the feasibility of proposed changes in scheduling plans. When GASP is used for simulation studies, the user generally stops short of final refinement, and timing considerations are from 50% to 33% of production effort discussed above.

1.1.5 THE ADVANTAGES OF MACHINE SCHEDULING

GASP was developed to be a tool in the hands of a person responsible for building school schedules. GASP is intended to make the scheduler's job an easier one; it does so by providing clerical service for the simple obvious procedures required to develop a workable schedule on the basis of pertinent information about the school. The more difficult intuitive procedures are left to the scheduler. The role of GASP is to augment rather than supplant the experience and resources of the scheduling officer.

The main objective of the GASP approach is that it allows the school to capitalize on the top administration by providing these scheduling officers with time-saving, accurate, and effective assistance.

Other advantages of GASP are:

- 1) The low cost and investment associated with innovation and feasibility study
- 2) The facility with which the school can become involved with recent advances in education: MODULAR SCHEDULING, TEAM TEACHING, TRACKING and CONTINUOUS PROGRESS
- 3) The flexibility of approaches to a problem, and the applicability to a variety of different philosophies
- 4) The opportunity to introduce to the administration the fundamentals of a system approach to scheduling often leading to a renewed understanding of basic trouble spots and potential areas of significant improvement

1.1.5(2) THE ADVANTAGES OF MACHINE SCHEDULING (Continued)

While the GASP approach is similar to that of manual scheduling methods, there are some gains:

- 1) Heuristics and algorithms more mathematically oriented are brought to bear on scheduling decisions
- 2) A powerful file maintenance system allows the user to worry less about keeping his data organized; by splitting off this burden, more attention can be directed to the schedule itself
- 3) The user will find it comparatively easy to freeze portions of his schedule without the commitment so often associated with such a move; it is easier to undo and quite possible to redo
- 4) Because of this relative freedom from commitment at any given point, the user is encouraged to innovate and check out potential schemes
- 5) Far more statistics in the form of reports, distribution graphs, and summaries are feasible than with hand scheduling
- 6) Production output, suitable for distribution to students and staff, is a relatively small part of the overhead of the system, and is readily available when scheduling is completed

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2.1.1 CLASSIFICATION OF CHARACTERS

In general, 1 character corresponds to 1 position or column on an IBM card. Characters are classified as alphabetic, numeric, special, or local. The alphabetic characters are the 26 capital letters of the alphabet. The numeric characters are the 10 digits 0 through 9. Special characters are: period '.', comma ',', dash '-', dollar '\$', star '*', and slash '/'. Blank may usually be considered one of the alphabetic characters, and may also be used in place of preceding zeros in integers (unless otherwise specified).

ALL other characters on the machine equipment being used are designated local characters. Graphics for printing will not be guaranteed for local characters.

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2.1.2 ALPHANUMERIC ORDER

Frequently in GASP, comparisons and sequencing of characters will be necessary. In all such situations, a consistent ordering of the characters will be used. This ordering maintains the natural numeric sequence of the numeric characters, and the natural alphabetic sequence of the alphabetic characters. The numeric characters collate before the alphabetic characters. Blank is the first (lowest) character in the ordering, and special characters precede both the numeric and the alphabetic characters. NOTE THAT LOCAL CHARACTERS are not assigned a place in the ordering. Exact alphanumeric order (or 'collating sequence') is given by the table below:

1. blank
2. \$ * . - , /
3. 0 1 2 3 4 5 6 7 8 9
4. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

(The above sequence follows the ASCII standard).

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2.2.1 TIME PATTERNS, GENERAL DISCUSSION

The following definitions will be of use: the schedule cycle is that period of time for which the schedule does not repeat itself. In traditional situations, this is almost always one week. The cycle is divided into a number of modules (or periods; the two terms will be used interchangeably). For example, many high schools employ six, seven, or eight periods per day. With the usual five day cycle this means that the cycle is composed of 30, 35, or 40 modules.

Let N be the number of modules in a schedule cycle. Let P be the number of modules used for each day of the cycle. Number the modules consecutively in the cycle, 1 through N . Then the first P modules represent the first day of the cycle, the next P modules the second day of the cycle, and so on. GASP limits N (the total number of modules in the cycle) to not more than 160. Further, P (the number of periods per day) must not be greater than 32. Finally, N/P (the number of days in the cycle) must not be greater than 12.

A time pattern is defined to be any combination of periods in the cycle. Consider the 35 module cycle representing the 'five day, seven module per day' situation ($N = 35$, $P = 7$). Modules numbered 1, 8, 15, 22, and 29 would represent the time pattern 'first period every day'. Modules numbered 13 and 14 would represent the time pattern 'double period beginning in period 6 on Tuesday'.

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2.2.2 TIME PATTERN NAMES

All time pattern names used by GASP must be constructed as described in this section. Each day in the cycle must be given a one character day name; alphabetic or numeric characters must be used (special or local characters are not allowed, nor is blank). Periods are also given period names; from one to five alphabetic or numeric characters are used, blank or local characters may not be used. Of the special characters, only the period . may be used. A DAY NAME MAY NOT BE ONE OF THE CHARACTERS USED IN A PERIOD NAME.

Time pattern names may best be described with a number of examples. Suppose that a college schedules classes Monday through Friday, 8 A.M. through 6 P.M. Further, classes are scheduled 9 A.M. through noon on Saturday, and a few classes are scheduled weekday evenings. Between 9 A.M. and 5 P.M. each half hour must be accounted for since some classes meet for one hour, and some for one and one half hours, during this time.

Let us assign day names of M, T, W, R, F, S for Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday respectively. Let us assign period names 8, 9, 9.30, 10, 10.30, 11, 11.30, 12, 12.30, 1, 1.30, 2, 2.30, 3, 3.30, 4, 4.30, 5, and EVE. Further, let us assume that the usual class is of one hour duration (two half hour periods); this number of periods in the most commonly used class arrangement will be termed the standard class length and in this example it is 2. The periods 8, 5, and EVE stand in a special status inasmuch as they are not one half hour periods. Day names, period names, standard class length, and special status periods may be specified by the user; see the section titled DAY AND MODULE SPECIFICATIONS, XL RECORD OPTIONS (5.2.2) for details.

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2.2.2(2) TIME PATTERN NAMES, (Continued)

GASP will recognize time pattern names based on the above information as follows:

Example #	TIME PATTERN NAME	Description
1	MWF 9	Monday, Wednesday, Friday 9 to 10
2	T EVE	Tuesday Evening
3	R 12-3.30	Thursday noon to 3.30 (<u>not</u> the period 3.30 to 4)
4	TR 2 TR 9	Tuesday and Thursday 2 to 3 and 9 to 10
5	MW 10.30, F2	Monday and Wednesday 10.30 to 11.30 Friday 2 to 3
6	MW 10.30 *LAB TO BE ARRANGED	Monday and Wednesday 10.30 to 11.30
7	MW 10.30 *LAB, F2-5	Monday and Wednesday 10.30 to 11.30 Friday 2 to 5
8	M9, TR10, WF2, S10-12	Monday 9 to 10, Tuesday and Thursday 10 to 11, Wednesday and Friday 2 to 3, Saturday 10 to 12
9	M9TR10WF2S10-12	(SAME AS EXAMPLE 8)
10	MWF 8, MWF 9-11	Monday, Wednesday, Friday 8 to 11
11	(TO BE ARRANGED)	Pattern will include no periods
12	F	Friday, all day
13	9	ILLEGAL; pattern will include no periods

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2.2.2(3) TIME PATTERN NAMES, (Continued)

Example #	TIME PATTERN NAME	Description
14	M 9-	ILLEGAL; treated as M 9
15	M-9	ILLEGAL; treated as M 9
16	(SEE INSTRUCTOR IN CHARGE). MWF9.	Monday, Wednesday, Friday 9 to 10

The above examples show that:

- A) the basic element of a time pattern name is one or more day names, optionally followed by a period name (#1) or by two period names connected by the dash '-' character (#3).
- B) any number of these basic elements may be combined to make up a more complex time pattern name. Blanks may intervene (#4), the comma ',' may be used to separate the basic elements (#5), or they may simply be run together without fear of ambiguity (#9).
- C) if the special character dash '-' is not used, the standard class length is assumed (#1,#4), except for special status periods (#2,#9).
- D) characters between any special (or local) character (except '.', '-', or ',') and the first occurring comma are treated as arbitrary comments, and will not enter into the time pattern (#6,#7,#16)
- E) all blank or all comment time pattern names result in empty time patterns (#11)
- F) blanks are completely ignored in the interpretation of time pattern names

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2.2.2(4) TIME PATTERN NAMES (Continued)

- G) While commas may be used to signal the end of a basic element of the time pattern name (#8), they are generally not required (#9). They are required to terminate comments initiated by a special (or local) character (#7). Had the commas been left out of (#7) the basic element F2-5 would have been treated as part of the comment and would have been ignored.

These examples show only one possible interpretation of the dash '-' character; that is, 'up to but not including the following period name'. The alternate interpretation, 'up to and including the following period name' is possible; see the section DAY AND MODULE SPECIFICATIONS, XL record options (5.2.2) for details.

Basic time pattern names are limited to 32 characters; in some situations time pattern names are limited to fewer positions. Time pattern names appear on various outputs and are interpreted and used by GASP to specify the modules used by time patterns they name.

2.2.3 TIME PATTERN KEYS

Each time pattern used by GASP must have an eleven character time pattern key associated with it. This time pattern key provides the main identification for the time pattern; each time pattern key must be different from all other time pattern keys.

The first character in all time pattern keys is the special character period '.'. The remaining ten characters may be any alphabetic, numeric, or special character (but NOT a local character). Blanks may also be used in time pattern keys. Except for the initial period, the format of time pattern keys is at the discretion of the user.

It is suggested that the user assign time pattern keys so that they represent easily remembered mnemonics for the time patterns they identify. In cases where time pattern names are short (10 characters or less) with NO LOCAL CHARACTERS, the names may also be used for the time pattern keys.

Hereafter the symbol

.ttttttttt

will often be used to denote a time pattern key. Examples of legal time pattern keys are:

.MTWRF 3	.*LUNCH,M11	.5X1 MOD 15
.ABCDE14	./LAB/, 4C	. REGTP59
.ABCDE 14	.LAB 4C	.MT4,F2-5
.00312	.LUNCH M11	.LAB,MORN,8

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2.2.4 TIME PATTERN BLOCKS

Time pattern blocks represent a partition of the schedule cycle into one to eight patterns. The purpose of these blocks is to organize the time patterns of the school into basic families. Time patterns belong to a block if they overlap (fall within) the block. The following rules characterize these blocks:

- 1) No pair of blocks should conflict
- 2) Time patterns of the school should ordinarily fall within a single block. (This will not always be possible).
- 3) The blocks should 'cover' the entire cycle.

The user should design blocks AND time patterns such that the above rules are satisfied as often as possible.

If the user does not specify time pattern blocks, GASP will assign up to eight blocks as described in the following examples:

Let P = number of modules on each day.

2.2.4(2) TIME PATTERN BLOCKS (Continued)

CASE I, P no greater than 8

- A) P blocks will be assigned
- B) The first block will be 'every day, module 1'
The second block will be 'every day, module 2'
...
etc.

CASE II, P = 16

- A) Eight blocks will be assigned
- B) The first block will be 'every day, modules 1-2'
The second block will be 'every day, modules 3-4'
...
The eighth block will be 'every day, modules 15-16'

CASE III, P = 15

- A) Eight blocks will be assigned
- B) Same as case II, except
...
The eighth block will be 'every day, module 15'.

CASE IV, P no greater than 8

- A) Eight blocks will be assigned
- B) Blocks always contain the same modules on each day
- C) The average block will contain P/8 modules on each day;
- D) Two blocks can differ by at most 1 module per day;
The 'earlier' part of the day will have the longer blocks.

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2.3.1 RESOURCES, GENERAL DISCUSSION

The resources of a school are defined to be its instructors, rooms, and students. Reference will sometimes be made to the instructor resource set (group of all instructors for a school), room resource set, or student resource set.

A resource element is a single instructor, room, or student.

Often the symbol

I

Will be used to denote instructors; the symbol

R

Will be used to denote rooms; and the symbol

S

Will be used to denote students

2.3.2 RESOURCE NAMES

Each resource element may be assigned up to 32 characters of arbitrary information by the user, which will be termed its resource name. Such resource names are NOT used internally by the GASP program; however, resource names do appear on various outputs of the program. Usually, the full name of instructors, rooms, or students will appear as a part of the resource name; other information which might be included are phone extensions of instructors, capacities of rooms, or, for students: home room numbers, locker codes, etc.

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2.3.3 RESOURCE KEYS

Each resource element used by GASP (instructor, room, or student) must have an eleven character resource key associated with it. This resource key provides the main identification for the resource element; each resource key must be different from all other resource keys.

The first character in all resource keys must be either I (for instructors), R (for rooms), or S (for students). The remaining ten characters of resource keys may be any alphabetic, numeric, or special character (but NOT a local character). Blanks may also be used in resource keys. Except for the initial alphabetic character, I, R, or S, the format of resource keys is at the discretion of the user.

It is suggested that the user assign resource keys so that they represent easily remembered mnemonics for the resource elements they identify. Often a significant portion of the resource name may be used as the key; for instructors the last name and initials, for rooms the school designation for the room number or name, for students the school number or the social security number might provide a sensible resource key.

Hereafter the symbol xrrrrrrrrrr

will often be used to denote resource keys. Examples of legal resource keys are:

ISMITH AE
ISMITH QX
IMACFARLA
IENGPROFS

R L 2
R356
R 356
RE19-319

S63589
S532345681
SJONES JD
SJUNIOR 478

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2.4.1 SUBJECT (OR COURSE) NAMES

Each subject (or course; the two designations are used interchangeably) must be assigned a unique subject name of six characters. Any alphabetic, numeric, or special character (but NOT a local character) may be used in a subject name. Blanks may also be used in subject names. These subject names will always be used to designate subjects on outputs from the GASP program. Hence character combinations should be selected with outputs like student schedules in mind. Since the subject name provides the only identification of the subject, each subject name must be different from all other subject names.

Reference should be made to the following section SUBJECT TRACKS (2.4.2) for additional information on subject names.

Hereafter the symbol

jjjjjj

will often be used to denote subject names. Examples of legal subject names are:

EN 152
SC 444
MATH 3
MATH-3

PHY ED
18.372
479
CHORUS

BAND
L III
8/3/A
QUIZ

2.4.2 SUBJECT TRACKS

The user may wish to specify tracking for subjects. Up to 36 tracks may be specified for any subject. Tracking is ordinarily used in cases where several classes of the same subject are taught at varying levels of difficulty or rates of progress. Tracking is specified by a single alphabetic or numeric character (blank may NOT be used) called the track character. Track characters are positioned immediately to the right of the six character subject name.

If a subject is not tracked, GASP is designed so that the position reserved for the track character may be used as an additional part of the subject name, allowing seven character subject names for untracked subjects. Seven character subject names permit the use of blank or special characters in the seventh position, as well as alphabetic or numeric characters.

Hereafter the symbol

k

will often be used to denote track characters. The notation

jjjjjjk

denotes a subject track (or if tracking is not used, the subject name).

2.4.2(2) SUBJECT TRACKS (Continued)

Examples of legal subject tracks are:

HI 11 A	AM HIS1	CHORUSH
HI 11 B	AM HIS2	CHORUSF
HI 11 C	AM HIS3	
HI 11 Z	AM HI69	

Examples of subject names of 7 characters are:

ORCHEST
DRIV ED
HOME EC
18.985J

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2.4.3 SUBJECT PHASES

Any subject, or subject track, may be taught in several phases. For example, a subject may have a recitation phase and a laboratory phase; in secondary schools with 'team teaching', subjects are often given in lecture, medium, seminar and individual study phases. Each such phase is identified with a single alphabetic or numeric character (blank may also be used) called the phase character. Phase characters are positioned immediately to the right of the seven character subject track.

Hereafter the symbol

p

will often be used to designate phase characters. The notation

jjjjjjkp

denotes a subject phase. Examples of legal subject phases are:

18.01 T	EN 223 L	357 AR
18.01 TL	EN 223 M	357 AB
18.01 TB	EN 223 S	CHEM R
18.01 TR	EN 223 I	CHEM B

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2.4.4 CLASSES (OR SECTIONS)

A subject phase may be offered in, or subdivided into, numerous classes (or sections, the two terms are used interchangeably). Classes of a subject phase are identified by attaching two numeric characters (blank may NOT replace preceding zeros in this integer) called the class integer to the subject phase. The class integer is positioned immediately to the right of the eight character subject phase.

Hereafter the symbol

cc

will be used to denote the class integer of a subject phase. The notation

jjjjjjkpc

denotes the class representation.

Ordinarily, the first class of a subject phase would have a class integer equal to 01, the second class a class integer of 02, and so on up to a maximum of 99. However, it is not necessary that the class integers begin at any particular number, nor is it necessary to avoid 'gaps' between successive classes. A class integer may not be used more than once for a subject phase, since it is imperative to have unique representations. Examples of legal class representations are:

SCI 13H 01	18.03 TL10	CHORUS 91
SCI 13H 02	18.03 TL20	CHORUS 92
SCI 13H 03	18.03 TL30	CHORUS 93
SCI 13H 24	18.03 TL40	BAND M01

2.4.5 CLASS NAMES

Each class may be assigned up to 10 characters of arbitrary information by the user, which will be termed its class name. Such class names are NOT used internally by the GASP program; however, class names do appear on various outputs of the program. Often, class names are equivalent to the class representation described in 2.4.4 TITLED CLASSES (OR SECTIONS).

2.4.6 CLASS KEYS

Each class used by GASP must have an eleven character class key associated with it. The class key provides the main identification for the class; each class key must be different from all other class keys.

The first character in all class keys must be the special character slash '/'. The remaining ten characters of the class key must be the class representation described in the previous section 2.4.4 TITLED CLASSES (OR SECTIONS), that is jjjjjjkpcc

Hereafter the symbol

/jjjjjjkpcc

will often be used to denote class keys.

When it is necessary that GASP determine ALL subjects for a school, all unique jjjjjj parts of the class keys provide the answer. Likewise, all unique jjjjjjk parts of class keys determine the collection of ALL subject tracks, and all unique jjjjjjkp parts of class keys identify the collection of ALL subject phases.

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2.5.1 GROUP DESIGNATORS, GENERAL

Each class, each time pattern and each resource element used by GASP must have a four position group designator assigned to it by the user. Group designators may contain alphabetic, numeric or blank characters. Basically, each character position in a group designator should contain a code describing some attribute relating to the user's school. The codes used, and the attributes they describe are arbitrary and will differ from school to school.

Group designators are used by many parts of the GASP program to access special groupings of classes, time patterns, instructors, rooms or students. The term 'special groupings' in the above sentence invariably means groupings which 'make sense' for the particular school being scheduled.

In the following sections of this manual, many references will be made to group designators; wherever possible hints and suggestions will be made regarding their specification and use. In this section some general examples will be given as an introduction to group designators.

Hereafter, the mnemonic

dddd

will be used to refer to a group designator. The five kinds of group designators will be referred to as class group designators, time pattern group designators, instructor group designators, room group designators and student group designators.

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2.5.2 CLASS GROUP DESIGNATORS

Attributes which will often have pertinence in describing classes are

- 1) Subject area, i.e. English, History, Math, etc.;
- 2) The class of the students most likely to be assigned to the section, i.e. Freshmen, Seniors, etc.;
- 3) The level at which the subject is taught, i.e. Advanced Placement, Honors, Standard, Remedial, etc.;
- 4) The type of subject, i.e. Required, Elective, etc.

Other attributes, if they are more descriptive of classes in a given situation, should replace some or all of the above examples.

Suppose, for example, that the above four attributes are selected for inclusion in class group designators. The question remaining concerns appropriate coding for these attributes. First of all, each of the attributes must be assigned a unique character position in the class group designators; the position chosen for each attribute must remain the same for ALL classes in the school. Suppose that the positions chosen match the examples as numbered above; that is, subject area will be coded in position 1 of all group designators for classes; class of students will be coded in position 2, and so on. One suggested coding scheme for the four attributes is suggested in the following table:

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2.5.2(2) CLASS GROUP DESIGNATORS (Continued)

1) <u>Subject Area</u>	2) <u>Class/Students</u>	3) <u>Subject Level</u>	4) <u>Subject Type</u>
E English	1 Freshmen	A Advanced Plcmt.	R Required
H History	2 Sophomores	H Honors	E Elective
S Science	3 Juniors	O Ordinary	
M Math	4 Seniors	R Remedial	
L Language			
P Phys Ed.			
A Academic Elec.			
B Business Elec.			
C Technical Elec.			

Coding for group designators is, for the most part, arbitrary and should be done so that the codes have mnemonic value to the user; however, in situations like 2) and 3) above where the attributes can be logically placed on a numeric scale (or in a top-to-bottom listing) the codes should be designed so that their alphanumeric order is appropriate.

Given all of the above discussion and the above table, examples can be given of classes and their appropriate group designators:

The class group designator 'E3HE' refers to an English class basically taught to Juniors at the Honors level as an elective. The class group designator 'C AE' could refer to a basket-weaving class which is taught to no particular level of students (the second position is blank) at the Advanced Placement level as an elective.

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2.5.3 TIME PATTERN GROUP DESIGNATORS

Characteristics of the time patterns must be coded into the time pattern group designators in a fashion similar to that used for coding the characteristics or the classes in class group designators. Again, the attributes coded into the four positions are arbitrary, and should reflect an appropriate classification for the particular school. However, it is recommended that the first two positions of the time group designators be defined as in the following example.

In this example for time pattern group designators, the first two positions are used to describe the module/day format of the time pattern. The first position is a numeric digit specifying the longest number of consecutive modules for any day in the time pattern. The second position is a numeric digit specifying the number of days used by the time pattern.

The attributes selected for coding in the third and fourth character positions are more variable. Examples of possible characteristics are 1) time of day, i.e. 'basically a morning pattern', 'basically a pattern around lunch periods', 'basically an afternoon pattern', etc.;

2) special use time patterns, i.e. 'patterns which are useful for most subjects', 'patterns which are useful for laboratory subjects only', etc.

Suppose that the day names for a school are M, T, W, R, and F; suppose that the period names are 1, 2, 3, 4, 5, 6, and 7. Further, suppose that the notation 2-3 is used to

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2.5.3(2) TIME PATTERN GROUP DESIGNATORS (Continued)

indicate the periods '2 and 3', not '2 to 3'. Then, examples of time patterns with appropriate group designators are

<u>Time Pattern</u>	<u>Group Designator</u>	<u>Comments</u>
MTWRF 3	15AR	'A' indicates A.M. (morning) 'R' indicates regular pattern
MTRF 6	14PR	'P' indicates P.M. (afternoon)
W 6-7	21PL	'L' indicates lab pattern
M 1-2, TWRF 2	25AC	'C' indicates special pattern useful only for Chemistry
MWF 6, TR 5-7	35PX	The longest number of consecutive modules on any day (both T and R) is 3. The pattern uses 5 days.
MRF 4-5	23HL	'H' indicates lunch period involved

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2.5.4 RESOURCE GROUP DESIGNATORS

Characteristics of the resources must be coded into the resource group designators in a fashion similar to that used for coding the characteristics of the classes in class group designators. While the attributes coded into the four positions are arbitrary, the first three positions of these group designators will be involved with class/resource ties if the confining rule is specified for the resource element. Reference should be made to the section (3.3.10) titled CL RECORDS, CR FIELD (CONFINING RULES).

Examples of attributes which may be coded into instructor group designators are

- 1) Rank, i.e. head of department, master teacher, teacher, apprentice, etc.;
- 2) Department, i.e. English, Math, etc.;
- 3) Specialty, i.e. honors groups, remedial groups, etc.

Examples of attributes which may be coded into room group designators are

- 1) Location on campus
- 2) General room size category
- 3) Type of room, i.e. laboratory, standard class room, special class room, lecture hall, etc.

Examples of attributes which may be coded into student group designators are

- 1) Class level, i.e. freshman, sophomore, etc.
- 2) Male/female
- 3) General track of student, i.e. honors, standard, remedial, etc.

2.5.5 GROUP DESIGNATOR SELECTORS

Group designator selectors are used to access groupings of classes, time patterns, and resource elements which are determined by their group designators.

Hereafter, the mnemonic

hhdddmmmm

will be used to denote a group designator selector.

The dddd and mmmm portions of group designator selectors correspond to group designators. The four position group designators of the classes, time patterns, or resource elements under consideration are compared, position by position, with the corresponding d and m parts of the selector.

If a d position in the selector is blank, any character in the corresponding position of the group designator being examined will be selected. Further, if a position in the group designator being examined is blank, it will be selected regardless of the corresponding d and m positions in the selector.

If a d position in the selector is the same as its corresponding m position, to be selected the corresponding position in the group designator being examined must match (be the same as) the d and m positions.

If a d position in the selector is lower (according to alphanumeric order) than its corresponding m position, the corresponding position in the group designator being examined must fall within the 'range' determined by 'd through m inclusive'.

2.5.5(2) GROUP DESIGNATOR SELECTORS (Continued)

If a d position in the selector is higher (according to alphanumeric order) than its corresponding m position, the corresponding position in the group designator being examined must fall outside the range determined by 'm through d, exclusive'.

Group designators, as described so far, provide a means for determining whether or not a class, time pattern or resource element falls into a grouping specified by the selector. In GASP, when such an interpretation must be made, the hh portion of the group designator selector fields is not used.

The hh portion of the group designators is included when GASP must build a list of classes, time patterns or resource elements on the basis of the selector. All classes, time patterns or resource elements in the grouping specified by the ddddmmmm portion of the selector are regarded as candidates for such lists. The hh portion of group designator selectors allows the user to specify both the size of the list and the ordering of the elements within the list.

If hh is *L, all classes, all time patterns, or all resource elements in the grouping specified by the ddddmmmm portion of the selector will be included in the list in alphanumeric sequence on their keys.

If hh is *R, all classes, time patterns, or resource elements in the grouping specified by the ddddmmmm portion of the selector will be included in the list. In this case however, the list will be in random (unpredictable) order.

2.5.5(3) GROUP DESIGNATOR SELECTORS (Continued)

Finally, if hh is an integer nn, only nn elements of the classes, time patterns, or resource elements specified by the ddddmmmm portion of the selector will be included in the list. The ordering will be random, as was true of the *R option.

As an example. Consider the following 10 class group designators (refer to section 2.52 titled CLASS GROUP DESIGNATORS also).

Group Designator,	
<u>dddd</u>	
1)	E1H (English, Freshman, Honors)
2)	E4A (English, Senior, Adv. Placement)
3)	S2RR (Science, Sophomore, Remedial, Required)
4)	S3RR (Science, Junior, Remedial, Required)
5)	M4OE (Math, Senior, Ordinary, Elective)
6)	L4 E (Language, Senior, Elective)
7)	P2 E (Phys Ed, Sophomore, Elective)
8)	P1 E (Phys Ed, Freshman, Elective)
9)	A E (Academic, Elective)
10)	C E (Technical, Elective)

Typical group designator selectors would act on the above designators as follows:

Selector	
<u>ddddmmmm</u>	<u>would select from above designators</u>
S2RRS2RR	3), 'Science, Sophomore, Remedial, Required'
S RRS RR	3) and 4), 'Science, Remedial, Required'
E E	1) and 2), 'English'
OE OE	5), 6), 7), 8), 9) and 10), 'Ordinary, Elective'
3 4	2), 4), 5), 6), 9) and 10), 'Junior and Senior'
D 9	1), 2), 3), 4), 5), 6), and 7) and 8), 'all except Academic, Business, Technical'
F D	1), 2), 3) and 4), 'all except Elective'
1 S 2 Q	1), 7), 8), 9) and 10), 'Freshman and Sophomore, except required'
L RL R	none 'Language, Required'
0000ZZZZ	all group designators are selected by completely blank selectors
	all group designators are selected

2.6.1 ASSIGNMENTS IN GASP, DESCRIPTION

The term assignment refers to the act of scheduling one time pattern or resource element to a class. A time assignment will refer to the time pattern assigned to a class; a resource assignment (instructor assignment, room assignment, student assignment) will refer to a resource (instructor, room, student) assigned to a class. Assignments may be represented by writing a class key, and a time pattern key or resource key, as a pair; for example:

/LAT 42H 02 and .MTWRF 7	(Time assignment)
/18.03 JL34 and .RTP 28	(Time assignment)
/EN 441S 04 and ISMITH LQ	(Instructor assignment)
/18.03 JL34 and R14N-332	(Room assignment)
/BWEAVEHL83 and S375807757	(Student assignment)

Assignments can be categorized as being either temporary or permanent, and as being either valid or invalid. A temporary assignment can be made only by GASP, not by the user; such assignments are liable to be altered during a GASP run. A permanent assignment, however, is always set by the user, and will never be altered by GASP.

The first requirement for a valid assignment is that it does not lead to a conflict. The other requirement is that all constraints placed on the assignment are satisfied. Constraints are limitations which can be placed on assignments by the user and which will be described in later sections. If these requirements are not met an assignment may still be made but will be regarded as invalid.

2.6.2 ASSIGNMENT CHARACTERS

Whenever an assignment exists, whether made by GASP or supplied by the user, an assignment character is automatically included as part of the assignment. Assignment characters are chosen from the special character set, and 'flag' the status of the assignment with respect to its being temporary or permanent, and valid or invalid. The actual character chosen is determined by the status table below. The user may partially control the use of assignment characters; reference should be made to the section (4.3.4) titled ASSIGNMENT CONTROL CORRECTIONS.

Hereafter the symbol

g

will often be used to denote the possible assignment control characters.

STATUS TABLE FOR ASSIGNMENT CHARACTERS

	<u>VALID</u>	<u>INVALID</u>
TEMPORARY	,	\$
PERMANENT	.	*

The GASP program automatically selects the appropriate temporary and permanent assignment characters to use for assignments; the user need not, and can not, establish the validity of an assignment. On the other hand, GASP will never automatically change temporary assignments to permanent ones or vice versa. The user has complete control over the permanency of the assignment characters.

2.6.3 ASSIGNMENT REQUESTS IN GASP, DESCRIPTION

An assignment request, or simply a request, provides information which specifies assignments to be made by GASP. Requests will be categorized as time requests or resource requests as described in the following sections.

Requests consist of one or more request components. Each component has a request modifier character included with it; these characters determine the specific role the component is to play.

Hereafter the symbol

q

will be used to denote the possible request modifier characters.

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2.6.4 TIME REQUESTS

At most one time request may be associated with each class. The components of a time request are

<u>component</u>	<u>q</u>	<u>Description</u>
------------------	----------	--------------------

.tttttttttL		Specification of one of the possible time pattern keys which GASP may assign to the class.
-------------	--	--

*hhdddmmmL	hhdddm	hhdddm is a time pattern group designator selector. Any time pattern key selected by this selector is one of the possible time pattern keys GASP may assign to the class.
------------	--------	---

Note that the request modifier character for time request components is always 'L', mnemonic for 'List'. Where the user has made a request not satisfied by at least one permanent time assignment to the class, GASP will provide a temporary time assignment on the basis of the list of time pattern keys specified or selected by the components of the request. The maximum number of request components is variable but ordinarily it will be equal to the number of modules in the schedule cycle.

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2.6.5 RESOURCE REQUESTS

Several resource requests may be associated with each resource element. The components of resource requests are:

<u>component</u>	<u>q</u>	<u>Description</u>
/jjjjjjkpcR	R	'Required request'. This component represents one request. GASP will insure that one assignment is made for the subject phase jjjjjjkp. If a class integer cc is specified, the request can be satisfied by that class only; in normal usage cc is unspecified (blank).
/jjjjjjkpcT	T	'Track substitution request'. This component represents one request. GASP will insure that one assignment is made for the subject phase jjjjjjkp if a valid assignment is possible. If a valid assignment is not possible track substitution is tried (see the section titled TRACK SUBSTITUTION, 2.7.6). If a class integer cc is specified, the request can be satisfied by a class with that class integer only; in normal usage cc is unspecified (blank). *See footnote
/jjjjjjkpcE	E	'Elective request'. This component represents one request. GASP will insure that one assignment is made for the subject phase jjjjjjkp unless a valid assignment cannot be made and an Alternate request is available. See following component. If a class integer cc is specified, the Elective request can be satisfied by that class only; in normal usage cc is unspecified (blank). *See footnote
/jjjjjjkpcA	A	'Alternate request'. This component is considered as an alternative to any Elective request(s) for the resource element. If a valid assignment cannot be made for an Elective request but a valid assignment can be made to a class of the subject phase jjjjjjkp (to the class jjjjjjkpc if cc is specified), the latter assignment will be made in lieu of the former. In normal usage cc is unspecified (blank). *See footnote
/jjjjjjkpnnM	M	'Multiple request'. This component represents one request. GASP will make up to nn valid assignments for the subject phase jjjjjjkp; only valid assignments will result from multiple requests and therefore no assignments need result. If nn is unspecified (blank), all classes of the subject phase may be assigned.

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2.6.5(2) RESOURCE REQUESTS (Continued)

<u>component</u>	<u>q</u>	<u>Description (Continued)</u>
/jjjjjjk*ccq		(Where q is one of the first four modifier characters above: R, T, E, or A).
/jjjjjjk*nnM		Requests of the form /jjjjjjkpcq (/jjjjjjkpnnM) will be satisfied for each phase p of the subject track jjjjjjk.
/jjjjjjk* q		
/jjjjjjk* M		
*hhdddmqq		(Where q is any of the request modifier characters: M, A, T, E, or R; and hhdddm is a class group designator selector). Requests of the form jjjjjjkp q will be satisfied for any subject phase jjjjjjkp involving a group designator selected by hhdddm.

*Footnote:

For the 360 'Basic' option, T (Track substitution) and E (Elective) requests are treated identically to R (Required) requests. A (Alternate) requests are ignored.

2.7.1 RESOURCE LOADS

The load of a resource element is defined to be the number of modules in the cycle occurring in assignments for the resource element. The upper limit of the load of any resource element can be specified by the user. If the maximum load for a resource element is specified, too many requests may result in assignments which exceed the specified load. In this case, assignments made when and after the load is exceeded will be flagged with an invalid assignment character.

Ordinarily, maximum loads are used for resources with Multiple requests which might result in more assignments than the user desires.

This constraint is ignored for the 'Basic' 360 option.

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2.7.2 RESOURCE FREE TIME

The user may specify a time pattern of modules for which a resource element is not to be assigned. If assignments of classes are made which conflict with this free time, such assignments will be flagged as invalid. The user may specify resource free time by either giving a time pattern name or by giving a time pattern key. If free time is specified for a resource element, that time is not included in load calculations for the element.

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2.7.3 RESOURCE PREFERRED FREE TIME

The user may specify a time pattern of modules for which a resource element would preferably be free of assignments. While such time patterns are taken into consideration by GASP, valid assignments may be made which conflict with preferred free time modules. The user may specify resource preference time by either giving a time pattern name or by giving a time pattern key.

For the 'Basic' 360 option, this preference is ignored.

2.7.4 CLASS RESOURCE MAXIMUMS

A class resource maximum (class instructor maximum, class room maximum, class student maximum) sets an upper limit or capacity on the number of resource assignments (instructor assignments, room assignments, student assignments) which can be made for a particular class. For instructor or room assignments, this maximum is usually 1 except for team teaching situations or for classes requiring more than 1 room. For students, this maximum represents the seat capacity for the classes.

Where maximums are specified and requests force assignments to exceed these maximums, assignments will be made to such classes but will be identified as invalid.

2.7.5 SUBJECT PHASE PRIORITY

Subject phase priority represents an additional organization of subject phases for the entire school. A non-zero subject phase priority digit establishes for each subject phase a suggested place in the sequence GASP will use in scheduling the entire school. In general, phases with a priority character of 1 will be scheduled first, those with 2 next and so on.

GASP reserves for itself the final judgement as to the exact scheduling order and in some cases will override the user's priority. An intelligent choice of priority will assist GASP considerably in making good assignments from the viewpoint of the user. In most cases this priority should establish the same order the user would use to attack the problem were he doing the master schedule himself.

Usually, three or four levels of priority are adequate; it is not useful to specify any more than a rough categorization of priority.

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2.7.6 TRACK SUBSTITUTION

The term track substitution represents an additional organization of tracks within a subject. Up to three track substitutions can be associated with each subject track. The one, two, or three track characters given as track substitutions are interpreted by GASP as being alternatives when considering original resource requests. In cases where the user has provided a track substitution request and valid assignments can not be made to the original subject track, the track substitutions will be tried until either a valid assignment can be made, or all of the track substitutions have been tried. For the 'Basic' 360 option, track substitutions will not be made; Track substitution requests are treated identically to Required requests in this case.

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2.7.7 CLASS/CLASS TIES

There are situations where the user of GASP will wish to make an 'association' between the classes of one subject phase and another subject phase. Frequently these associations will be between phases of the same subject, but they may also involve phases of two subjects.

The class/class tie is the class key of a previously scheduled class which by this reference (tying) provides a context in which the tied class is to be scheduled. Such ties allow the schedule of the tied class to be based on the schedule of the class to which it is tied. The user must also provide, in addition to the basic class/class tie, instructions as to the use of the tie. The specific instructions are described in the following two sections titled PHASE SEQUENCING RULES and THREADING RULES (2.7.8) and (2.7.9). The specification of a class/class tie, without an accompanying specification for at least one of the above rules, has no value except that it may affect the sequencing or ordering of subject phases in scheduling processes.

In specifying class/class ties, any class may be tied to one (and only one) other class; however, any class may have several classes tied to it. If several classes of a subject phase have ties specified to other classes, all such ties must be made to classes of the same subject phase.

There may be 'chains' of such ties; that is, classes of one subject phase may be tied to classes of another subject phase which in turn may be tied to classes of a third subject phase, and so on. It is a further requirement that subject phases may not recur in a chain of class/class ties so that a 'loop' or 'cycle' results.

2.7.7(2) CLASS/CLASS TIES (Continued)

Examples of legal class/class tie specifications are:

1. Classes of HI 11 XS tied to classes of HI 11 XM:
HI 11 XS01 tied to HI 11 XM01
HI 11 XS02 tied to HI 11 XM01
HI 11 XS03 tied to HI 11 XM01
HI 11 XS04 tied to HI 11 XM02
HI 11 XS05 tied to HI 11 XM02
HI 11 XS06 tied to HI 11 XM02
HI 11 XS07 tied to HI 11 XM03
HI 11 XS08 tied to HI 11 XM03
HI 11 XS09 tied to HI 11 XM03
Classes of HI 11 XM tied to classes of HI 11 XL:
HI 11 XM01 tied to HI 11 XL01
HI 11 XM02 tied to HI 11 XL01
HI 11 XM03 tied to HI 11 XL02
2. Classes of CHEM 1 R tied to classes of CHEM 1 B:
CHEM 1 R01 tied to CHEM 1 B01
CHEM 1 R02 tied to CHEM 1 B02
CHEM 1 R03 tied to CHEM 1 B03
CHEM 1 R04 tied to CHEM 1 B04
3. Classes of ENG 43 S tied to classes of ENG 43 M
Classes of ENG 43 M tied to classes of ENG 43 L
Classes of LIT 41 L tied to classes of ENG 43 L
Classes of LIT 41 S tied to classes of LIT 41 L
In example 3, it would be illegal to add the further tie
Classes of ENG 43 L tied to classes of LIT 41 S
since this would represent a 'loop' in the chain of ties: LIT 41S ties to LIT 41 L ties to ENG 43 L ties back to LIT 41 S
4. Classes of FRENCH S tied to classes of FRENCH L
Classes of FRENCH M tied to classes of FRENCH L
Classes of FRENCH I, no ties

2.7.8 PHASE SEQUENCING RULES

One of three phase sequencing rules may be specified for any class which also has a designated class/class tie to another class as described in the preceding section. All three of these rules have the effect of limiting the choice of time pattern which will be selected by GASP for assignment to the class.

One of the rules is termed the standard phase sequencing rule. Suppose that jjjjjjkpcc is a class in a chain of class/class ties and that the standard rule is specified for jjjjjjkpcc. Then, the time pattern assigned to jjjjjjkpcc will not contain any modules on those days already represented in assignments for preceding classes in the chain. For example, suppose that HI 11 XS03 is tied to HI 11 XM01 which is in turn tied to HI 11 XL01 and that the standard phase sequencing rule has been specified for HI 11 XS03. Further, the time assigned to HI 11 XL01 is 'MW 3' and the time assigned to HI 11 XM01 is 'R 3'. Then, the time pattern which will be assigned to HI 11 XS03 will not have any modules on Monday, Wednesday or Thursday.

The other two possible phase sequencing rules are specifically defined by the user. They will be termed simply, the 'A' phase sequencing rule and the 'B' phase sequencing rule. Suppose that class XXXXXXXX01 is tied to class YYYYYYYY01.

To use the 'A' phase sequencing rule, the user associates an independent, arbitrary time pattern with each time pattern in his request list for class XXXXXXXX01. These associated time patterns are called 'QA' patterns and have the effect of eliminating their associated request from consideration if the 'QA' pattern conflicts with the time actually chosen for YYYYYYYY01. The 'B' phase sequencing rule is handled similarly except that a 'QB' pattern is used.

2.7.8(2) PHASE SEQUENCING RULES (Continued)

As an example, suppose that 18.781JR03 is tied to 18.781JL02. Suppose that the time pattern assigned to 18.781JL02 is 'MWF 10'. Suppose also that the time pattern request list for 18.781JR03 and the 'QA' and 'QB' patterns are as follows:

<u>Time Pattern Request Component</u>	<u>'QA' Pattern</u>	<u>'QB' Pattern</u>
MWF 1 TRS 10	MWF TRS	MWF1-5, TRS TRS9-12, MWF

Had the 'A' rule been specified, the time chosen would be 'TRS 10'; if the 'B' rule were used, the assignment would be MWF1. Note that the 'A' rule here gives the same results as the standard rule; the 'B' rule has the effect of forcing the class on the same day but on the other side of the lunch period from the tied class.

If a phase sequencing rule is specified which cannot be satisfied because of the time request for a class, the rule will be suspended and an invalid assignment made. Permanent time assignments violating a phase sequencing rule are identified as invalid.

The phase sequencing rules are ignored by the 'Basic' 360 option.

2.7.9 THREADING RULES

Resource assignments to the several classes of a subject phase may be based upon the resource assignments made to the classes of another subject phase when an appropriate class/class tie exists. The user of GASP may specify that the threading rule be applied in making resource assignments to any class which is tied to some other class. This rule may be applied independently for any of the three resource sets (instructors, rooms or students).

Suppose that class XXXXXXXX01 is tied to class YYYYYYYY01 and that the threading rule is specified for students being assigned to class XXXXXXXX01. Then, no student will be assigned validly to XXXXXXXX01 unless he is also assigned to YYYYYYYY01. If specified for instructors or rooms, the threading rule operates for those resources in exactly the same manner.

The threading rule may be applied strongly or weakly. If applied strongly, assignments which break the threading rule are made when necessary and such assignments will have an invalid assignment character associated with them. If the threading rule is applied weakly, threading will be abandoned if the number of invalid assignments in the schedule can be reduced by so doing.

As an example of the two variations of the threading rules, consider the two subject phases MATH 9 M and MATH 9 S which have tied classes as follows:

MATH 9 S01	tied to	MATH 9 M01
MATH 9 S02	tied to	MATH 9 M01
MATH 9 S03	tied to	MATH 9 M01
MATH 9 S04	tied to	MATH 9 M02
MATH 9 S05	tied to	MATH 9 M02
MATH 9 S06	tied to	MATH 9 M02

2.7.9(2) THREADING RULES (Continued)

Suppose that students are being assigned to MATH 90S under the strong threading rule and that instructors are being assigned under the weak threading rule and that students and instructors are common between the two phases. Then, GASP will exert strong pressure to make assignments such that students assigned to MATH 9 M 1 will also be assigned to one of the classes MATH 9 S01, MATH 9 S02 or MATH 9 S03; similarly, students assigned to MATH 9 M02 will also be assigned to one of the classes MATH 9 S04, MATH 9 S05 or MATH 9 S06. Student assignments which break the threading rule will be flagged as invalid since the rule was applied strongly. Since instructors are being assigned with the weaker threading rule, they will be assigned like the students when completely valid schedules are possible. However, an instructor might be assigned to MATH 9 M02 and MATH 9 S03 if it is necessary in order to avoid one or more invalid assignments.

Since no rule was specified for room assignments for the MATH 9 S classes, rooms will be assigned to them without regard to the room assignments for MATH 9 M.

Threading rule specifications are ignored if the 'Basic' 360 option is being used.

2.7.10 CLASS/RESOURCE TIES

The user of GASP may wish to place restrictions on the assignments of one or more of the resource sets to classes of a subject phase; such restrictions are termed class/resource ties. A class/resource tie is a special group designator selector associated with a class providing for resource assignments on the basis of resource element group designators. For purposes of these special selectors, one of which is given for each resource set, only the first three positions of resource element group designators are used. Since this selection involves only three positions of group designators, the special selector has the format dddmmm for each of the resource sets (instructors, rooms and students).

The user must also provide, in addition to the basic class/resource tie, instructions as to the use of the tie. The specific instructions are described in the following section titled CONFINING RULES (2.7.11). The specification of a class/resource tie, without a specified confining rule, has no meaning.

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2.7.11 CONFINING RULES

The confining rule limits resource assignments for class/resource ties. It allows the user to specify, for any particular class, a subgroup of any of the resource sets that should be assigned.

The confining rule, like the threading rule, may be applied strongly or weakly. If the rule is applied strongly, violations of the rule will cause invalid assignments. If the rule is applied weakly, it will be abandoned for any resource element if by so doing a schedule with fewer invalid assignments can be computed. The confining rule may be applied independently for any of the three resource sets (instructors, rooms, or students).

For example, suppose that four classes of Chemistry are given in a school:

CHEM 1 01
CHEM 1 02
CHEM 1 03
CHEM 1 04

Then, the confining rule could be used to exert strong pressures that 'college preparatory students' only would be assigned to, say, the classes CHEM 1 01 and CHEM 1 02; that students in the 'technical program' would be assigned to CHEM 1 03 and that all other students would be assigned to the remaining class, CHEM 1 04.

Confining rule specifications are ignored by the 'Basic' 360 option.

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3.1.1 GASP FILE STRUCTURE

The building blocks of the GASP file are fields. Each field is a string of characters (alphabetic, numeric, special or local). Each field has a two-character name associated with it, mnemonic for the type of information stored in the field. Ordinarily, there will be many occurrences of fields with the same name in the file. For example, the keys and names described in the last chapter are fields; so are group designators and selectors, the subject phase priority character, or the phase sequencing rule name.

To give the file a structure, fields are grouped together into records. Each record is composed of several fields and each record has a name associated with it. There are records with four different names in the GASP file. There is a record named TP for every time pattern key in the file. For each class, there is one CL record in the file. Each resource element has an RE record in the file. Finally, XL records in the file control the scheduling operations of the GASP program.

For records in the file with the same name, there is a constant set of fields making up each record. As an example, every CL record has a class key, group designator, subject phase priority character, etc.

What have been referred to as keys are called key or identification fields for the records in which they appear. Key fields are the means by which a record and its other fields may be located in the file. The GASP file is always maintained in alphanumeric order on the sole basis of key fields.

3.1.1(2) GASP FILE STRUCTURE (Continued)

The GASP file, then, is an ordered sequence of records. Recall that each type of key discussed in Chapter 2 had a specified character for its initial position: '.' for time pattern keys, '/' for class keys, 'I' for instructor keys, 'R' for room keys and 'S' for student keys. The keys for XL records will all have a blank in their initial position. Therefore, since blank is the first character in the alphanumeric collating sequence, all XL records will occur first in the file. Similarly, all TP records occur next, then all CL records, then all instructor RE records, then all room RE records and finally all student RE records.

The term file maintenance will be used to refer to the procedure of updating (adding, changing, deleting) the records of the file and of insuring the validity and sequence of the file. File maintenance is based on corrections (in the form of correction records) supplied by the user of GASP.

The GASP file may be thought of as a FRAMEWORK of fields: information and assignment fields specified by the user as a description of the school; and request fields for unspecified assignments anticipating the scheduling activity of GASP. In this sense, GASP may be regarded as a sophisticated file maintenance program capable of inserting and changing assignments in the schedule by inserting and changing fields in the file. GASP's major function, the production of a new GASP file, is completely determined by the status of the old GASP file and its correction records.

3.1.2 RECORD PREFACES AND SUFFIXES

Every record in the GASP file has two special fields which are always automatically maintained by the program. These two fields, the record preface and the record suffix, provide crucial information about the record for the GASP program.

The record preface is a field occupying the first four character positions of every GASP record. The contents of any record preface is as follows:

<u>Positions</u>	<u>Mnemonic</u>	<u>Description</u>
1-2	RR	Record name, or type, e.g. 'XL', 'TP', 'CL', 'RE'
3	u	Record run code. See following section (3.1.3) titled, RECORD RUN CODES
4	s	Record status code. See following section (3.1.4) titled, RECORD STATUS CODES

The four mnemonics 'XLus', 'TPus', 'CLus', and 'REus' refer to the four possible record prefices.

The record suffix is a field occupying the last four character positions of every GASP record. The contents of any record suffix is as follows:

<u>Positions</u>	<u>Mnemonic</u>	<u>Description</u>
1-3	yyy	Record parity. These characters provide a checking mechanism on the validity of the record, i.e. that the key field in the record when read is identical to the key when last written. When it appears, the parity is three nonsensical characters and need never be interpreted by the user.
4	e	The record mark, (Hollerith Code 0-2-8) which flags the end of the record.

3.1.3 RECORD RUN CODES

GASP runs may be numbered by the user; ordinarily the first run is numbered 1, the second 2, and so on up to 35. If more than 35 runs are required for a given school, numbering should start back at 1.

Any time a record is created or altered in the GASP file, the run code in the record preface (position 3 of all records) reflects the current run number. All unaltered records having run codes greater than or equal to the current run number have their run codes set to one less than the current run number. If the run number is set to '1', either by the user or in the absence of a user specified run number, unchanged records receive a run code of zero.

A single character is used to represent the 36 possible run numbers; this is the run code. Run numbers and their corresponding run code are given in the following table (RN = 'run number', RC = 'run code').

3.1.3(2) RECORD RUN CODES (Continued)

<u>RN</u>	<u>RC</u>	<u>RN</u>	<u>RC</u>	<u>RN</u>	<u>RC</u>	<u>RN</u>	<u>RC</u>
01	1	10	A	19	J	28	S
02	2	11	B	20	K	29	T
03	3	12	C	21	L	30	U
04	4	13	D	22	M	31	V
05	5	14	E	23	N	32	W
06	6	15	F	24	O	33	X
07	7	16	G	25	P	34	Y
08	8	17	H	26	Q	35	Z
09	9	18	I	27	R	00	0

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3.1.4 RECORD STATUS CODES

All file records have a record status code in their fourth character position; these codes are single characters representing one of two possible record status conditions; these are

- 1) Active status
- 2) Protected status

An active record is easier to update than a protected record; the user must change the status of a protected record to active before he can update it. Records are normally maintained in active status; a special action on the part of the user is required to place a record in protected status. The act of placing a record in protected status insures that any assignment fields are made permanent. See the section (4.3.4) titled ASSIGNMENT CONTROL CORRECTIONS for further details.

The status characters also give information about the last record change taken on a record (see the section (4.4.1) titled CORRECTION ACTIONS for details); therefore, there are more than two possible status characters. The table below gives all possible status characters and the record status condition they represent.

<u>Status Represented</u>	<u>Status Characters</u>
Active status	C U R I A
Protected status	H

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3.1.5 RECORDS, GENERAL

All records in the GASP file have the following four general characteristics:

- 1) The record preface (XLus, TPus, CLus, or REus) is always in positions 1-4.
- 2) The record key or identification field is always in positions 7-17. Record keys for TP records always have the form .ttttttttt; record keys for CL records always have the form /jjjjjjkpec; record keys for RE records always have the form xxxrrrrrrrr. XL record keys always begin with the blank character (position 7 of the record).
- 3) The collection of regular fields for the record always begins in position 18.
- 4) The record suffix, yyyy, always ends the record in the last four character positions. XL and TP records are always 84 characters long; for these records, the suffix begins in position 81. The CL and RE records have varying lengths from 84 to 996 characters (in multiples of 12). Suffixes in CL and RE records may begin as early as position 81 and as late as position 993.

The remainder of this chapter describes the GASP file TP, CL and RE records. XL records, since they are involved with control for a run, are described in Chapter 5 where the various events of a run are detailed.

3.2.1 TP RECORD, BD FIELD

The BD (time pattern Block Definition) field may be present on from 1 to 8 TP records in the GASP file in position 20. When used, the field should contain a decimal integer 1, 2, 3, 4, 5, 6, 7, or 8. These TP records, in addition to their normal function, serve to define time pattern blocks described in section (2.2.4) titled TIME PATTERN BLOCKS.

3.2.2 TP RECORD, GD FIELD

The GD (time pattern Group Designator) field is a time pattern group designator dddd as described in the section (2.5.3) titled TIME PATTERN GROUP DESIGNATORS. This field is always present on TP records in positions 21-24 (field length is 4 positions).

3.2.3 TP RECORD, NA FIELD

The NA (time pattern Name) field is a legal time pattern name as described in the section (2.2.2) titled TIME PATTERN NAMES. This field is always present on TP records in positions 25-56 (field length is 32 positions).

3.2.4 TP RECORD, QA FIELD

The QA ('QA' time pattern) field is the 'QA' time pattern associated with the time pattern name (NA) of the record used for phase sequencing rule A. If present, the QA field is either a legal time pattern name or a time pattern key. .tttttttttt which references the desired 'QA' time pattern. This field is optional on TP records in positions 57-68 (field length is 12 positions).

Since the desired 'QA' time pattern name can exceed 12 positions, the .tttttttttt option is available. If .tttttttttt is used, it will be recognized by the initial '.' (period).

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3.2.5 TP RECORD, QB FIELD

The QB (QB time pattern) field is the 'QB' time pattern associated with the time pattern name (NA) of the record used for phase sequencing rule B. If present, the QB field is either a legal time pattern name or a time pattern key .tttttttttt which references the desired QB time pattern. This field is optional on TP records in positions 69-80 (field length is 12 positions).

Since the desired 'QB' time pattern name can exceed 12 positions, the .tttttttttt option is available. If .tttttttttt is used, it will be recognized by the initial '.' (period).

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3.2.6 TP RECORD FORMAT

<u>Position</u>	<u>Field Name</u>	<u>Description</u>
1- 4		Record preface, TPus
5- 6		Unused
7- 17		Time pattern key, .tttttttttt
18- 19		Unused
20	BD	Block definition, a decimal integer 1, 2,.... 8
21- 24	GD	Time pattern group designator, dddd
25- 56	NA	Time pattern name
57- 68	QA	'QA' time pattern, time pattern name or .tttttttttt
69- 80	QB	'QB' time pattern, time pattern name or .tttttttttt
81- 84		Record suffix, yyyy

3.3.1 CL RECORD, GD FIELD

The GD (class Group Designator) field is a class group designator dddd as described in the section (2.5.2) titled CLASS GROUP DESIGNATORS. This field is always present on CL records in positions 21-24 (field length is 4 positions).

3.3.2 CL RECORD, NA FIELD

The NA (class NAME) field is an arbitrary class name as described in the section titled CLASS NAMES (2.4.5). This field is always present on CL records in positions 25-34 (field length is 10 positions).

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3.3.3 CL RECORD, PR FIELD

The PR (subject phase Priority) field is the subject phase priority digit as described in the section (2.7.5) titled SUBJECT PHASE PRIORITY. This field is always present on CL records in position 35.

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3.3.4 CL RECORD, CT FIELD

The CT (Class/class Tie) field is a class key representing a class/class tie as described in the section (2.7.7) titled CLASS/CLASS TIES. If present, this field is a class key, /jjjjjjkpcc. This field is optional on CL records in positions 37-47 (field length is 11 positions).

The CT field must be present if the user intends to use either or both a phase sequencing rule and a threading rule.

3.3.5 CL RECORD, PS FIELD

The PS (Phase Sequencing rule) field is one of three characters 'S' 'A', or 'B' indicating the phase sequencing rule for a class/class tie as described in the section (2.7.8) titled PHASE SEQUENCING RULES. 'S' is used for the Standard rule, 'A' for the A phase sequencing rule and 'B' for the B phase sequencing rule. This field is optional on CL records in position 48.

Unless the user has also specified the class/class tie in the CT field, the rule given in the PS field is ignored. If the phase sequencing rule is violated, invalid assignments will result. Cases in which phase sequencing rules may be violated are:

- 1) Permanent time assignments
- 2) Failure to supply adequate time pattern keys in the time request, and
- 3) Improper class/class tie specification

3.3.6 CL RECORD, TR FIELD

The TR (Threading Rules) field is a set of three characters, either 'S' or 'W' for each resource, indicating the threading rule for a class/class tie as described in the section (2.7.9 titled THREADING RULES. 'S' indicates the 'strong' rule, 'W' the 'weak' one. The first position is reserved for instructors, the second for rooms, and the third for students; any or all may be specified. The field is optional on CL records in positions 49-51 (field length is 3 positions).

Unless the user has also specified the class/class tie in the CT field, the rules given in the TR field will be ignored. If a strong threading rule is violated, invalid resource assignments will result.

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3.3.7 CL RECORD, RT FIELD

The RT (class/Resource Tie) field is a set of three special group designator selectors representing class/resource ties as described in the section (2.7.10) titled CLASS/RESOURCE TIES. If present, the first 6 positions of the field represent the instructor selector dddmmmm; the second 6 positions are the room selector dddmmmm; and the final 6 positions are the student selector dddmmmm; any or all may be specified. This field is optional on CL records in positions 52-69 (field length is 18 positions).

A dddmmmm selector for a resource must be present in the RT field if the user intends to use a confining rule for the resource. Without specifying these rules, however, the class/resource tie itself does not enter into the resource assignments for the class.

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3.3.8 CL RECORD, CR FIELD

The CR (confining rules) field is a set of three characters, either 'S' or 'W' for each resource indicating the confining rule for class/resource ties as described in the section (2.7.11) titled CONFINING RULES; 'S' indicates the 'strong' rule, 'W' the 'weak' one. The first position is reserved for instructors, the second for rooms and the third for students; any or all may be specified. The field is optional on CL records in positions 70-72 (field length is 3 positions).

Unless the user has specified a corresponding class/resource selector in the RT field, the rules given in the CR field are ignored. If a strong confining rule is violated, invalid resource assignments will result.

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3.3.9 CL RECORD, RM FIELD

The RM (Resource Maximums) field is a set of three integers indicating the resource maximums for the resources as described in the section (2.7.4) titled CLASS RESOURCE MAXIMUMS. The first position of the RM field is used for instructors, the second position is used for rooms, and the last 3 positions are used for students. Any or all may be specified. The field is optional on CL records in positions 73-77 (field length is 5 positions).

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3.3.10 CL RECORD, TS FIELD

The TS (Track Substitution) field is a list of up to 3 track characters to indicate alternates for track substitution requests when making resource assignments as described in the section (2.7.6) titled TRACK SUBSTITUTION. If present, track characters specified must refer to existing subject phases with same jjjjjj and p parts of their keys. This field is optional on CL records in positions 78-80 (field length is 3 positions).

Blank positions of the TS field are ignored; the order in which the track characters are listed in this field (left to right) is the order in which the subject tracks will be considered as alternates.

Since track substitution pertains to the 'subject' portion of requests, jjjjjj, the track substitution field used by GASP will be the one on the first CL record in the file for the subject phase jjjjjjpkp.

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3.3.11 CL RECORD, TQ FIELDS

A TQ (Time reQuest) field is a request component, .ttttttttttL or *hhdddddmmmmL, as described in the section titled TIME REQUESTS (2.6.4). There may be as many as 32 TQ fields on each CL record (or none) beginning in position 85 and in every twelfth position thereafter (field length is 12 positions).

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3.3.12 CL RECORD, TA FIELDS

A TA (Time Assignment) field is a time pattern key, together with an assignment character, .tttttttttg . The class key of the CL record and a TA field specify a time assignment for the class as described in the sections (2.6.1) titled ASSIGNMENTS IN GASP, DESCRIPTION and (2.6.2) titled ASSIGNMENT CHARACTERS. All TA fields on a CL record follow the last TQ field (the first TA field is in positions 85-96 if there are no TQ fields). TA fields are each 12 positions long.

3.3.13 CL RECORD FORMAT

<u>Positions</u>	<u>Field Name</u>	<u>Description</u>
1- 4		Record preface, CLus
5- 6		Unused
7- 17		Class key, /jjjjjjkpcc
18- 20		Unused
21- 24	GD	Class group designator, dddd
25- 34	NA	Class name, arbitrary
35	PR	Subject phase priority digit, 1, 2,, 9
36		Unused
37- 47	CT	Class/class tie specification, /jjjjjjkpcc
48	PS	Phase sequencing rule, 'S', 'A' or 'B'
49- 51	TR	Threading rules, 'S' or 'W' for instructors, rooms, students (in order)
52- 69	RT	Class/resource tie specifications, dddmm selectors for instructors, rooms, students (in order)
70- 72	CR	Confining rules, 'S' or 'W' for instructors, rooms, students (in order)
73- 77	RM	Resource maximums, integers; first position instructors, second position rooms, last three positions students.
78- 80	TS	Track substitution list, kkk.
81- 84		Blank (or if no TQ and TA fields, the record suffix)

3.3.13(2) CL RECORD FORMAT (Continued)

<u>Positions</u>	<u>Field Name</u>	<u>Description</u>
85- 96	TQ or TA	Time request component, .ttttttttttq or *hhdddmmmmq Time assignment, .ttttttttttg.
97-108	TQ or TA	Time request component Time assignment
.....
985-992		Blank
993-996		Record suffix, yyyy

Note:

The above description shows the maximum length record with 75 TQ and/or TA fields. Up to 32 TQ fields may be present; TA fields always follow TQ fields. CL records are of variable length depending upon the number of TQ and TA fields on the record. If any TQ or TA fields are present, the record ends with 12 characters following the last TA field as in 985-996 above; if no TQ or TA fields are present, the suffix is in positions 81-84.

3.4.1 RE RECORD, ML FIELD

The ML (resource Maximum Load) field is a three-digit integer indicating a maximum load for the resource element as described in the section (2.7.1) titled RESOURCE LOADS. The field is optional on RE records in positions 18-20 (field length is 3 positions).

3.4.2 RE RECORD, GD FIELD

The GD (resource Group Designator) field is a resource group designator dddd as described in the section (2.5.4) titled RESOURCE GROUP DESIGNATORS. This field is always present on RE records in positions 21-24 (field length is 4 positions).

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3.4.3 RE RECORD, NA FIELD

The NA (resource NAME) field is an arbitrary resource name as described in the section (2.3.2) titled RESOURCE NAMES. This field is always present on RE records in positions 25-56 (field length is 32 positions).

3.4.4 RE RECORD, RF FIELD

The RF (Resource Free time) field is a time pattern indicating the resource element free time as described in the section (2.7.2) titled RESOURCE FREE TIME. If present the RF field is either a legal time pattern name or a time pattern key .tttttttttt which references the desired free time pattern. This field is optional on RE records in positions 57-68 (field length is 12 positions).

Since the desired free time pattern name can exceed 12 positions, the .tttttttttt option is available. If .tttttttttt is used, it will be recognized by the initial '.' (period).

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3.4.5 RE RECORD, RP FIELD

The RP (Resource Preferred free time) field is a time pattern indicating the resource element preferred free time as described in the section (2.7.3) titled RESOURCE PREFERRED FREE TIME. If present the RP field is either a legal time pattern name or a time pattern key .tttttttttt which references the desired time pattern. This field is optional on RE records in positions 69-80 (field length is 12 positions).

Since the desired free time pattern name can exceed 12 positions, the .tttttttttt option is available. If .tttttttttt is used, it will be recognized by the initial '.' (period).

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3.4.6 RE RECORD, RQ FIELDS

An RQ (Resource reQuest) field is a request component, /jjjjjjkpcq, /jjjjjjkp q /jjjjjjkpnnM, /jjjjjjkp M, /jjjjjjk*ccq, /jjjjjjk* q, /jjjjjjk*nnM, /jjjjjjk* M, or *hhdddddmmmq as described in the section (2.6.5) titled RESOURCE REQUESTS. There may be as many as 32 RQ fields on each RE record (or none) beginning in position 85 and in very twelfth position thereafter (field length is 12 positions).

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3.4.7 RE RECORD, RA FIELDS

An RA (Resource Assignment) field is a class key, together with an assignment character, /jjjjjjkpcq . The resource key of the RE record and an RA field specify a resource assignment for the class as described in the sections (2.6.1) titled ASSIGNMENTS IN GASP, DESCRIPTION and (2.6.2) titled ASSIGNMENT CHARACTERS. All RA fields on an RE record follow the last RQ field (the first RA field is in positions 85-96 if there are no RQ fields). RA fields are each 12 positions long.

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3.4.8 RE RECORD FORMAT

<u>Position</u>	<u>Field Name</u>	<u>Description</u>
1- 4		Record preface, REus
5- 6		Unused
7- 17		Resource element key, Ixxxxxxx, Rxxxxxxx, or Sxxxxxxx
18- 20	ML	Resource element maximum load, integer
21- 24	GD	Resource element group designator, dddd
25- 56	NA	Resource element name, arbitrary
57- 68	RF	Resource element free time, time pattern name or .ttttttttt
69- 80	RP	Resource element preferred free time, time pattern name or .ttttttttt
81- 84		Blank (or if no RQ or RA fields, the record suffix)
85- 96	RQ or	Resource request component: /jjjjjkp q, /jjjjjkpcq, /jjjjjkp M, /jjjjjkpnm, /jjjjjk* q, /jjjjjk* /jjjjjk* M, /jjjjjk*nm, or *hdddddmmuq
	RA	Resource assignment, /jjjjjkpcq
	RQ or	Resource request component
	RA	Resource assignment
.....
985-992		Blank
993-996		Record suffix, yyyy

NOTE:
The above description shows the maximum length record with 75 RQ and/or RA fields. Up to 32 RQ fields may be present; RA fields always follow RQ fields. RE records are of variable length depending upon the number of RQ and RA fields on the record. If any RQ or RA fields are present, the record ends with 12 characters following the last RA field as in 985-996 above; if no RQ or RA fields are present, the suffix is in positions 81-84. 05

4.1.1 CORRECTIONS, GENERAL

Between runs of GASP, the user will be concerned with changes he will want to effect in various records of the GASP file. Various changes which are possible in GASP are:

- 1) The creation of new records
- 2) The removal of records
- 3) The complete replacement of existing records and
- 4) The changing of fields in existing records

Such changes will be referred to as corrections to the file.

All corrections to the file must be made by preparing specified correction records. Many correction records are quite similar in format to the file records. All correction records are 80 characters long. Correction records are always punched on standard IBM cards.

For the first run of GASP for a school, correction records must be prepared which create all necessary GASP file records.

4.1.2 CORRECTION CLASSIFICATIONS

All correction records refer to, or act upon, one or more records in the GASP file. Correction records are divided into three categories. Each of the 3 categories represents a different method for locating the file record(s) which is (are) to be changed because of a correction. The 3 categories, and their associated methods, are described in following sections (4.2.1) titled STANDARD CATEGORY CORRECTIONS, (4.2.2) titled MACRO CATEGORY CORRECTIONS and (4.2.3) titled VERTICAL CATEGORY CORRECTIONS.

Correction records are also classified according to their basic function in the updating process. The three possible functions are described in following sections (4.3.1) titled FIELD REPLACEMENT CORRECTIONS, (4.3.2) titled ADD/DROP CORRECTIONS and (4.3.4) titled ASSIGNMENT CONTROL CORRECTIONS.

The classifications of category and function are independent of each other; every correction record must have both category and function specified by the user.

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4.2.1 STANDARD CATEGORY CORRECTIONS

If the standard category is specified on a correction record, only one file record may be changed by the correction. Such correction records contain the key field and the record name of the GASP file record which is to be changed.

For example, suppose that a correction record which is categorized as standard contains a key field of .MTWRF 1 and the record reference 'TP'. Then, this correction record would affect only the TP record in the file (if any exists) with the time pattern key .MTWRF 1

A standard category correction record is always identified with 'S' in position 1.

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4.2.2 MACRO CATEGORY CORRECTIONS

If the macro category is specified on a correction record, several file records may be changed by the correction; all file records which are changed will be of the same type, TP, CL or RE. A macro correction, when first encountered by the GASP program, is immediately changed into a specified number of standard correction records. This is done by altering the key field specified on the macro correction record in a consistent and continuous fashion so that unique key fields are generated in the standard correction records which are produced.

For example, suppose that a correction record which is categorized as macro contains the key field /ENG 41 R20, and the record reference CL. The '20' in the cc positions of the class key is not interpreted as a class integer, but as the number of standard corrections which are to be produced by the macro correction. 20 standard correction records will be generated with the class keys, /ENG 41 R01 , /ENG 41 R02 , /ENG 41 R03 , , /ENG 41 R20.

Macro corrections are especially useful in generating corrections which apply to all classes of a subject phase; they are also useful in generating large numbers of resource element corrections when GASP is used to simulate schools.

A macro category correction record is always identified with 'M' in position 1.

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4.2.3 VERTICAL CATEGORY CORRECTIONS

If the vertical category is specified on a correction record, several file records may be changed by the correction; all file records which are changed will be of the same type, TP, CL or RE. The file records which are affected by a vertical correction are determined by

- 1) The specification of the first position of record key, '.', '/', 'I', 'R' or 'S' and
- 2) The specification of a group designator selector of the form dddmmmm .

A vertical correction will affect a file record if the first position of the file record key is the same as that specified in 1) above and if the group designator on the file record is selected by 2) above.

For example, suppose that a correction record which is categorized as vertical contains 'R' for 1) above, and 'WB 3WB 8' for 2) above. Then all RE records representing room resource elements which have group designators with 'W' in the first position, 'B' in the second position, and '3' or greater in the fourth position will be affected by the vertical correction record. Recall that if the group designator selector is blank, ALL elements are selected; all room RE records, for example, can be altered with a single vertical correction.

Vertical corrections are useful, particularly if group designators are chosen carefully.

A vertical category correction record is always identified with 'V' in position 1.

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4.3.1 FIELD REPLACEMENT CORRECTIONS

The field replacement function is provided for corrections which must insert or change fields which occur in any file records in positions 18-80. Fields on field replacement correction records correspond to the possible fields located in positions 18-80 of some GASP file record. Field replacement always 'operates' according to the rule:

If any character of a given correction record field is not blank, the entire correction record field replaces the contents of the corresponding GASP file record field. Conversely, if all characters of a given correction record field are blanks, no change occurs in the corresponding GASP file record field. Further, if all positions of the correction record field are dashes, the corresponding GASP file record field is blanked. In the case of the GD field on TP, CL and RE records and of the TR, RT, CR, and RM fields on CL records the field replacement rule is applied using parts of these fields. Each position of a GD field is considered to be a separate field for purposes of field replacement so that if, for example, only the 3rd position of a group designator is to be changed, only the 3rd position need be punched on the correction record. In the cases of the CL record TR, RT, CR and RM fields, updating will be separately done for the instructor, room, and student portions.

A field replacement correction record is always identified with 'FR' in positions 2-3.

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4.3.2 ADD/DROP CORRECTIONS

The add/drop function is provided for corrections which must insert or delete TQ (time request), TA (time assignment), RQ (Resource request) or RA (resource assignment) fields on CL and RE GASP file records. The mnemonic 'add/drop' refers to the act of inserting/deleting a request or assignment on a CL or RE record in the file. Up to five adds and/or drops may be given on a single add/drop correction record; each add or drop is given in one of the five 'add/drop' fields on these correction records. Add/drop fields are described in the following section (4.3.3) titled ADD/DROP FIELDS.

An add/drop correction record is always identified with 'AD' in positions 2-3.

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4.3.3 ADD/DROP FIELDS

Add/drop fields are each 12 positions long. The first position is always interpreted as the specification about whether a field represents an 'add' (insert) or a 'drop' (delete) as follows:

<u>First Position</u>	<u>Interpretation</u>
-	'Drop' for any request or assignment field which is not a group designator selector
\$	'Drop' for any field which is a group designator selector
+	'Add' for any field which is not a group designator selector (ANY character except '-', '\$', '*' or ',' may be used in place of '+')
*	'Add' a group designator selector as a component of a request
,	'Add' request components which are based on a group designator selector

All possible add/drop fields are listed in the following table. The local character '+' is used to mean 'add' as described above.

<u>Add/Drop Field</u>	<u>Description</u>
-tttttttttt. -tttttttttt*	Any time assignment TA field .tttttttttt. or .tttttttttt* will be deleted from a CL record
+tttttttttt. +tttttttttt* +tttttttttt	A permanent time assignment TA field .tttttttttt. or .tttttttttt* will be insured on a CL record
-tttttttttt -ttttttttttq	All time assignment and time request TA and TQ fields with the same time pattern key .tttttttttt will be deleted from a CL record

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4.3.3(2) ADD/DROP FIELDS (Continued)

<u>Add/Drop Field</u>	<u>Description</u>
+ttttttttttq	A time request TQ field .ttttttttttq is created as the last TQ field on a CL record
-jjjjjjkpc. -jjjjjjkpc* -jjjjjjkpc	Any resource assignment RA field /jjjjjjkpc. or /jjjjjjkpc* will be deleted from an RE record
+jjjjjjkpc. +jjjjjjkpc* +jjjjjjkpc	A permanent resource assignment RA field /jjjjjjkpc. or /jjjjjjkpc* will be insured on an RE record
-jjjjjjk	All resource assignment and resource request RA and RQ fields with the same subject phase jjjjjjk will be deleted from an RE record
+jjjjjjkpcq +jjjjjjkpnm	A resource request RQ field /jjjjjjkpcq (/jjjjjjkpnm) is created as the last RQ field on an RE record (cc and nn portions of these fields may be blank)
-jjjjjjk*	All resource assignment and resource request RA and RQ fields with the same subject track jjjjjjk will be deleted from an RE record
+jjjjjjk*ccq +jjjjjjk*nnm	A resource request RQ field /jjjjjjk*ccq (/jjjjjjk*nnm) is created as the last RQ field on an RE record (cc and nn portions of these fields may be blank)
hhdddddmmmq	The initial '' indicates an add field with a group designator selector. A request field TQ or RQ *hhdddddmmmq is created as the last request field on a CL or RE record
,hhdddddmmmq	The initial ',' indicates components are to be added to a CL or RE record based on the group designator selector. TQ fields .ttttttttttq or RQ fields /jjjjjjk q are created as the last request fields on a CL or RE record as selected by the group designator selector hhdddddmmmq
\$hhdddddmmmq	The initial '\$' indicates a drop field with a group designator selector. Any request TQ or RQ field *hhdddddmmmq is deleted from a CL or RE record.
\$	'\$' followed by 11 blanks causes all request and assignment fields on a CL or RE record to be deleted.

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4.3.4 ASSIGNMENT CONTROL CORRECTIONS

The assignment control function is provided for corrections which control the temporary or permanent status of assignments. The following six assignment control functions are allowed:

<u>Assignment Control Function</u>	<u>Description</u>
F	'Fix Valid assignments' All valid assignments are insured permanent status. In practice, this will cause all '.' assignment characters to be replaced with '\$' assignment characters in GASP file records being corrected.
FV	'Fix Valid Schedules' All CL or RE records which contain <u>only</u> valid assignments (no invalids) will have all the assignments made permanent, i.e., the '.' assignment character
FA	'Fix All assignments' All assignments are insured permanent status. In practice, this will cause all '.' and '\$' assignment characters to be replaced with '\$' and '*' assignment characters in GASP file records being corrected.
R*	'Reset Invalid assignments' All invalid assignments are insured temporary status. In practice, this will cause all '*' assignment characters to be replaced with '\$' assignment characters in GASP file records being corrected.
RI	'Reset Invalid Schedules' All CL or RE records which have 1 or more invalid assignments will have all the assignments, valid or not, made temporary, i.e., the '.' or '\$' character.
RA	'Reset All assignments' All assignments are insured temporary status. In practice, this will cause all '.' and '*' assignment characters to be replaced with '.' and '\$' assignment characters in GASP file records being corrected.

An assignment control correction record is always identified with 'AC' in positions 2-3.

4.4.1 CORRECTION ACTIONS

Every correction has associated with it an action. All legal actions, and an associated single character action code, are given and described in the following table. Actions cause the status code of the GASP file record (position 4 in preface) to be set to the action code. Actions also control the updating (changing) of fields in these records.

<u>Action Code</u>	<u>Action</u>	<u>Description</u>
C	Create	If, and only if, there is no record in the GASP file with the key field of the correction record, a record is created using fields given on the correction record.
U	Update	If, and only if, the status code of the GASP file record being corrected represents the active status, appropriate fields of the GASP file record are updated (changed) on the basis of the correction record fields.
D	Delete	If, and only if, the status code of the GASP file record being corrected represents the active status, the record is removed from the file.
R	Replace	If, and only if, the status code of the GASP file record being corrected represents the active status, the record will be removed from the file and a new one created in its place using fields given on the correction record.
I	Insert	Either a C (create) or a U (update) action is performed, depending upon whether or not a record exists in the GASP file with the key field of the correction record.
H	Hold	If, and only if, there is a record in the GASP file with the key field of the correction record, the permanent status is insured.
A	Activate	If the status code of the GASP file record being corrected represents the protected status, the active status is insured, and appropriate fields of the GASP file record are updated (changed) on the basis of the correction record fields.
P	Purge	If there exists a record in the GASP file with the key field of the correction record, the record is removed from the file.

Correction records involving illegal actions will not affect corresponding GASP file records. See section (5.4.3) titled GUEA EDITS, ERROR CONDITIONS.

4.4.2 CORRECTION RECORD PREFACES

Every correction record has a 6 position correction record preface field located in the first 6 positions of the record. The format of all correction record prefaces is:

<u>Position</u>	<u>Description</u>
1	'S' for standard category corrections 'M' for macro category corrections 'V' for vertical category corrections
2-3	'FR' for field replacement corrections 'AD' for add/drop corrections 'AC' for assignment control corrections
4-5	'XL' if the record to be updated is an XL record 'TP' if the record to be updated is a TP record 'CL' if the record to be updated is a CL record 'RE' if the record to be updated is an RE record
6	'C' if the create action is to be taken 'U' if the update action is to be taken 'D' if the delete action is to be taken 'R' if the replace action is to be taken 'I' if the insert action is to be taken 'H' if the hold action is to be taken 'A' if the activate action is to be taken 'P' if the purge action is to be taken

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4.4.2(2) CORRECTION RECORD PREFACES (Continued)

Legal correction preface fields (positions 1-5 only) are

SFRXL	SFRTP	SFRCL SADCL SACCL	SFRRE SADRE SACRE
	MFRTP	MFRCL MADCL MACCL	MFRRE MADRE MACRE
	VFRTP	VFRCL VADCL VACCL	VFRRE VADRE VACRE

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4.4.3 THE CORRECTION FILE

The correction file is composed of all correction records for a run. Where more than 1 correction record affects the same GASP file record, the corrections act upon the file record in exactly the same order as the corrections were submitted for the run, EXCEPT that 'PR' corrections are processed before 'AD' or 'AC' corrections. Placement of vertical corrections is critical and they normally are placed at the end of the deck. For example, if a vertical is to apply to a newly created record, the vertical correction must follow the creating correction.

4.5.1 SF RTP CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	SF RTP
6	An action character: C, U, R, I, A, H, D or P
7- 17	Key of TP record to update: .tttttttttt (Following fields, same format as TP record)
18- 19	Ignored
20	BD field, block definition: a decimal integer 1, 2, ...,8
21- 24	GD field, time pattern group designator: dddd
25- 56	NA field, time pattern name
57- 68	OA field, OA time pattern name or a key: .tttttttttt
69- 80	QB field, QB time pattern name or a key: .tttttttttt

If the action character is D, H or P, any fields punched in 18-80 will be ignored. If the action character is C or R, all fields of the created or replaced record are initially set to blank. Finally, if the action character is C, U, R, I or A, the field replacement function is applied for the five fields BD, GD, NA, QA and QB: any non-blank fields on the correction record replace corresponding fields in the record being updated. (Each position of the GD field is updated separately for field replacement).

4.5.1(2) SFRTTP CORRECTION RECORD FORMAT (Continued)

Note that a field in a file record which is non-blank will not be set to blank with the field replacement function alone. The desired effect can be achieved by punching all dashes in the corresponding field on the SFRTTP correction.

After all corrections to a given TP record have been processed, and if the TP record QA field is blank, positions 8-17 of the file record will be copied into positions 25-34, thereby setting the name field equal to the key field (except for the initial period).

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4.5.2 MFRTTP CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	MFRTTP
6	An action character: C, U, R, I, A, H, D or P
7- 15	<u>Partial</u> key of TP records to update: .tttttttt
16- 17	Number of TP records to update (Following fields same format as TP record)
18- 19	Ignored
20	BD field, block definition: decimal integer 1, 2,...8
21- 24	GD field, time pattern group designator: dddd
25- 56	NA field, time pattern name
57- 68	QA field, QA time pattern name or a key: .tttttttttt
69- 80	QB field, QB time pattern name or a key: .tttttttttt

Let NN be the two digit number given in positions 16-17 of the correction. Then, NN SFRTTP corrections are generated; these NN corrections are all identical to the MFRTTP correction except that

- 1) Position 1 of the generated records is changed to S
- 2) Positions 16-17 have

01	on the first record generated
02	on the second record generated
03	on the third record generated

and so on until

NN on the last record generated

Therefore, the keys of the records which will be updated on the basis of SFRTTP corrections are .tttttttt01, .tttttttt02, .tttttttt03,, .ttttttttNN.

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4.5.3 VFRTTP CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	VFRTTP
6	An action character: may be U, R, A, H, D or P
7	First position of time pattern keys, i.e. '.'
8- 15	Time pattern group designator selector: ddddmmmm
16- 17	Ignored (Following fields, same format as TP records)
18- 19	Ignored
20	BD field, block definition: a decimal integer 1, 2, ...8
21- 24	GD field, time pattern group designator: dddd
25- 56	NA field, time pattern name
57- 68	QA field, QA time pattern name or a key: .tttttttttt
69- 80	QB field, QB time pattern name or a key: .tttttttttt

All TP records having group designator fields which are selected by the group designator selector on the correction (positions 8-15) will be updated as if the VFRTTP correction record were a SFRTP correction.

Note that this correction provides an easy method for consistently changing group designator fields in TP records; records are updated on the basis of the 'old' group designator but a 'new' group designator may be specified if the GD field on the correction is non-blank.

4.6.1 SFRCL CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	SFRCL
6	An action character: C, U, R, I, A, H, D or P
7- 17	Key of CL record to update: /jjjjjjkpc
18- 20	Unused
21- 24	GD field, class group designator: dddd
25- 34	NA field, class name
35	PR field, subject phase priority digit
36	Unused
37- 47	CT field, class/class tie specification: /jjjjjjkpc
48	PS field, phase sequencing rule: S, A or B
49- 51	TR field, threading rules: S or W for instructors, rooms, students
52- 69	RT field, class/resource ties: dddmmm for instructors, rooms, students
70- 72	CR field, confining rules: S or W for instructors, rooms, students
73- 77	RM field, resource maximums for instructors, rooms, students
78- 80	TS field, track substitution list: kkk

If the action character is D, H or P, any fields punched in 18-80 will be ignored. If the action character is C or R, all fields of the created or replaced record are initially set to blank. Finally, if the action character is C, U, R, I or A, the field replacement function is applied for the 10 fields GD, NA, PR, CT, PS, TR, RT, CR, RM and TS: any non-blank fields on the correction record replace corresponding fields in the record being

4.6.1(2) SFRCL CORRECTION RECORD FORMAT (Continued)

updated. For purposes of field replacements, the GD field is handled as 4 single position fields and the TR, RT, CR and RM fields are handled using their I/R/S (instructor/room/student) portions separately.

Note that a field in a file record which is non-blank will not be set to blank with the field replacement function alone. The desired effect can be achieved by punching dashes in the corresponding field on the SFRCL correction.

After all corrections have been processed for a given CL record and if the NA field in the CL file record is blank, positions 8-17 of the class key are copied into positions 25-34 of the file record to set the name field equal to the class key (except for the initial slash).

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4.6.2 SADCL CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	SADCL
6	Action character, must be U
7- 17	Key of CL record to update: /jjjjjjkpc
18	May be blank, '1', 'A' or 'B'. See discussion below
19- 30	Add/drop field
31- 42	Add/drop field
43- 54	Add/drop field
55- 66	Add/drop field
67- 78	Add/drop field
79- 80	Ignored

Refer to the section (4.3.3) titled ADD/DROP FIELDS for a description of add/drop fields and their effects.

Add/drop fields on SADCL corrections are processed as follows:

- 1) Add/drop fields are taken in the order given on the correction(s).
- 2) Blank fields are ignored; so are fields with illegal formats.
- 3) Add fields attempting to create more than 32 TQ fields or more than 75 TQ and TA fields will be ignored.
- 4) If position 18 of the correction is not '1', 'A' or 'B' each add/drop field will be processed according to the description given in section (4.3.3).

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4.6.2(2) SADCL CORRECTION RECORD FORMAT (Continued)

- 5) If position 18 of the correction is '1', the first field (positions 19-30) is not treated as an add/drop field; instead a test is made as described in the table below: SADCL CONDITIONALS. If the result of the test is 'yes', the remaining four fields on the correction are treated as normal add/drop fields. If the result of the test is not 'yes', the remaining fields on the correction are ignored. If the format of the first field is illegal, the entire correction is ignored.
- 6) If position 18 of the correction is 'A', the first two fields (positions 19-30 and 31-42) are not treated as add/drop fields; instead tests are made as described in the table below. If the results of both tests are 'yes', the remaining three fields on the correction are treated as normal add/drop fields. Otherwise the entire correction is ignored.
- 7) If position 18 of the correction is 'B', the first two fields (positions 19-30 and 31-42) are not treated as add/drop fields; instead tests are made as described in the table below. If the results of at least one of the tests is 'yes', the remaining three fields on the correction are treated as normal add/drop fields. Otherwise, the entire correction is ignored.

SADCL CONDITIONALS

<u>Conditional Fields</u>	<u>Condition Resulting in a 'yes' Test</u>
+tttttttttg	There is an assignment field TA: .tttttttttg
+ttttttttt	There is an assignment field TA: .ttttttttt with any g
-tttttttttg	There is not an assignment field TA: .tttttttttg
-ttttttttt	There is not an assignment field TA: .ttttttttt with any g
+tttttttttq	There is a request field TQ: .tttttttttq
-tttttttttq	There is not a request field TQ: .tttttttttq
*hhdddmmmmq	There is a request field TQ: *hhdddmmmmq
\$hhdddmmmmq	There is not a request field TQ: *hhdddmmmmq

NOTE:

Any character other than '-', '*' or '\$' may be used in place of '+' in these conditional fields.

4.6.3 SACCL CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	SACCL
6	Action character: must be U
7- 17	Key of CL record to update: /jjjjjjkpec
18- 20	Ignored
21- 22	Assignment control function If FV 'fix valid schedules' If F, 'fix valid assignments' If FA, 'fix all assignments' If RI 'reset invalid schedules' If R* 'reset invalid assignments' If RA 'reset all assignments' (Any other code will be ignored)
23- 80	Ignored

Refer to the section (4.3.4) titled ASSIGNMENT CONTROL CORRECTIONS. This correction affects all the time assignments located in TA fields of the CL record being updated.

4.6.4 MFRCL CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	MFRCL
6	An action character: C, U, R, I, A, H, D or P
7- 15	<u>Partial</u> key of CL records to update: /jjjjjkkp
16- 17	Number of CL records to update (Following fields have same format as CL record except for CT field)
18- 20	Unused
21- 24	GD field, class group designator: dddd
25- 34	NA field, class name
35	PR field, subject phase priority digit
36	Ignored
37- 45	<u>Partial</u> CT field, subject phase part of class/class tie: /jjjjjkkp
46- 47	Number of classes to be tied to each class of above field
48	PS field, phase sequencing rule: S, A or B
49- 51	TR field, threading rules: S or W for instructors, rooms, students
52- 69	RT field, class/resource ties: dddmm for instructors, rooms, students
70- 72	CR field, confining rules: S or W for instructors, rooms, students
73- 77	RM field, resource maximums for instructors, rooms, students
78- 80	TS field, track substitution list: kkk

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4.6.4(2) MFRCL CORRECTION RECORD FORMAT (Continued)

Let NN be the two digit number given in positions 16-17 of the correction; let II be the two digit number given in positions 46-47 of the correction. Then, NN SFRCL corrections are generated; these NN corrections are all identical to the MFRCL correction except that

- 1) Position 1 of the generated records is changed to S
- 2) Positions 16-17 have 01 on the first record generated
02 on the second record generated
and so on, until
NN on the last record generated
- 3) If positions 37-45 are non-blank, then
positions 46-47 have 01 on the first II records generated
02 on the second II records generated
and so on

If II is 01, the numbers in 16-17 and 46-47 will be the same on all records generated.

Therefore, the keys of the records which will be updated on the basis of SFRCL corrections are /jjjjjkkp01, /jjjjjkkp02, /jjjjjkkp03,, /jjjjjkkpNN.

4.6.5 MADCL CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	MADCL
6	Action character: must be U
7- 15	<u>Partial</u> key of CL records to update: /jjjjjjkp
16- 17	Number of CL records to update (Following fields same format as SADCL correction record)
18	May be blank, 1, A or B; see description for SADCL correction record
19- 30	Add/drop field
31- 42	Add/drop field
43- 54	Add/drop field
55- 66	Add/drop field
67- 78	Add/drop field
79- 80	Ignored

Let NN be the two digit number given in positions 16-17 of the correction. Then, NN SADCL corrections are generated; these NN corrections are all identical to the MADCL correction except that

- 1) Position 1 of the generated records is changed to 'S'
- 2) Positions 16-17 have 01 on the first record generated
02 on the second record generated
03 on the third record generated

and so on, until

NN on the last record generated

Therefore, the keys of the records which will be updated on the basis of SADCL corrections are /jjjjjjkp01, /jjjjjjkp02, /jjjjjjkp03,, /jjjjjjkpNN.

4.6.6 MACCL CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	MACCL
6	Action character: must be U
7- 15	<u>Partial</u> key of CL records to update: /jjjjjjkp
16- 17	Number of CL records to update
18- 20	Ignored
21- 22	Assignment control function If FV 'fix valid schedules' If F, 'fix valid assignments' If FA 'fix all assignments' If RI 'reset invalid schedules' If R* 'reset invalid assignments' If RA 'reset all assignments'
23- 80	Ignored

Let NN be the two digit number given in positions 16-17 of the correction. Then, NN SACCL corrections are generated; these NN corrections are all identical to the MACCL correction except that

- 1) Position 1 of the generated records is changed to S
- 2) Positions 16-17 have 01 on the first record generated
02 on the second record generated
03 on the third record generated

and so on, until

NN on the last record generated

Therefore, the keys of the records which will be updated on the basis of SACCL corrections are /jjjjjjkp01, /jjjjjjkp02, /jjjjjjkp03,, /jjjjjjkpNN

4.6.7 VFRCL CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	VFRCL
6	Action character, May be U, R, A, H, D or P
7	First position of class keys, i.e. '/'
8- 15	Class group designator selector: ddddmmmm
16- 17	Ignored (Following fields, same format as CL records)
18- 20	Unused
21- 24	GD field, class group designator: dddd
25- 34	NA field, class name
35	PR field, subject phase priority digit
36	Unused
37- 47	CT field, class/class tie specification: /jjjjjjkpc
48	PS field, phase sequencing rule: S, A or B
49- 51	TR field, threading rules: S or W for instructors, rooms, students
52- 69	RT field, class/resource ties: dddmmm for instructors, rooms, students
70- 72	CR field, confining rules: S or W for instructors, rooms, students
73- 77	RM field, resource maximums for instructors, rooms, students
78- 80	TS field, track substitution list: kkk

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4.6.7(2) VFRCL CORRECTION RECORD FORMAT (Continued)

All CL records having group designator fields which are selected by the group designator selector on the correction (positions 8-15) will be updated as if the VFRCL correction record were a SFRCL correction.

Note that this correction provides an easy method for consistently changing class group designator fields in CL records: records are updated on basis of the 'old' group designator but a 'new' group designator may be specified if the GD field on the correction is non-blank.

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4.6.8 VADCL CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	VADCL
6	Action character: must be U
7	First position of class keys, i.e. '/'
8- 15	Class group designator selector: ddddmmmm
16- 17	Ignored
	(Following fields same format as SADCL correction record)
18	May be blank, 1, A or B; see description for SADCL correction record
19- 30	Add/drop field
31- 42	Add/drop field
43- 54	Add/drop field
55- 66	Add/drop field
67- 78	Add/drop field
79- 80	Ignored

All CL records having group designator fields which are selected by the group designator selector on the correction (positions 8-15) will be updated as if the VADCL correction record were a SADCL correction.

4.6.9 VACCL CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	VACCL
6	Action character: must be U
7	First position of class keys, i.e. '/'
8- 15	Class group designator selector: ddddmmmm
16- 17	Ignored
18- 20	Ignored
21- 22	Assignment control function If FV 'fix valid schedules' If F, 'fix valid assignments' If FA 'fix all assignments' If RI 'reset invalid schedules' If R* 'reset invalid assignments' If RA 'reset all assignments' (Any other code will be ignored)
23- 80	Ignored

All CL records having group designator fields which are selected by the group designator selector on the correction (position 8-15) will be updated as if the VACCL correction record were a SACCL correction.

4.7.1 SFRRE CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	SFRRE
6	An action character: C, U, R, I, A, H, D or P
7- 17	Key of RE record to update: xxxxxxxxxxx (Following fields, same format as 18-80 of RE record)
18- 20	ML field, maximum load
21- 24	GD field, resource element group designator: dddd
25- 56	NA field, resource element name
57- 68	RF field, resource free time pattern name or key: .ttttttttt
69- 80	RP field, resource preferred free time pattern name or key: .ttttttttt

If the action character is D, H or P, any fields punched in 18-80 will be ignored. If the action character is C or R, all fields of the created or replaced record are initially set to blank. Finally, if the action character is C, U, R, I or A, the field replacement function is applied for the five fields ML, GD, NA, RF, and RP: any non-blank fields on the correction record replace corresponding fields in the record being updated. For field replacement purposes, each position of the GD field is treated separately.

Note that a field in a file record which is non-blank will not be set to blank with the field replacement function alone. The desired effect can be achieved by punching dashes in the corresponding field on the SFRRE correction.

4.7.1(2) SFRRE CORRECTION RECORD FORMAT (Continued)

After all corrections have been processed which affect a single RE file record and if the NA field is blank, positions 8-17 of the file record are copied into positions 25-34 thereby setting the name field equal to the key field (omitting the I, R or S from the first key position).

4.7.2 SADRE CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	SADRE
6	Action character: must be U
7- 17	Key of RE record to update: xxxxxxxxxx
18	May be blank, 1, A or B. See discussion below.
19- 30	Add/drop field
31- 42	Add/drop field
43- 54	Add/drop field
55- 66	Add/drop field
67- 78	Add/drop field
79- 80	Ignored

Refer to the section (4.3.3) titled ADD/DROP FIELDS for a detailed description of add/drop field formats and their effects.

Add/drop fields on SADRE corrections are processed as follows:

Add/drop fields are taken in the order given on the correction(s).

Blank fields are ignored; so are fields with illegal formats.

Add fields attempting to create more than 32 RQ fields or more than 75 RQ and RA fields are ignored.

- a) If position 18 of the correction is not 1, A or B each add/drop field will be processed according to the description given in the section (4.3.3).

4.7.2(2) SADRE CORRECTION RECORD FORMAT (Continued)

- 5) If position 18 of the correction is 1, the first field (positions 19-30) is not treated as an add/drop field; instead a test is made as described in the table below: SADRE CONDITIONALS. If the result of the test is 'yes', the remaining four fields on the correction are treated as normal add/drop fields. If the result of the test is not 'yes', the remaining fields on the correction are ignored. If the format of the first field is illegal, the entire correction is ignored.
- 6) If position 18 of the correction is 'A', the first two fields (positions 19-30 and 31-42) are not treated as add/drop fields; instead tests are made as described in the table below. If the results of both tests are 'yes', the remaining three fields on the correction are treated as normal add/drop fields. Otherwise, the entire correction is ignored.
- 7) If position 18 of the correction is 'B', the first two fields (positions 19-30 and 31-42) are not treated as add/drop fields; instead tests are made as described in the table below. If the results of at least one of the tests is 'yes', the remaining three fields on the correction are treated as normal add/drop fields. Otherwise, the entire correction is ignored.

4.7.2(3) SADRE CORRECTION RECORD FORMAT (Continued)

<u>Conditional Fields</u>	<u>Condition Resulting in a 'yes' Test</u>
+jjjjjjkpcqg	There is an assignment field RA: /jjjjjjkpcqg
+jjjjjjkpcc	There is an assignment field RA: /jjjjjjkpcc with any g
-jjjjjjkpcqg	There is not an assignment field RA: /jjjjjjkpcqg
-jjjjjjkpcc	There is not an assignment field RA: /jjjjjjkpcc with any g
+jjjjjjkpcq	There is a request field RQ: /jjjjjjkpcq (/jjjjjjkpnnM)
+jjjjjjkpnnM	
-jjjjjjkpcq	There is not a request field RQ: /jjjjjjkpcq (/jjjjjjkpnnM)
-jjjjjjkpnnM	
+jjjjjjk*ccq	There is a request field RQ: /jjjjjjk*ccq (/jjjjjjk*nnM)
+jjjjjjk*nnM	
-jjjjjjk*ccq	There is not a request field RQ: /jjjjjjk*ccq (/jjjjjjk*nnM)
-jjjjjjk*nnM	
*hhdddddmmmq	There is a request field RQ: *hhdddddmmmq
\$hhdddddmmmq	There is not a request field RQ: *hhdddddmmmq

NOTE:

Any character other than '-', '+', or '\$' may be used in place of '+', in these conditional fields.

4.7.3 SACRE CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	SACRE
6	Action character: must be U
7- 17	Key of RE record to update: xxxxxxxxxxx
18- 20	Ignored
21- 22	Assignment control function If FV 'fix valid schedules' If F, 'fix valid assignments' If FA 'fix all assignments' If RI 'reset invalid schedules' If R* 'reset invalid assignments' If RA 'reset all assignments' (Any other code will be ignored)
23- 80	Ignored

Refer to the section (4.3.4) titled ASSIGNMENT CONTROL CORRECTIONS. This correction affects all the resource element assignments located in RA fields of the RE record being updated.

4.7.4 MFRRE CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	MFRRE
6	An action character: C, U, R, I, A, H, D or P
7- 15	<u>Partial</u> key of RE records to update: xxxxxxxx
16- 17	Number of RE records to update (following fields same format as RE record)
18- 20	ML field, maximum load
21- 24	GD field, resource element group designator: dddd
25- 56	NA field, resource element name
57- 68	RF field, resource free time pattern name or key: .ttttttttt
69- 80	RP field, resource preferred free time pattern name or key: .ttttttttt

Let NN be the two digit number given in positions 16-17 of the correction. Then, NN SFRRE corrections are generated; these NN corrections are all identical to the MFRRE correction except that

- 1) Position 1 of the generated records is changed to S
- 2) Positions 16-17 have
 - 01 on the first record generated
 - 02 on the second record generated
 - 03 on the third record generated

and so on, until

NN on the last record generated

Therefore, the keys of the records which will be updated on the basis of SFRRE corrections are xxxxxxxx01, xxxxxxxx02, xxxxxxxx03,, xxxxxxxxNN.

4.7.5 MADRE CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	MADRE
6	Action character: must be U
7- 15	<u>Partial</u> key of records to update: xxxxxxxx
16- 17	Number of RE records to update (Following fields same format as SADRE correction record)
18	May be blank, 1, A or B; see description for SADRE correction record
19- 30	Add/drop field
31- 42	Add/drop field
43- 54	Add/drop field
55- 66	Add/drop field
67- 78	Add/drop field
79- 80	Ignored

Let NN be the two digit number given in positions 16-17 of the correction. Then, NN SADRE corrections are generated; these NN corrections are all identical to the MADRE correction except that

- 1) Position 1 of the generated records is changed to S
- 2) Positions 16-17 have
 - 01 on the first record generated
 - 02 on the second record generated

and so on, until

NN on the last record generated

Therefore, the keys of the records which will be updated on the basis of SADRE corrections are xxxxxxxx01, xxxxxxxx02, xxxxxxxx03,, xxxxxxxxNN.

4.7.6 MACRE CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	MACRE
6	Action character: must be U
7- 15	<u>Partial</u> key of RE records to update: xxxxxxxx
16- 17	Number of RE records to update
18- 20	Ignored
21- 22	Assignment control function If FV 'fix valid schedules' If F, 'fix valid assignments' If FA 'fix all assignments' If RI 'reset invalid schedules' If R* 'reset invalid assignments' If RA 'reset all assignments' (Any other code will be ignored)
23- 80	Ignored

Let NN be the two digit number given in positions 16-17 of the correction. Then, NN SACRE corrections are generated; these NN corrections are all identical to the MACRE correction except that

- 1) Position 1 of the generated records is changed to S
- 2) Positions 16-17 have
 - 01 on the first record generated
 - 02 on the second record generated
 - 03 on the third record generated
 - and so on, until
 - NN on the last record generated

Therefore, the keys of the records which will be updated on the basis of SACRE corrections are xxxxxxxx01, xxxxxxxx02, xxxxxxxx03,, xxxxxxxxNN.

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4.7.7 VFRRE CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	VFRRE
6	Action character: may be U, R, A, H, D or P.
7	First position of resource element key. i.e. 'I', 'R' or 'S'
8- 15	Resource group designator selector for instructors, rooms, students: dddmmmm
16- 17	Ignored (Following fields, same format as 18-80 in RE records)
18- 20	ML field, maximum load
21- 24	GD field, resource element group designator: dddd
25- 56	NA field, resource element name
57- 68	RF field, resource free time pattern name or key: .ttttttttt
69- 80	RP field, resource preferred free time pattern name or key: .ttttttttt

All RE records having keys which match the correction in position 7 and which have group designator fields which are selected by the group designator selector on the correction (positions 8-15) will be updated, as if the VFRRE correction record were a SFRRE correction.

Note that this correction provides an easy method for consistently changing group designator fields in RE records for a given resource; records are updated on the basis of the 'old' group designator but a 'new' group designator may be specified if the GD field on the correction is non-blank.

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4.7.8 VADRE CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	VADRE
6	Action character: must be U
7	First position of resource element keys, i.e. 'I', 'R', or 'S'
8- 15	Resource group designator selector for instructors, rooms, students: dddmmmm
16- 17	Ignored
	(Following fields same format as SADRE correction record)
18	May be blank, 1, A or B; see description for SADRE correction record
19- 30	Add/drop field
31- 42	Add/drop field
43- 54	Add/drop field
55- 66	Add/drop field
67- 78	Add/drop field
79- 80	Ignored

All RE records having keys which match the correction in position 7 and which have group designator fields which are selected by the group designator selector on the correction (positions 8-15) will be updated as if the VADRE correction record were a SADRE correction.

4.7.9 VACRE CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	VACRE
6	Action character: must be U
7	First position of resource element keys, i.e. 'I', 'R' or 'S'
8- 15	Resource group designator selector for instructors, rooms, students: dddmmmm
16- 17	Ignored
18- 20	Ignored
21- 22	Assignment control function If FV 'fix valid schedules' If F, 'fix valid assignments' If FA 'fix all assignments' If RI 'reset invalid schedules' If R* 'reset invalid assignments' If RA 'reset all assignments' (Any other code will be ignored)
23- 80	Ignored

All RE records having keys which match the correction in position 7 and which have group designator fields which are selected by the group designator selector on the correction (positions 8-15) will be updated as if the VACRE correction record were a SACRE correction.

4.8.1 SFRXL CORRECTION RECORD FORMAT

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	An action character: C, U, R, I, A, H, D or P
7- 17	Key, XL record to update
18- 80	See below

For updating purposes, positions 18-80 on any SFRXL correction are treated as one field. Therefore, the user must specify the complete contents of an XL record which is being changed or created.

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5.1.1 PROGRAM BLOCKS, INTRODUCTION

This chapter will discuss the basic activities of the GASP program; the discussion is given in the same order as the described events occur during a GASP run. The description given here is not intended to be completely detailed.

The GASP program is divided into a number of blocks; each block has a specific role to play. Each of the blocks has a four letter name. Each block, as it begins, expects the GASP file and/or correction file to have a prescribed status; when each block is finished, it leaves the GASP file and/or correction file in an appropriate status.

Ordinarily, all of the blocks play a part in a GASP run; however, the user may cause GASP to bypass some of the blocks.

Later sections will describe the nine blocks in terms of their response to, and effect on, the GASP file.

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5.1.2 THE GASP LOG, INTRODUCTION

A run log, or simply, a log, is always prepared by GASP. This log is a communication or report to the user summarizing GASP's various activities for the run. Each block of the program identifies its portion of the log with appropriate page headings.

As the blocks of the program are being executed, comments are entered into the log. Other entries in the log are records which could not be processed normally by a program block; such records are printed as they are encountered with one or more error flags in the left margin. Error flags are single character codes reflecting a particular error condition. Finally, various summaries, reports and other documentation describing the run or the file are made a part of the log.

The various possible entries into the log will be described as part of the discussion for each of the blocks.

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5.1.3 MAL-FUNCTION ERRORS, INTRODUCTION

Once in a while, equipment failures may occur during a GASP run. Most often, such failures are associated with the mechanical equipment which is a part of the computer (as opposed to the electronic equipment) or with the magnetic storage medium used for the GASP file (tapes or disks). These failures, when they occur, will be termed mal-function errors.

The user will be notified of mal-function errors on the log for the run; also, the machine operator is notified of these errors. Occasionally the operator can take corrective action and reinitiate the run.

When listed, mal-function errors are identified on the log by giving a record and the flag 'M'. Records listed with the M flag may or may not be recognizable to the user. Unreadable information may be associated with mal-function errors; further, the file format during some parts of a GASP run is 'unfamiliar' as regards this documentation. The log listing of mal-function errors will be of little help to most users of GASP.

Some mal-function errors may cause a GASP job to be terminated abnormally. In these cases, system and/or user completion codes attempt to identify the error condition.

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5.1.4 XL RECORDS, INTRODUCTION

Many of the program blocks provide the user certain optional features. The user controls most options by insuring that appropriate XL records are a part of the file. XL records are also used to provide GASP with information about the school which does not logically fit into the context of the TP, CL or RE records.

The key field of each XL records has blank characters in the first 2 positions (positions 7-8 of the record). Positions 9-12 always contain the name of one of the program blocks; the block name in these positions will be referred to as the XL block reference.

Each XL record has a format 'tailored' for its particular function; since there are many 'one-of-a-kind' XL records, fields on these records do not have names. It is not possible to update only one or two fields in an XL record in the file. If an XL record must be corrected or changed, the user must specify all fields on the correction record.

A detailed description of possible XL records is given in the discussion of each program block.

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5.1.5 LABEL CONTROL CARD

The label control card is submitted to a GASP run as a part of the correction deck. It may occur anywhere in the correction deck.

The format of the card is:

<u>Positions</u>	<u>Description</u>
1- 5	'LABEL'
6	Blank
7- 8	Run number, 1, 2, ....35
9- 10	Ignored
11- 42	Additional identification for user, usually name of school
43- 80	Ignored

If this card is omitted, GASP will use '1' for the run number. See section (3.1.3) titled RECORD RUN CODES.

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5.1.6 OPTION CONTROL CARD

The option control card is submitted to a GASP run as a part of the correction deck. It may occur anywhere in the correction deck.

The format of the card is:

<u>Position</u>	<u>Description</u>
1- 6	'OPTION'
7- 8	Ignored
9- 12	Four character switches, chosen from the following:
13- 16	
17- 20	'STA' 'SKIP GATA BLOCK'
21- 24	'SRA' 'SKIP GARA AND GATA BLOCKS'
25- 28	'FTA' 'FULL GATA OPTION'
29- 32	'FRA' 'FULL GARA OPTION'
33- 36	'ED' 'EDIT MODE'
37- 40	'EDL' 'EDIT MODE AND FILE LIST'

Switches may be punched on the OPTION card in any order. Blank switch fields or illegal codes are ignored.

A complete description of the ED and EDL switches is given in section 5.5.1 titled GSEQ PROGRAM BLOCK. A complete description of the STA and FTA switches is given in 5.6.1 titled GATA PROGRAM BLOCK. A complete description of the SRA and FRA switches is given in 5.7.1 titled GARA PROGRAM BLOCK.

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5.2.1 GASP PROGRAM BLOCK

The GASP block is the first block entered on any run of GASP. The GASP block accomplishes certain preparatory or initializing functions for the other blocks.

XL records which reference this block ('GASP' in positions 9-12) are not interpreted by the block when it is initially entered. However, the block does provide the means for other blocks to interpret the contents of such XL records when they need to do so.

The GASP block does not have any effect on the GASP file or the correction file. This block merely 'starts off' the run.

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5.2.2 DAY AND MODULE SPECIFICATIONS, XL RECORD OPTIONS

In order for GASP to properly interpret time pattern names, it must have a description of the cycle, including day names, period names, standard class length, and special status periods. Three different XL records are used to convey this information to GASP. A fourth XL record is used to specify "lunch" periods.

The first XL record pertaining to day and module specifications has the following format:

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GASP', the XL block reference
13- 16	'D.M.', mnemonic for Day/Module
17	Must be blank
18- 22	Ignored
23- 24	2 digit non-zero integer less than or equal to 12, indicating the number of days in the cycle; that is, the number of day names.
25- 26	Ignored
27- 28	2 digit non-zero integer less than or equal to 32 indicating the number of periods in the day; that is, the number of period names.
29- 30	Ignored
31- 32	2 digit non-zero integer less than or equal to 32 indicating the number of modules in the standard class length.
33- 35	Ignored
36	'I' or 'E'. If I, GASP will interpret the '-' (dash) in time pattern names as 'up to and including' the following period name. For example, '1-2' indicates periods 1 and 2. If E, GASP will interpret the '-' in time pattern names as 'up to but excluding' the following period name. For example, '1-3' indicates periods 1 and 2.

5.2.2(2) DAY AND MODULE SPECIFICATIONS, XL RECORD OPTIONS (Continued)

<u>Positions</u>	<u>Description</u>
37- 80	Ignored
81- 84	yyyy, the record suffix

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

If the user has not supplied this record, GASP will create one for the file as follows:
(unspecified positions are made blank)

<u>Positions</u>	<u>Description</u>
1- 4	XLus, record preface
9- 12	'GASP'
13- 16	'D.M.'
23- 24	'05', indicating 5 days in the cycle
27- 28	'07', indicating 7 periods in a day
31- 32	'01', indicating standard class length of 1 module
36	'I', '1-2' interpreted as periods 1 and 2 in time pattern names
81- 84	yyyy, record suffix

5.2.2(3) DAY AND MODULE SPECIFICATIONS, XL RECORD OPTIONS (Continued)

If the user has supplied this record, but some of the fields are blank or illegal, the standard options, as just described, will be used for individual fields.

The second XL record pertaining to day and module specifications has the following format:

<u>Positions</u>	<u>Description</u>
1- 4	XLus. the record preface
5- 6	Ignored
7- 8	Must blank
9- 12	'GASP', the XL block reference
13- 16	'DAYS', mnemonic for day names
17	Must be blank
18- 27	Ignored
28	Day name of first day in cycle
29- 31	Ignored
32	Day name of second day in cycle, if any
33- 35	Ignored
.....	Consecutive day names in cycle, positions 36, 40, 44, 48, 52, 56, 60, 64, 68
72	Day name of twelfth day in cycle, if any
73- 80	Ignored
81- 84	yyyy, the record suffix

5.2.2(4) DAY AND MODULE SPECIFICATIONS, XL RECORD OPTIONS (Continued)

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: May be C, U, R, I, A, H, D or F
7- 80	As given for above XL record

If the user has not supplied this record, GASP will create one for the file as follows:

(unspecified positions are made blank)

<u>Positions</u>	<u>Description</u>
1- 4	XLus. record preface
9- 12	'GASP'
13- 16	'DAYS'
28	'M', for Monday
32	'T', for Tuesday, if the number of days in the cycle is greater than or equal to 2; otherwise blank
.....	Similarly, 'W' for Wednesday, 'R' for Thursday, 'F' for Friday, 'S' for Saturday, then, 'G', 'H', 'I', 'J', 'K' and 'L'. As many of these day names will be assumed as the number of days specified in positions 23-24 of the first XL record described in this section.
81- 84	yyyy. record suffix

If the user has supplied this record, but some of the fields are blank or illegal, the standard options, as just described, will be used for individual fields.

5.2.2(5) DAY AND MODULE SPECIFICATIONS, XL RECORD OPTIONS (Continued)

The third XL record pertaining to day and module specifications has the following format:
(there will be as many of these records in the file as there are period names)

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GASP', the XL block reference
13- 17	'MODnn', where nn is '01' for the first period name, '02' for the second period name, and so on. nn may never be greater than 32 and may not be greater than the number specified in positions 27-28 of the first XL record described in this section.
18	'S' if period is a special status period; otherwise blank
19	Ignored
20- 24	Period name corresponding to nn in positions 13-17 above. The first character of the period name must begin in position 20.
25- 72	These positions should be left blank by the user of GASP unless he is familiar with the internal time pattern representation described in the technical documentation. These positions will normally be set by GASP to indicate the location of modules within the schedule cycle.
73- 80	Ignored
81- 84	yyyy, the record suffix

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: May be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

5.2.2(6) DAY AND MODULE SPECIFICATIONS, XL RECORD OPTIONS (Continued)

If the user has not supplied one of the above records for each period name, GASP will create them for the file, as follows: (unspecified positions are made blank)

<u>Positions</u>	<u>Description</u>
1- 4	XLus, record preface
9- 12	'GASP'
13- 17	'MOD01' for the first record created, 'MOD02' for the second record created, and so on, until as many records are created as the number of periods specified in positions 27-28 of the first XL record described in this section.
20- 21	If the nn in positions 16-17 is less than or equal to 9, position 17 is copied into position 20. If nn is greater than or equal to 10, positions 16-17 are copied into positions 20-21.
81- 84	yyyy, record suffix

If the user has supplied one or more of these records, but some of the records or fields are illegal, the standard options, as just described will be used.

Assuming that the user has provided no XL records for the GASP block, GASP will provide the file with the following nine records:

XLus	GASPD.M.	05	07	01	I				
XLus	GASPDAYS		M	T	W	R	F		
XLus	GASPMOD01	1		1	8	15	22	29	
XLus	GASPMOD02	2		2	9	16	23	30	
XLus	GASPMOD03	3		3	10	17	24	31	
XLus	GASPMOD04	4		4	11	18	25	32	
XLus	GASPMOD05	5		5	12	19	26	33	
XLus	GASPMOD06	6		6	13	20	27	34	
XLus	GASPMOD07	7		7	14	21	28	35	

5.2.2(7) DAY AND MODULE SPECIFICATIONS, XL RECORD OPTIONS (Continued)

To achieve the day/module arrangements used in the example in section (2.2.1) titled TIME PATTERNS, GENERAL DISCUSSION, the user would have included as corrections the following SFRXL records.

```
SFRXLC GASPD.M.      06 19 02   E
SFRXLC GASPMOD01S 8
SFRXLC GASPMOD02 9
SFRXLC GASPMOD03 9.30
SFRXLC GASPMOD04 10
SFRXLC GASPMOD05 10.30
SFRXLC GASPMOD06 11
SFRXLC GASPMOD07 11.30
SFRXLC GASPMOD08 12
SFRXLC GASPMOD09 12.30
SFRXLC GASPMOD10 1
SFRXLC GASPMOD11 1.30
SFRXLC GASPMOD12 2
SFRXLC GASPMOD13 2.30
SFRXLC GASPMOD14 3
SFRXLC GASPMOD15 3.30
SFRXLC GASPMOD16 4
SFRXLC GASPMOD17 4.30
SFRXLC GASPMOD18S 5
SFRXLC GASPMOD19S EVE
```

Note that it was unnecessary to create the second XL record described in this section since GASP will create the appropriate record automatically with day names of M, T, W, R, F, and S.

5.2.2(8) DAY AND MODULE SPECIFICATIONS, XL RECORD OPTIONS (Continued)

The fourth XL record pertaining to day and module specifications is optional; if used, it provides information pertaining to the scheduling of lunch for resources:

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GASP', the XL block reference
13- 17	'SNACK'
18- 24	Ignored
25- 56	A time pattern name, in the usual GASP format, giving all periods which may be used for lunch. A resource is considered able to have lunch on a given day if any lunch module for that day is free in the resources schedule.
57- 80	Ignored
81- 84	yyyye, the record suffix

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: May be C, U, R, I, A, H, D, or F
7- 80	As given for the above XL record

5.2.3 GASP BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS

COMMENTS ON LOG

(None)

ERROR FLAGS ON LOGGED RECORDS

(No records are logged by the GASP block)

REPORTS, SUMMARIES, DOCUMENTATION ON LOG

(None of these are logged by the GASP block)

XL RECORDS REFERENCING GASP BLOCK

Key Field

XL Record Function

GASPD.M.	Day/module record giving number of periods and days, etc. Generated by GASP if not submitted by user.
GASPDAYS	Record giving names of days in cycle. Generated by GASP if not submitted by user.
GASPMODnn	Record for each period name. Generated by GASP if not submitted by user.
GASPSNACK	Record to define lunch periods.

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5.3.1 GCOR PROGRAM BLOCK

The GCOR block scans and edits the user's correction records submitted for the run; if the format of a record passes necessary tests, it is placed in the correction file for the run. The label and option control cards are intercepted and saved for the duration of the run.

Acceptable macro category correction records are expanded to their corresponding standard category formats. At this point, only vertical and standard corrections are in the correction file.

Finally, the correction file is sequenced.

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5.3.2 EDITS ON CORRECTION RECORDS IN GCOR BLOCK

As much checking is done as possible on the correction record fields. Some of these checks result in fatal errors; that is, if such error(s) occur on a correction record the record is not placed in the correction file. Other errors can be ignored by automatically substituting an assumption for the offending field(s); these are non-fatal errors. Mal-function errors may occur; these may cause either fatal or non-fatal errors to occur. All records containing errors are listed in the log for the GCOR block together with appropriate error flag(s).

The first check on any correction record determines the legality of the first 5 characters of the record's preface. If the preface is not one of the legal correction preface fields (SFRXL, SFRTP, MFRTP, VFRTP, SFRCL, SADCL, SACCL, MFRCL, MADCL, MACCL, VFRCL, VADCL, VACCL, SFRRE, SADRE, SACRE, MFRRE, MADRE, MACRE, VFRRE, VADRE, VACRE) the record is listed in the log with the fatal error flag 'R'. If the preface is legal, edits proceed on the basis of the preface field as described in the following sections.

5.3.3 GCOR EDITS, SFRXL FIELDS

<u>Positions</u>	<u>Field</u>	<u>Edit Performed</u>	<u>Error Flags</u>	<u>Fatal and Ignored</u>
6		If the action is not legal: C U R I A H D P	A	Yes
7- 8	Key	If not blank	K	Yes
9- 12	Key	If not a block name	K	Yes
13- 17	Key	If not legal for particular block reference in 9-12	K	Yes

5.3.4 GCOR EDITS, SFRTP FIELDS

<u>Positions</u>	<u>Field</u>	<u>Edit Performed</u>	<u>Error Flags</u>	<u>Fatal and Ignored</u>
6		If the action is not legal: C U R I A H D P	A	Yes
7	Key	If not '.' or blank	K	Yes
7	Key	If blank, set to '.'	None	No
8- 17	Key	If a local character occurs in any position	K	Yes
20- 20	BD	If not blank, or a digit 1, 2, ....8	F	No
57- 68	QA	If position 57 is '.', and local characters occur in 58-68, complete QA field is set to blank	F	No
69- 80	QB	If position 69 is '.', and local characters occur in 70-80, complete QB field is set to blank	F	No

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5.3.5 GCOR EDITS, SFRCL FIELDS

<u>Positions</u>	<u>Field</u>	<u>Edit Performed</u>	<u>Error Flags</u>	<u>Fatal and Ignored</u>
6		If the action is not legal: C U R I A H D P	A	Yes
7	Key	If not '/' or blank	K	Yes
7	Key	If blank, set to '/'	None	No
8- 15	Key	If a local character occurs in any position	K	Yes
16- 17	Key	If not a non-zero integer	K	Yes
35	PR	If not blank or non-zero digit, set to blank	F	No
37- 47	CT	If these positions are all blank, no further edit on the CT field is performed	None	No
37	CT	If not '/' or blank, CT field is completely blanked	F	No
37	CT	If blank, set to '/'	None	No
38- 45	CT	If a local character occurs in any position, CT field is completely blanked	F	No
46- 47	CT	If not a non-zero integer, CT field is completely blanked	F	No
48	PS	If not blank, 'A', 'B' or 'S', set to blank	F	No
49- 51	TR	If any position is not blank, 'S' or 'W', it is set to blank	F	No
52- 69	RT	If a non-blank m position corresponds to a blank d position, it is set to blank	F	No
52- 69	RT	If an m position is blank for a non-blank d position, the m position is set to the d position	None	No
70- 72	CR	If any position is not blank, 'S' or 'W', it is set to blank	F	No
73	RM	If not a digit or blank, set to blank	F	No
74	RM	If not a digit or blank, set to blank	F	No
75- 77	RM	If not an integer or blank, set to blank	F	No
78- 80	TS	If a local character in any position, position is blanked	F	No

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5.3.6 GCOR EDITS, SADCL FIELDS

<u>Positions</u>	<u>Field</u>	<u>Edit Performed</u>	<u>Error Flags</u>	<u>Fatal and Ignored</u>
6		If the action is not legal: U	A	Yes
7	Key	If not '/', or blank	K	Yes
7	Key	If blank, set to '/'	None	No
8- 15	Key	If a local character occurs in any position	K	Yes
16- 17	Key	If not a non-zero integer	K	Yes
18		If not blank, 'l', 'A' or 'B'	I	Yes
19- 30)		For each non-blank add/drop field, edits are performed depending upon the first character position: If the first position is '+' (or not '-', '*', ', ' or '\$') and If positions 2-11 contain local characters, the entire field is blanked If position 12 is not blank, 'L', '.' or '*', the entire field is blanked If the first position is '-' or '\$' (\$hhdddddmmmm) the field is not edited If the first position is '*', or ',', (*hhdddddmmmmmq or ,hhdddddmmmmmq) and If hh is not 'L', 'R' or a non-zero integer, the entire field is blanked If a non-blank m position corresponds to a blank d position, the entire field is blanked If an m position is blank for a non-blank d position, the m position is set to the d position If position 12 is not 'L', it is set to 'L'	F	No
31- 42)			F	No
43- 54)			F	No
55- 66)			F	No
67- 78)			None	No
			None	No

5.3.7 GCOR EDITS, SACCL FIELDS

<u>Positions</u>	<u>Field</u>	<u>Edit Performed</u>	<u>Error Flags</u>	<u>Fatal and Ignored</u>
6		If the action is not legal: U	A	Yes
7	Key	If not '/' or blank	K	Yes
7	Key	If blank, set to '/'	None	No
8- 15	Key	If a local character occurs in any position	K	Yes
16- 17	Key	If not a non-zero integer	K	Yes
21- 22	(Assignment control code)	If not 'FV', 'P.', 'FA', 'RI', 'R*' or 'RA'	I	Yes

5.3.8 GCOR EDITS, SPRE FIELDS

<u>Positions</u>	<u>Field</u>	<u>Edit Performed</u>	<u>Error Flags</u>	<u>Fatal and Ignored</u>
6		If the action is not legal: C U R I A H D P	A	Yes
7	Key	If not 'I', 'R' or 'S'	K	Yes
8- 17	Key	If a local character occurs in any position	K	Yes
18- 20	ML	If not an integer or blank, set to blank	F	No
57- 68	RF	If position 57 is '.', and local characters occur in 58-68, complete RF field is set to blank	F	No
69- 80	RP	If position 69 is '.', and local characters occur in 70-80, complete RP field is set to blank	F	No

5.3.9 GCOR EDITS, SADRE FIELDS

<u>Positions</u>	<u>Field</u>	<u>Edit Performed</u>	<u>Error Flags</u>	<u>Fatal and Ignored</u>
6		If the action is not legal: U	A	Yes
7	Key	If not 'I', 'R' or 'S'	K	Yes
8- 17	Key	If a local character occurs in any position	K	Yes
18		If not blank, 'l', 'A' or 'B'	I	Yes
19- 30)		For each non-blank add/drop field, edits are performed		
31- 42)		depending upon the first character position:		
43- 54)		If the first position is '+' (or not '-', '*', ', or		
55- 66)		'\$') and		
67- 78)		If positions 2-11 contain local characters, the entire field is blanked	F	No
		If positions 10-11 are not blank or a non-zero integer, the entire field is blanked	F	No
		If positions 10-11 are non-blank, and if position 12 is not blank, '.', '*', 'M', 'A', 'T', 'E' or 'R', the entire field is blanked	F	No
		If positions 10-11 are blank or position 9 is '*' and position 12 is not 'M', 'A', 'T', 'E' or 'R', it is set to 'R'	None	No
		If the first position is '-' or '\$' (\$hhdddddmmmm) the field is not edited		
		If the first position is '*' or ',' (*hhdddddmmmmq or ,hhdddddmmmmq) and		
		If hh is not 'L', 'R' or a non-zero integer, the entire field is blanked	F	No
		If a non-blank m position corresponds to a blank d position, the entire field is blanked	F	No
		If an m position is blank for a non-blank d position, the m position is set to the d position	None	No
		If position 12 is not 'M', 'A', 'T', 'E' or 'R' it is set to 'R'	None	No

5.3.10 GCOR EDITS, SACRE FIELDS

<u>Positions</u>	<u>Field</u>	<u>Edit Performed</u>	<u>Error Flags</u>	<u>Fatal and Ignored</u>
6		If the action is not legal: U	A	Yes
7	Key	If not 'I', 'R' or 'S'	K	Yes
8- 17	Key	If a local character occurs in any position	K	Yes
21- 22	(Assignment control code)	If not 'FV', 'P.', 'FA', 'RI' 'R*' or 'RA'	I	Yes

5.3.11 GCOR EDITS, MFRTF, MADCL, MACCL, MFRRE, MADRE AND MACRE RECORDS

All macro category corrections generate standard corrections; generated standard corrections are edited exactly the same as standard corrections which are submitted by the user.

Additionally, a special edit is made on the key field of all macro category correction records. Positions 16-17 of the key field must be a non-zero decimal integer; if this is not the case, the macro correction record is printed with a flag of K and no standard corrections are generated. (It will be remembered that the number of standard corrections generated is the number in positions 16-17 of macro corrections).

5.3.12 GCOR EDITS, VFRTP, VFRCL, VADCL, VACCL, VFRRE, VACRE AND VADRE RECORDS

All vertical corrections undergo the same edits in position 7 and in positions 18-80 as their corresponding standard category corrections; the same flags are used for error conditions on vertical corrections as are used for the corresponding standard corrections. Further, errors are treated as fatal or non-fatal according to whether or not the error is fatal on the corresponding standard correction. As is true of all corrections, the 'A' error flag is used for illegal action characters in position 6; on the VFRTP, VFRCL and VFRRE corrections, the actions may be U, R, A, H, P or D. On all other vertical corrections, the only legal action is U. Action errors are always fatal.

The group designator selector in positions 8-15 (key fields) of all vertical corrections is edited as follows:

<u>Positions</u>	<u>Field</u>	<u>Edit Performed</u>	<u>Error Flags</u>	<u>Fatal and Ignored</u>
8- 15	Key	If a non-blank m position corresponds to a blank d position	K	Yes
8- 15	Key	If an m position is blank for a non-blank d position, the m position is set to the d position	None	No

5.3.13 GCOR BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS

COMMENTS ON LOG

GCOR BLOCK COMPLETED. NNNNN CORRECTIONS READ, NNNNN RECORDS IN CORRECTION FILE

ERROR FLAGS ON LOGGED RECORDS

<u>Error Flag</u>	<u>Description</u>
R	Fatal, illegal correction preface
A	Fatal, illegal action code character on record
K	Fatal, illegal key in correction record
F	Not fatal; field format bad, edit has taken place
I	Fatal, field format bad

REPORTS, SUMMARIES, DOCUMENTATION ON LOG

(None are logged by the GCOR block)

XL RECORD REFERENCING THE GCOR BLOCK

(None)

5.4.1 GUEA PROGRAM BLOCK

The GUEA block updates the GASP file on the basis of the correction file prepared by the GCOR block. The only errors which can occur in this block are those involving the file maintenance procedure; either the GASP file or correction file are subject to these errors. In the case that mal-function errors occur, GASP should be rerun.

Any standard category corrections which apply to a GASP file record are processed in the order in which the user supplied the corrections. In the case that more than 1 correction applies to a single GASP file record, corrections of ALL categories are processed in the order in which the user supplied correction cards, EXCEPT that field replacement corrections apply before add/drop or assignment control corrections.

For TP, CL and RE records with blank name fields (NA), positions 8-17 of the record (key field without 1st character) will be placed in the first 10 positions of the NA field.

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5.4.2 GUEA PROGRAM BLOCK, RESETTNG OF ASSIGNMENT CHARACTERS .

After all corrections have been processed for a single GASP file record, the GUEA block insures that assignment characters in assignment fields (TA fields in CL records, RA fields in RE records) are set as follows:

- 1) All assignment fields on a record in protected status (the result of a Hold correction action) are given permanent assignment characters,
- 2) All assignment fields with temporary assignment characters are deleted from the CL and RE records, except
 - a) Such fields will not be deleted from CL records if the GATA block will not be run
 - b) Such fields will not be deleted from RE records if the GARA block will not be run

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5.4.3 GUEA EDITS, ERROR CONDITIONS

<u>Positions</u>	<u>File</u>	<u>Error Condition</u>	<u>Error Flags</u>	<u>Fatal and Ignored</u>
1- 2	GASP	Record name not 'XL', 'TP', 'CL' or 'RE' (mal-function error)	R	Yes
3	GASP	Illegal run code character; if illegal changed to zero (mal-function error)	C	No
4	GASP	Illegal status code character (mal-function error)	S	Yes
1- 5	CORRECTION	Illegal correction preface (mal-function error since GCOR prepared the correction file)	R	Yes
6	CORRECTION	Illegal action code character (mal-function error since GCOR prepared the correction file)	A	Yes
Action/status	BOTH FILES	Illegal correction action code for GASP file record; if illegal, correction has no effect on GASP record	U	No (GASP) Yes (CORR.)
7	BOTH FILES	First character of key inconsistent with record preface (mal-function error)	K	Yes
8- 17	BOTH FILES	Local character in key (mal-function error)	K	Yes
7- 17	GASP	File out of sequence (mal-function error)	Q or E	Yes
7- 17	CORRECTION	File out of sequence (mal-function error)	Q	Yes
Parity	GASP	Probable confusion in key field (mal-function error)	P	Yes
Length	GASP	Record length improper for format (mal-function error)	Z	Yes
	GASP	Attempt to create more than 32 TQ or RQ fields or more than 75 TQ and TA or RQ and RA fields on a CL or RE record. Excess fields are lost.	F	No
	GASP	A key in a TQ, TA, RQ or RA field references a time pattern or class which does not exist in the file	N	No

5.4.4 CORRECTION LISTING CONTROL, XL RECORD OPTIONS

Ordinarily, the GUEA block prints on the log all SFRXL correction records, all vertical correction records, and any correction records which have error flags associated with them.

Vertical corrections for TP, CL or RE records will be logged:

a) With the V flag prior to processing TP, CL or RE records IF there is insufficient storage to hold all such corrections. In this event, such verticals have not been used to update records.

b) With a decimal integer in the flag area after processing the TP, CL or RE records. In this case, the decimal integer gives a count of the number of file records which were selected by the vertical correction.

Optionally, the user may request that all correction records for the run be listed on the log. In this case, correction records without errors are listed with no flags.

The XL record controlling this option has the following format:

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GUEA', the XL block reference
13- 17	Must be blank
18- 20	Ignored
21- 24	'CORR', indicates all corrections to be listed; anything else in this field indicates that the standard option listing only SFRXL corrections, vertical corrections and error corrections on the log will be used
25- 80	Ignored
81- 84	yyye, the record suffix

5.4.4(2) CORRECTION LISTING CONTROL, XL RECORD OPTIONS (Continued)

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

If the user has not supplied this record, GASP will create one for the file as follows:

(1. specified positions are made blank)

<u>Positions</u>	<u>Description</u>
1- 4	XLus, record preface
9- 12	'GUEA'
81- 84	yyyye, record suffix

5.5 GUEA BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS

MENTS ON LOG

NO TP TIME PATTERN RECORDS IN GASP FILE. RUN WILL BE TERMINATED AT END OF BLOCK.

NO CL CLASS RECORDS IN GASP FILE. RUN WILL BE TERMINATED AT END OF BLOCK.

NO RE RECORDS FOR INSTRUCTORS IN GASP FILE.

NO RE RECORDS FOR ROOMS IN GASP FILE.

NO RE RECORDS FOR STUDENTS IN GASP FILE.

INSUFFICIENT STORAGE SPACE FOR TIME PATTERNS. RUN WILL BE TERMINATED.

INSUFFICIENT STORAGE SPACE FOR TIME PATTERN LITERALS (QA, QB, RF, RP FIELDS). EXCESS LITERALS IGNORED.

INSUFFICIENT STORAGE SPACE FOR CLASSES. RUN WILL BE TERMINATED.

THERE ARE MORE THAN 4095 CLASSES. RUN WILL BE TERMINATED.

THERE ARE MORE THAN 4095 TIME PATTERNS AND LITERALS. RUN WILL BE TERMINATED.

THERE ARE MORE THAN 16383 RESOURCES. RUN WILL BE TERMINATED.

GUEA BLOCK COMPLETED. RECORD COUNTS-NNNNN OLD GASP, NNNNN NEW GASP, NNNNN CORRECTION.

5.4.5(2) GUEA BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS (Continued)

ERROR FLAGS ON LOGGED RECORDS

<u>Error Flags</u>	<u>Description</u>
R	Fatal (mal-function), illegal record preface
C	Not fatal (mal-function), illegal run code in GASP record
S	Fatal (mal-function), illegal status code character in GASP record
A	Fatal (mal-function), illegal action code character in correction record
K	Fatal (mal-function), illegal character in a key
Q,E	Fatal (mal-function), file out of sequence at this point
P	Fatal (mal-function), parity error in GASP record, probably confusion in key field
V	Fatal (insufficient storage), vertical correction ignored
N	Not fatal (edit), request or assignment field in GASP file record references non-existent time pattern or class
Z	Fatal (mal-function), record length improper for GASP record
F	Not fatal, attempt to create excess request or assignment fields on CL or RE records
U	Not fatal for GASP records, wrong action for status of GASP record; correction ignored
nnnnn	(Decimal integer) vertical correction logged. nnnnn is count of file records selected by the correction

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5.4.5(3) GUEA BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS (Continued)

REPORTS, SUMMARIES, DOCUMENTATION ON LOG

(None are logged by the GUEA block)

XL RECORD REFERENCING THE GUEA BLOCK

<u>Key Field</u>	<u>XL Record Function</u>
GUEA	Controls the listing of corrections

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5.5.1 GSEQ PROGRAM BLOCK

The GSEQ program block associates a special sequencing field with each CL and RE record in the GASP file. This sequencing field will enter into the determination of the order in which GASP will make assignments. Sequencing fields are computed on the basis of existing fields in the records.

Sequencing fields contain alphabetic and numeric characters. When CL or RE records are sequenced into alphanumeric order on these fields, the first records in these sequences will offer GASP less 'flexibility' in determining assignments than subsequent records.

Later program blocks may override sequencing fields determined in the GSEQ block.

The user can control the makeup of the CL record sequencing field.

All edits on user corrections to the GASP file are complete at the conclusion of the GSEQ block. An option switch, 'ED', allows the user to terminate a GASP run at this point. If this option is exercised, the log for the GCOR, GUEA and GSEQ blocks will contain all regular output for these blocks; the remaining blocks will not be executed. A second option switch, 'EDL', causes control to be transferred to the GUEB block when the GSEQ block terminates. For this option, a new GASP file is generated and listed. The 'EDL' option causes the GASP run to terminate when GUEB is complete so that statistical (GSTO block) or production outputs (GPRO block) will not be given. The use of one of these options makes sense when large numbers of corrections (or very complicated corrections) should be edited before the expense of a complete run is undertaken. See section (5.1.6) titled OPTION CARD for details on setting these switches.

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5.5.2 GSEQ PROGRAM BLOCK, SEQUENCING FIELDS FOR CL RECORDS

The standard sequencing field for each CL record is composed of four characters as follows:

- 1) The subject phase priority digit is used as the first character of the sequencing field.
- 2) The second character of the sequencing field represents a count of the minimum number of periods not used on any single day in any of the time patterns which may be assigned to the class. ('unused modules' component)
- 3) The third character of the sequencing field represents a count of the minimum number of days not used in any of the time patterns which may be assigned to the class. ('unused days' component)

Characters 2 and 3 represent the complexity of the time patterns which may be assigned to the class.

- 4) The fourth character is based on the number of classes in the subject phase of which the class is a part. ('number of classes' component)

The user may alter the relative weight of the 4 character - components in the sequencing field. For example, the number of classes can be made more important than time pattern complexity. See section (5.5.4) titled SEQUENCING CONTROL XL RECORD OPTIONS.

After the above field has been computed for each class of a subject phase, the lowest (according to alphanumeric order) sequencing field for any class of the subject phase is assigned to all classes of the subject phase.

Finally if the user has specified class/class ties, the sequence fields as determined above may be lowered to insure that tied classes are scheduled after their class/class tie. CL records involving illegal ties will be listed on the log with the error flag of T and the tie cannot be guaranteed.

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5.5.3 GSEQ PROGRAM BLOCK, SEQUENCING FIELDS FOR RE RECORDS

The sequencing field for each RE record is composed of one character.

This field is a character representing a fraction as follows:

- 1) The numerator of the fraction is the sum of the number of classes involved in subject phases of all unsatisfied request RQ fields.
- 2) The denominator of the fraction is a count of all RA and unsatisfied RQ fields on the RE record.

The user has no control over this variable.

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5.5.4 SEQUENCING CONTROL, XL RECORD OPTIONS

Ordinarily, the GSEQ block creates sequencing fields as just described. Optionally, the user may specify that the sequencing fields created in GSEQ leave the GASP file in its original order: i.e., alphanumeric order on the key fields of its records. Further, the user can control the computation of the class sequencing variable.

The XL record controlling this option has the following format:

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GSEQ', the XL block reference
13- 17	Must be blank
18- 20	Ignored
21- 24	'KILL' indicates that all sequencing fields are to be blank, insuring GASP file order; anything else in this field indicates the standard option
25- 26	Ignored
27- 28	'Number of classes' cutoff; phases with more classes than this number will be treated as if they had this number of classes. If this field is not specified it is assumed to be '4'
29- 32	Ignored
33- 34	Relative weight of user priority component in CL sequencing variable
35- 36	Relative weight of 'unused module' component in CL sequencing variable
37- 38	Relative weight of 'unused day' component in CL sequencing variable
39- 40	Relative weight of 'number of classes' component in CL sequencing variable
41- 80	Ignored
81- 84	yyyy, the record suffix

Each component is placed into the sequencing variable by arithmetically adding it to the variable. The relative weight specifies the number of binary zeros (powers of 2) to be attached to the low order part of the component before the 'add' takes place except that zero

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5.5.4(2) SEQUENCING CONTROL, XL RECORD OPTIONS (Continued)

indicates that a component is to have no influence. The minimum weight which may be used is zero, the maximum is 25. Components may be added to the sequencing variable in an overlapping way if the user desires. If the user leaves the above 5 fields blank, the standard CL sequencing field will be computed.

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

If the user has not supplied this record, GASP will create one for the file as follows:
(unspecified positions are made blank)

<u>Positions</u>	<u>Description</u>
1- 4	XLus, record preface
9- 12	'GSEQ'
81- 84	yyyye, record suffix

5.5.5 GSEQ BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS, OPTION SWITCHES

COMMENTS ON LOG

GSEQ BLOCK COMPLETED

ERROR FLAGS ON LOGGED RECORDS

<u>Error Flag</u>	<u>Description</u>
M	Mal-function error. Record remains in the file
T	CL records (positions 1-80 only) of a phase involving illegal tie structure (CT fields)

REPORTS, SUMMARIES, DOCUMENTATION ON LOG

(None of these are logged by the GSEQ block)

XL RECORD REFERENCING GSEQ BLOCK

<u>Key Field</u>	<u>XL Record Function</u>
GSEQ	Record allows the user to suspend the computation of sequencing fields for run, or to specify makeup of CL sequencing variable.

OPTION SWITCHES

'ED 1'	Run is terminated at end of GSEQ
'EDL'	Run proceeds immediately to QUEB (bypassing GATA and GARA)

5.6.1(3) GATA PROGRAM BLOCK (Continued)

any assignments it or the user has provided for this or for previously scheduled classes.

Time assignments, whether permanent or temporary, are identified as valid or invalid as part of the scheduling process for each class.

The GATA program block can be bypassed upon specification by the user; the 'STA' switch punched on the OPTION card to achieve this. This option should not be exercised unless the time assignments for all classes in the GASP file are to remain 'as is'; usually this will mean that all time assignments are permanent and valid. If the 'STA' option is exercised, validity will not be recomputed for any time assignments.

5.6. GATA PROGRAM BLOCK, TIME ASSIGNMENTS

The following table summarizes the various conditions governing the computation of time assignments by the GATA block. Recall that any time assignments which exist in the file immediately prior to the execution of GATA are permanent assignments and that any assignments made by GATA will be temporary assignments.

<u>Number of Request Fields</u>	<u>Number of TA Permanent Assignments</u>	<u>Result</u>
0	0	An invalid time assignment; the time pattern key will be the first one in the file.
0	1, or more	No assignments made by GATA.
1, or more	0	1 time assignment will be made; the time pattern key selected will be the 'best' as computed by GATA from the list of possible keys in the request
1, or more	1, or more	If 1 or more of the time pattern keys in assignment (TA) fields are identical to the keys in 1 or more of the request components, no additional assignments will be made. Otherwise, 1 additional assignment will be made using the request components as above.

5.6.1 GATA PROGRAM BLOCK

The GATA program block is the primary scheduling or assignment block in the GASP program. This block insures that assignments indicated by request fields are satisfied by assignments. The time assignments made by this block are final for the duration of the run. Resource assignments to classes, while made by this block, are generally redone by the next program block (GARA); resource assignments made by GATA are 'acceptable', but may usually be improved upon. Normally, GATA will not make invalid temporary resource assignments.

Two options are available for the GATA block; these are called the 'FULL' and 'BASIC' options. Advantages of the BASIC option are faster processing and reduced storage space requirements. The disadvantage of the BASIC option is that it ignores any specifications calling for the threading rules, the confining rules, the phase sequencing rules, resource preferred free time, resource maximum loads or resource lunches. For the FULL option the STRONG threading and confining rules, the phase sequencing rules, and the resource maximum loads are automatically considered. For the FULL option of GATA, the user can cause the WEAK threading and confining rules, the resource preferred free time and lunch to be treated 'strongly', i.e., the weak threading and confining rules are treated as if they were strong rules, the resource preferred free time is treated as if it were resource free time and at least one of the lunch modules will remain unassigned on each day. Unless the user specifies (on the appropriate XL record), that a particular weak constraint be treated strongly, it will be ignored by the GATA block. Both options of GATA take into account time conflicts, resource maximums and the resource free time.

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5.6.1(2) GATA PROGRAM BLOCK (Continued)

The FULL option is not exercised UNLESS the user specifies the 'FTA' switch on the OPTION card for a run. Since the OPTION card does not become a part of the GASP file, it must be included for each run where the FULL option is desired. See the section (5.1.6) titled OPTION CARD for details about punching the option card. It is suggested that the first few runs of GASP for a given school, do not use the FULL option since these runs tend to be involved with "getting the data into shape" and in "getting a feel for the scheduling problem". The FULL option involves somewhat more expense and it can sometimes cloud the issue revolving around the more basic constraint of conflicts if other constraints are present as well. The user should not inject constraints such as threading rules, phase sequencing rules, etc., until he is assured that a conflict-free schedule is possible. (Initial data preparation should include all constraints that the user plans to use; the BASIC option merely ignores specifications for constraints handled only by the FULL option. The file maintenance blocks of GASP will edit all data fields regardless of the option being exercised).

CL records are processed by this block in the order determined by the sequencing field computed by GSEQ. All classes of a subject phase are processed simultaneously. If a permanent time assignment satisfying the time pattern request is not already made for a class, an appropriate time pattern is chosen on the basis of the time pattern request, and upon other constraints appropriate to the option being exercised as detailed above. Simultaneously, the resource assignments are made to the class. Alternate requests and substitute track substitution requests are ignored. Track substitution requests and Elective requests are treated as if they were Required requests. Since GATA activity is cumulative, class by class, it takes into consideration

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5.6.2(2) GATA PROGRAM BLOCK, TIME ASSIGNMENTS (Continued)

The following table summarizes the computation of the validity/invalidity status of all time assignments, whether temporary or permanent.

CONDITIONS RESULTING IN INVALID TIME ASSIGNMENTS

- 1) The assignment of the first time pattern key as described in the first case (no requests and no permanent assignments) in the table above will be an invalid assignment
- 2) The existence of 2 or more permanent assignments for a class which conflict with each other causes invalid assignments. The first of the pair or group of conflicting assignments will be valid; the remainder will be invalid. Temporary assignments cannot be invalid because of such conflicts since no request component which represents a conflict with any permanent assignments is considered as part of the request list.
- 3) If one of the phase sequencing rules is specified for the class and a time assignment (temporary or permanent) breaks the specified rule, then the time assignment is invalid. (If the BASIC option is exercised, phase sequencing rule specifications are ignored and assignments may be made and counted as valid which are in violation of a phase sequencing rule).

5.6.3 CONTROLLING SCHEDULING ACTIVITIES BY GATA, XL RECORD OPTIONS

There are 3 optional XL records referencing GATA which the user may create in the GASP file: these records, if used, have the effect of altering priorities built into the GATA block concerning the measures, feasibilities and evaluations which govern the assignment made. It is strongly recommended that new users of GASP not use these optional XL records until some experience in the use of GASP and some knowledge of the technical details of GATA have been gained. The various program parameters which these records set are assumed if the XL record does not specify them.

All three of the XL records have identical formats except that each references a separate resource set (instructors, rooms, students):

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GATA', the XL block reference
13- 16	Must be blank
17	'I' for instructors, 'R' for rooms, 'S' for students
18- 20	Ignored

5.6.3(2) CONTROLLING SCHEDULING ACTIVITIES BY GATA, XL RECORD OPTIONS (Continued)

<u>Positions</u>	<u>Assumed Value</u>	<u>Description</u>
21	1	A digit, 0,1...9. These digits specify the relative importance of the 3 resource sets. The preset values cause instructors, rooms, and students to be treated 'equally'. If the values for instructors and rooms were '1' and the value for students '2', student constraints would be weighted twice as heavily as those of the other resources in evaluating time patterns.
22- 24		Ignored
25- 28	1.00	'Time evaluation cutoff within old times'
29- 32	.95	'Time evaluation cutoff between old/new times'
33- 36	.95	'Time evaluation cutoff within new times'
37- 40	.95	'Time evaluation adjustment for new times'
41- 44	1.00	'Weight for must/twin resources in time evaluation'
45- 48	.95	'Weight for must/back-to-back-good resources in time evaluation'
49- 52	.90	'Weight for must/back-to-back-bad students in time evaluation'
53- 56	1.00	'Weight for may/twin resources in time evaluation'
57- 60	.95	'Weight for may/back-to-back-good resources in time evaluation'
61- 64	.95	'Weight for may/back-to-back-bad students in time evaluation'
The user should not set the values of the fields 25-28, 29-32,.....,61-64 unless he is familiar with the time evaluation formulas used in GATA		
65- 68		Ignored
39		If non-blank for 'FULL' option, treat RF as RF

5.6.3(3) CONTROLLING SCHEDULING ACTIVITIES BY GATA, XL RECORD OPTIONS (Continued)

<u>Positions</u>	<u>Assumed Value</u>	<u>Description</u>
70		If non-blank for 'FULL' option, treat weak TR as strong
71		If non-blank for 'FULL' option, treat weak CR as strong
72		If non-blank for 'FULL' option, treat lunch strongly
73- 80		Ignored
81- 84		yyyy, the record suffix

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

5.6.4 TIME ASSIGNMENT ANALYSIS REPORT, GATA BLOCK

A 1 line summary is printed on the log from the GATA block for each class processed by GATA. The ordering of this report will be the order in which GATA processes classes; all classes of a given subject phase will occur together in the report but the ordering of phases may be quite unlike their ordering in the GASP file. The classes within each phase on the report will not necessarily be in order. This report will be called the time assignment analysis report.

Special column headings will occur at the top of each page of the log for ease in reading the report. Examples from typical pages of this report are given next. A discussion of the contents of the report, using the column headers as references, follows the example.

5.6.4(2) TIME ASSIGNMENT ANALYSIS REPORT, GATA BLOCK (Continued)

GASP LOG FROM GATA BLOCK PAGE 5 06/18/67 14.32.18

CLASS	INSTRUCTORS	ROOMS	STUDENTS	TIMES
KEY	TOT INT FEA MEAS	TOT INT FEA MEAS	TOT INT FEA MEAS	AVE BEST PATTERN
/BIOL B01	1 0 1 1.00	1 0 1 1.00	3 3 3 1.00	1 0 0 0 1 .98 .98 M3-4
/CHEM B01	1 0 1 1.00	1 0 1 1.00	4 4 4 1.00	1 0 0 0 1 .98 .98 M5-7
/CHEM B02	1 0 1 1.00	1 0 1 1.00	4 4 4 1.00	1 0 0 0 1 .98 .98 F1-2
/CHEM B03	1 0 1 1.00	1 0 1 1.00	4 4 4 1.00	1 0 0 0 1 .98 .98 F3-4
/CHEM B04	1 0 1 1.00	1 0 1 1.00	3 3 3 1.00	1 0 0 0 1 .98 .98 F5-6
/PHYS B01	1 0 1 1.00	1 0 1 1.00	4 4 4 1.00	1 0 0 0 1 .98 .98 M2-3
/PHYS B02	1 0 1 1.00	1 0 1 1.00	4 4 4 1.00	1 0 0 0 1 .98 .98 M4-5
/PHYS B03	1 0 1 1.00	1 0 1 1.00	4 4 4 1.00	1 0 0 0 1 .98 .98 M6-7
/PHYS B04	1 0 1 1.00	1 0 1 1.00	3 3 3 1.00	1 0 0 0 1 .98 .98 M1-2
/BIOL 01	1 0 1 1.00	1 1 1 1.00	3 3 3 1.00	0 1 0 0 21 .83 .98 MTRF3
/CHEM 01	1 0 1 1.00	1 1 1 1.00	4 4 4 1.00	0 1 0 0 21 .73 .98 MTRR2
/CHEM 02	1 0 1 1.00	1 1 1 1.00	4 4 4 1.00	0 1 0 0 21 .72 .98 MTRR4
/CHEM 03	1 0 1 1.00	1 1 1 1.00	4 4 4 1.00	0 1 0 0 21 .67 .98 MTRF7
/CHEM 04	1 0 1 1.00	1 1 1 1.00	3 3 3 1.00	0 1 0 0 21 .62 .98 MTRR5
/PHYS 01	1 0 1 1.00	1 1 1 1.00	4 4 4 1.00	0 1 0 0 21 .73 .98 MTRF3
/PHYS 02	1 0 1 1.00	1 1 1 1.00	4 4 4 1.00	0 1 0 0 21 .67 .98 MTRF5
/PHYS 03	1 0 1 1.00	1 1 1 1.00	4 4 4 1.00	0 1 0 0 21 .59 .98 MTRF7
/PHYS 04	1 0 1 1.00	1 1 1 1.00	3 3 3 1.00	0 1 0 0 21 .49 .98 MTRF1
/STENO 01	1 0 1 1.00	1 0 1 1.00	3 3 3 1.00	0 1 0 0 3 .95 .95 MTRRF6-7
/STENO 02	1 0 1 1.00	1 0 1 1.00	3 3 3 1.00	0 1 0 0 3 .74 .95 MTRRF3-4
/ALG 1 01	1 0 1 1.00	1 1 1 1.00	5 5 5 1.00	0 1 0 0 7 .95 .95 MTRRF6
/GEOM 01	1 0 1 1.00	1 1 1 1.00	4 4 4 1.00	0 1 0 0 7 .88 .95 MTRRF1
/P CHEM 01	1 0 1 1.00	1 1 1 1.00	4 4 4 1.00	0 1 0 0 7 .70 .95 MTRRF2
/BS LAW 01	1 0 1 1.00	1 0 1 1.00	5 5 5 1.00	0 1 0 0 7 .95 .95 MTRRF7
/BS LAW 02	1 0 1 1.00	1 0 1 1.00	4 4 4 1.00	0 1 0 0 7 .81 .95 MTRRF5

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CLASS	INSTRUCTORS	ROOMS	STUDENTS	TIMES
KEY	TOT INT FEA MEAS	TOT INT FEA MEAS	TOT INT FEA MEAS	AVE BEST PATTERN
/PE 12G 05	1 0 1 1.00	1 0 1 1.00	3 3 3 1.00	0 1 0 0 35 .60 .98 T7
/PE 12G 06	1 0 1 1.00	1 0 1 1.00	3 3 3 1.00	0 1 0 0 35 .55 .98 R7
/PE 12G 07	1 0 1 1.00	1 0 1 1.00	3 3 3 1.00	0 1 0 0 35 .44 .98 R5
/PE 12G 08	1 0 1 1.00	1 0 1 1.00	1 1 1 1.00	0 1 0 0 35 .39 .82 R3
/JJJJJKP01	0 0 0 .00	0 0 0 .00	0 0 0 .00	1 0 0 0 1 .00 .00
TOTALS 179	178 173 176 176	109 1.00	594 594 1.00	169 0 10 .68

5.6.4(3) TIME ASSIGNMENT ANALYSIS REPORT, GATA BLOCK (Continued)

KEY : Identification of class

FOR EACH RESOURCE TYPE

TOT : Total number of resource assignments for this class

INT : Number of resource assignments made by GATA (not counted in this internal total are permanent assignments and those corresponding to requests with the class specified, /jjjjj)kpccq)

FEA : Number of resource assignments which are feasible, i.e., those that GATA considers as valid

MEAS : A fraction (.0 to 1.0) equal to # in FEA column divided by # in TOT column

FOR THE TIMES

. : Number of permanent-valid time assignments

~ : Number of temporary-valid time assignments

* : Number of permanent-invalid time assignments

\$: Number of temporary-invalid time assignments

N : Number of time patterns considered by GATA. (Will be less than or equal to the number of time patterns in the request list).

AVE : A fraction (.0 to 1.0) measuring 'goodness' of all considered time assignments

BEST : A fraction (.0 to 1.0) measuring 'goodness' of time assignment made. A measure of 1.0 is 'ideal', of .0 is very bad

PATTERN: A time pattern name, giving all modules assigned to the class. This name will include temporary and permanent assignments. The format of the name will not necessarily exactly match that punched on the corresponding TP record(s).

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5.6.5 GATA BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS, OPTION SWITCHES

COMMENTS ON LOG

WORK AREA OVERFLOWED FOR AT LEAST ONE CLASS

ERROR FLAGS ON LOGGED RECORDS

Error Flag	Description
M	Mal-function error. Record is removed from file.

REPORTS, SUMMARIES, DOCUMENTATION ON LOG.

Time Assignment Analysis report. A single line summarizing GATA activity for each class processed.

XL RECORDS REFERENCING GATA BLOCK

Key Field	XL Record Function
GATA I	reset assumed parameters, weights, etc. or specify switches for instructors.
GATA R	reset assumed parameters, weights, etc. for rooms.
GATA S	reset assumed parameters, weights, etc. for students.

OPTION SWITCHES

'FTA'	Run 'FULL' GATA option
'STA'	'Skip' (bypass) the GATA block entirely
'SRA'	'Skip' (bypass) both the GATA and GARA blocks entirely

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5.7.1 GARA PROGRAM BLOCK

The GARA program block is an auxiliary scheduling or assignment block in the GASP program. This block determines the validity of all resource assignments, and provides alternative techniques for resource assignment in addition to the option of using the resource assignments made during the GATA block. Where applied, the alternative techniques lead to replacement of the temporary resource assignments made during the GATA block with other, possibly different, temporary assignments. The GARA approach to resource assignments is generally more sophisticated than the GATA approach, and for most schools will result in better scheduling and allocation of resource elements.

The fundamental difference between the assignment approaches used by GARA and GATA is that GATA builds the resource schedule by assigning resources to classes, one class at a time; GARA builds the resource schedule by assigning classes to resources, one resource at a time in the sequence determined by the GSEQ block. Once GATA has associated a resource element with a class, no subsequent attempt is made to reconsider the initial assignment. GARA is capable of considering the entire spectrum of potential class assignments, and can usually come up with a 'better' schedule for the individual resource; several workable schedules are evaluated and compared to determine the final assignments.

Two options are available for the GARA block. These are called the FULL and BASIC options. Advantages of the BASIC option are faster processing and reduced storage space requirements. The disadvantage of the BASIC option is that it ignores any specifications calling for the threading rules, confining rules, resource preferred free time, resource maximum loads, substitute track substitution requests and alternate requests (track substitution and elective

5.7.1(2) GARA PROGRAM BLOCK (Continued)

requests are treated as if they were required requests in the BASIC option). Both options take into account time conflicts, resource maximums, resource free time, resource lunch, and provide for the 'balancing of sections'.

The FULL option is not exercised UNLESS the user specifies the 'FRA' switch on the OPTION card for the run. Since the OPTION card does not become a part of the GASP file it must be included for each run where the FULL option is desired. See the section (5.1.6) titled OPTION CARD for details about punching the OPTION card. The arguments pertaining to the use of the FULL GARA option are similar to those given for the FULL GATA option in section (5.6.1) titled GATA PROGRAM BLOCK. Additionally, the run should not ordinarily use the FULL GARA option until he has justified use of the FULL GATA option.

Under the alternative of using the resource assignments made during the GATA block (the so-called 'killed' GARA alternative), the validity of GATA resource assignments is established and reported. No attempt is made to alter or improve the GATA resource assignments. consequently the effort required in the GARA block is minimal.

For the 3 remaining alternatives, requests of the individual RE record are processed simultaneously. Classes are considered for the requests taking into consideration any permanent assignments, conflicts, resource maximums (including section balance), threading rules (FULL option only), confining rules (FULL option only), resource free time, resource maximum load (FULL option only), resource preferred free time (FULL option only), lunch specifications and the availability of substitutions (FULL option only).

5.7.1(3) GARA PROGRAM BLOCK (Continued)

Resource assignments, whether permanent or temporary, whether made by GATA or remade by GARA, are identified as valid or invalid as part of activity of the GARA block.

The four GARA alternatives allowed the user are described in the following sections; they are

- 1) The 'killed' GARA alternative (5.7.2), already briefly discussed above
- 2) The 'normal' GARA alternative (5.7.3), followed whenever one of the other options is unspecified
- 3) The 'extra' GARA alternative (5.7.4), a more elaborate - and more time consuming - assignment technique available primarily for handling students
- 4) The 'multiple' GARA alternative (5.7.5), a more elaborate assignment technique available primarily for handling rooms.

The GARA program block can be bypassed (along with the GATA block) upon specification by the user; the 'SRA' switch is punched on the option card to achieve this. This option should NOT be exercised unless all assignments for all classes and all resources in the GASP file are to remain 'as is'; usually this will mean that time assignments and resource assignments are permanent and valid. If the 'SRA' option is exercised validity will not be recomputed for any assignments.

5.7.2 GARA PROGRAM BLOCK, THE KILLED GARA ALTERNATIVE

This alternative is discussed prior to the three others since the entire effect of the killed GARA, that of assigning validity to a schedule, also comprises the final stage in each of the other three alternatives after they have decided upon a schedule. Since the GATA block generally does not make invalid temporary assignments, an incomplete schedule may result from the use of this alternative.

Validity determination is a well-defined process; the user should note that the rules do not necessarily seek a minimal number of invalid assignments, rather they base validity on a request priority determined jointly by GSEQ and the user.

REQUEST PRIORITY ORDERING

- 1) Highest priority is given to permanent assignments
- 2) Second priority is given to required requests
- 3) Third priority is given to track substitution requests
- 4) Fourth priority is given to elective requests, and associated alternate requests
- 5) Lowest priority is given to multiple requests

NOTE:

Resolution of priority within the above categories is based on the GATA sequencing variable which, among other things, honors tie structure and reflects the user's PR field priority for CL records. For the 'BASIC' option, no distinction is made between required, track substitution and elective requests.

5.7.2(2) GARA PROGRAM BLOCK, THE KILLED GARA ALTERNATIVE (Continued)

CONDITIONS RESULTING IN INVALID RESOURCE ASSIGNMENTS

- 1) The assigned class is in direct time conflict with a higher priority class in the schedule
- 2) The assigned class violates a strong application of the threading rule (FULL option only)
- 3) The assigned class violates a strong application of the confining rule (FULL option only)
- 4) Assignment to the class exceeds a specified resource maximum for the class
- 5) The assigned class is in direct time conflict with specified resource free time
- 6) Assignment to the class exceeds the resource maximum load (FULL option only)

Note that the rules governing invalidity are significantly dependent on the order in which resources are processed (e.g. condition 4) and upon the GARA sequence (e.g. condition 1). Therefore the user can expect somewhat different results depending on which alternative of GARA he is using. Results also depend on his own alterations to the GASP file (such as: changes in PR fields, the fixing of resource assignments in parts of the file, or changing resource requests from required to elective). GARA will never make temporary invalid multiple assignments.

5.7.3 GARA PROGRAM BLOCK, THE NORMAL GARA ALTERNATIVE

The normal GARA alternative is followed by default when no other alternative is specified by the user. GARA proceeds to assign classes to resources, one at a time, in GSEQ order. One pass is made over the RE records; once a resource has been processed no attempt to alter the schedule will occur. Validity for the assignments is determined as the schedules are completed, and balancing of section sizes is regarded as an ongoing, cumulative process; an effort will be made to maintain proportional balance within sections of the same subject phase.

A number of different schedule combinations are evaluated by GARA and the 'best', according to user supplied specifications, is chosen from the combinations.

5.7.4 GARA PROGRAM BLOCK, THE EXTRA GARA ALTERNATIVE

A more elaborate - and more expensive in computer time - alternative, the 'extra' GARA attempts better overall section balances. This objective is achieved by running an extra pass over the RE records during which resources are tentatively assigned to classes without regard to section sizes. Such a process is equivalent to treating each resource element as though it were the first element of its resource set; i.e. pressures from the filling of classes, and invalidities based on overflow of resource maximums, will not be factors in the assignment procedure. While the resulting schedules are not final for the run, copies of these intermediate schedules are transmitted to a second pass of GARA together with tallies of the section sizes.

The second pass over the RE records processes the resources in GSEQ order and starts with the intermediate schedule supplied to it by the first pass. The intermediate schedule is accepted only if no change in it would result in a 'better' schedule from the standpoint of the user supplied criteria for 'good' schedules and from the standpoint of section balance based on the updated tallies left over from pass one. Thus whenever changes in the schedule can be made to improve section balance without lowering the evaluation of the resource's schedule, such changes are made and the tallies of running class size are updated accordingly. Resource maximums are included as a factor in the final validity determination.

5.7.5 GARA PROGRAM BLOCK, THE MULTIPLE GARA ALTERNATIVE

A more elaborate alternative, the 'multiple' GARA leads to better scheduling of interchangeable resources having predominantly multiple request types (normally the rooms). This objective is achieved by running an extra pass over the RE records during which resources are identified with all classes to which they may be assigned. This information, in the form of counts by class, is transmitted to a second pass of GARA. During the first pass, any non-multiple requests are scheduled as in the normal alternative.

The second pass over the RE records processes the resource in GSEQ order and uses the tallies from the first pass to bias assignments satisfying multiple requests. In this manner, GARA knows if a particular resource is the last such resource which can be assigned to a class, and if not the last, just how many remaining resources can be assigned to it.

5.7.6 CONTROLLING SCHEDULING ACTIVITIES BY GARA, XL RECORD OPTIONS

There are 3 optional XL records referencing GARA which the user may create in the GASP file; these records, if used, have the effect of altering parameters built into the GARA block concerning the evaluation of schedules. They also specify the GARA alternative which will be used in scheduling the resource set. It is recommended that new users of GASP not use the parameter specification features of these optional XL records until some experience in the use of GASP and some knowledge of the technical details of GARA have been gained. On the other hand, alternative specification is to be expected after the first few runs of GASP.

All three of the XL records have identical formats except that each references a separate resource set (instructors, rooms, students):

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GARA', the XL block reference
13- 16	Must be blank
17	'I' for instructors, 'R' for rooms, 'S' for students
18- 20	Ignored

5.7.6(2) CONTROLLING SCHEDULING ACTIVITIES BY GARA, XL RECORD OPTIONS (Continued)

<u>Positions</u>	<u>Assumed Value</u>	<u>Description</u>
21- 24	NORM	'NORM' for the normal alternative (section 5.7.3) 'KILL' for the killed alternative (section 5.7.2) 'XTRA' for the extra alternative (section 5.7.4) 'MULT' for the multiple alternative (section 5.7.5)
25- 36		Ignored Each of the 24 positions (37-60) must be blank or a numeric digit 0,1,...,9. Each position governs the relative contribution one of the factors has in the evaluation of the schedule; 9 indicates the 'strongest' contribution, 0 has the effect of removing the factor from the evaluation of the schedule. Factors are assigned to positions as follows:
37	9	Resource maximum (section balance)
38	8	Weak threading rule
39	8	Weak confining rule
40	2	Lunch (2 is assumed for instructors and students only, 0 is assumed for rooms)
41	4	Preferred free time
42- 60		Unused
61- 64	75	'Maximum # of attempts to identify minimum validity level each time improvement occurs' (R, T, E Requests only)
65- 68	75	'Maximum # of attempts to obtain new schedules each time improvement occurs' (R, T, E Requests only)
69- 72	5	'Maximum # of non-improved schedules before accepting the final schedule each time improvement occurs' (R, T, E Requests only)
73- 76	3	'Maximum # of non-improved schedules before accepting the final schedule each time improvement occurs' (M Requests only)
The four numbers in the fields 61-64, 65-68, 69-72, and 73-76 should not vary radically since performance may go down (with a decrease in the numbers) or run time may become prohibitive (with an increase in the numbers).		
77- 80		Ignored
81- 84		yyye, the record suffix

5.7.6(3) CONTROLLING SCHEDULING ACTIVITIES BY GARA, XL RECORD OPTIONS (Continued)

The SPRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SPRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

5.7.7 RESOURCE ASSIGNMENT ANALYSIS REPORT, GARA BLOCK

A one line summary is printed on the log from the Gara block for each resource processed by GARA. The ordering of this report will be the order in which GARA processes resources; all resources in a resource set (instructors, rooms, students) will occur together in the report, with totals exhibited for each resource set. This report will be called the Resource Assignment analysis report.

Special column headings will occur at the top of each page of the log for ease in reading the report. Examples from typical pages of this report are given next. A discussion of the contents of the report, using the column headings as references, follows the example.

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5.7.7(2) RESOURCE ASSIGNMENT ANALYSIS REPORT, GARA BLOCK (Continued)

GASP LOG FROM GARA BLOCK PAGE 13 06/18/67 14.33.29

SAS LOG FROM DATA SET																										
STUDENT	...REQUESTS...					..ASSIGNMENTS..				VIOLATION COUNTS.....												SUMMARY.....		
	R	T	F	A	M	V	S	S	* L	CU	RM	ST	SC	WF	ML	WT	WC	RP	LU	SU	START	SCHED	FINAL			
S 1	6	1	0	0	0	7	0	0	0	28	0	0	0	0	0	0	0	0	0	0	34	17	1.00			
S 5	5	1	1	0	0	7	0	0	0	26	0	0	0	0	0	0	0	0	0	0	106	79	1.00			
S 12	6	0	0	0	0	6	0	0	0	27	0	0	0	0	0	0	0	0	0	0	167	152	1.00			
S 23	6	1	1	0	0	8	0	0	0	31	0	0	0	0	0	0	0	0	0	1	10	2	1.00			
S 24	4	1	2	0	0	7	0	0	0	27	0	0	0	0	0	0	0	0	0	0	93	48	1.00			
S 25	4	1	1	0	0	6	0	0	0	27	0	0	0	0	0	0	0	0	0	0	136	136	1.00			
S 28	4	1	1	0	0	6	0	0	0	26	0	0	0	0	0	0	0	0	0	0	99	81	1.00			
S 30	6	1	0	0	0	7	0	0	0	28	0	0	0	0	0	0	0	0	0	0	139	84	1.00			
S 32	3	1	2	0	0	6	0	0	0	24	0	0	0	0	0	0	0	0	0	0	146	140	1.00			
S 34	4	1	1	0	0	6	0	0	0	26	0	0	0	0	0	0	0	0	0	0	89	94	1.00			
S 36	4	1	1	0	0	6	0	0	0	26	0	0	0	0	0	0	0	0	0	0	140	137	1.00			
S 43	4	1	1	0	0	6	0	0	0	26	0	0	0	0	0	0	0	0	0	0	109	104	1.00			
S 47	6	1	0	0	0	7	0	0	0	28	0	0	0	0	0	0	0	0	0	0	103	79	1.00			
S 48	3	1	2	0	0	6	0	0	0	26	0	0	0	0	0	0	0	0	0	0	82	82	1.00			
S 50	4	1	1	0	0	6	0	0	0	26	0	0	0	0	0	0	0	0	0	0	117	116	1.00			
S 54	6	0	0	0	0	6	0	0	0	22	0	0	0	0	0	0	0	0	0	0	118	107	1.00			
S 55	5	0	1	0	0	6	0	0	0	25	0	0	0	0	0	0	0	0	0	0	107	104	1.00			
S 62	6	0	1	0	0	7	0	0	0	26	0	0	0	0	0	0	0	0	0	0	44	19	1.00			
S 65	8	0	0	0	0	8	0	0	0	32	0	0	0	0	0	0	0	0	0	2	23	8	1.00			
S 69	7	0	0	0	0	7	0	0	0	27	0	0	0	0	0	0	0	0	0	0	130	106	1.00			
S 70	6	0	1	0	0	7	0	0	0	26	0	0	0	0	0	0	0	0	0	0	109	78	1.00			
S 76	6	0	1	0	0	7	0	0	0	26	0	0	0	0	0	0	0	0	0	0	29	14	1.00			
S 79	6	0	0	0	0	6	0	0	0	22	0	0	0	0	0	0	0	0	0	0	120	103	1.00			
S 81	5	0	1	0	0	6	0	0	0	25	0	0	0	0	0	0	0	0	0	0	213	203	1.00			
S 83	5	0	1	0	0	6	0	0	0	25	0	0	0	0	0	0	0	0	0	0	146	139	1.00			
S 84	6	0	0	0	0	6	0	0	0	26	0	0	0	0	0	0	0	0	0	0	219	217	1.00			
S 87	5	0	1	0	0	6	0	0	0	25	0	0	0	0	0	0	0	0	0	0	110	76	1.00			
S 94	5	0	1	0	0	6	0	0	0	24	0	0	0	0	0	0	0	0	0	0	107	77	1.00			
S 95	7	0	0	0	0	7	0	0	0	27	0	0	0	0	0	0	0	0	0	0	228	192	1.00			
S 96	6	0	0	0	0	6	0	0	0	22	0	0	0	0	0	0	0	0	0	0	109	94	1.00			
S 98	4	0	2	0	0	6	0	0	0	24	0	0	0	0	0	0	0	0	0	0	123	113	1.00			
S 2	6	1	0	0	0	7	0	0	0	28	0	0	0	0	0	0	0	0	0	0	152	91	1.00			
S 7	5	1	0	0	0	6	0	0	0	23	0	0	0	0	0	0	0	0	0	0	79	77	1.00			
S 8	4	1	1	0	0	6	0	0	0	26	0	0	0	0	0	0	0	0	0	0	105	105	1.00			
S 11	5	1	0	0	0	6	0	0	0	23	0	0	0	0	0	0	0	0	0	0	121	115	1.00			
S 15	3	1	2	0	0	6	0	0	0	25	0	0	0	0	0	0	0	0	0	0	99	98	1.00			
S 19	5	1	0	0	0	6	0	0	0	23	0	0	0	0	0	0	0	0	0	0	96	89	1.00			
S 26	4	1	1	0	0	6	0	0	0	26	0	0	0	0	0	0	0	0	0	0	85	85	1.00			
S 27	6	0	0	0	0	6	0	0	0	23	0	0	0	0	0	0	0	0	0	0	125	114	1.00			
S 37	5	1	1	0	0	7	0	0	0	27	0	0	0	0	0	0	0	0	0	0	68	43	1.00			
S 41	5	1	1	0	0	6	0	1	0	27	1	1	0	0	0	0	0	0	0	0	286	171	0.86			
S 42	7	0	0	0	0	7	0	0	0	28	0	0	0	0	0	0	0	0	0	0	123	69	1.00			
S 45	6	0	1	0	0	7	0	0	0	27	0	0	0	0	0	0	0	0	0	0	161	85	1.00			
S 80	5	0	0	0	0	5	0	0	0	21	0	0	0	0	0	0	0	0	0	0	78	78	1.00			
S 29	4	1	1	0	0	6	0	0	0	26	0	0	0	0	0	0	0	0	0	0	212	205	1.00			
TOTALS	100	474	105	0	0	625	0	1	0	26	1	1	0	0	0	0	0	0	11	0	11818	10354	0.99			

5.7.7(3) RESOURCE ASSIGNMENT ANALYSIS REPORT, GARA BLOCK (Continued)

INSTRUCTOR or ROOM or STUDENT : The key of the resource for identification purposes

REQUESTS : Counts, by request type of the number of RQ fields (except for multiples) in the GASP file for this resource; i.e., the 'R' column is for required 'E' for electives etc. In the case of multiples this count is the number of potential assignments that GASP can make.

ASSIGNMENTS : Information about the resource assignments in the GASP file for this resource. The first 4 columns are counts under the headings:
Under '.', the number of temporary-valid assignments
Under 'P', the number of permanent-valid assignments
Under '\$', the number of temporary-invalid assignments
Under '**', the number of permanent-invalid assignments

The fifth column, titled 'LD' is the resource load; i.e. a count of the number of modules of the classes for which it has been scheduled

VIOLATION COUNTS: Gives counts of violations of strong and weak rules in the schedule assigned. Counts are given in 10 columns:

Under 'CO', the number of invalidities due to time pattern conflict
Under 'RM', the number of invalidities due to exceeding resource maxima
Under 'ST', the number of invalidities due to violation of a strong threading rule
Under 'SC', the number of invalidities due to violation of a strong confining rule
Under 'RF', the number of invalidities due to conflict with resource free time
Under 'ML', the number of invalidities due to exceeding the resource maximum load
Under 'WT', the number of violations of a weak threading rule
Under 'WC', the number of violations of a weak confining rule
Under 'RP', the number of conflicts with resource preferred free time
Under 'LU', the number of days on which lunch cannot be accommodated
Under 'SU', the number of 'T' and 'E' requests that were satisfied by track or elective substitution

5.7.7(4) RESOURCE ASSIGNMENT ANALYSIS REPORT, GARA BLOCK (Continued)

SUMMARY : Information summarizing the activity required to produce the schedule in the GASP file:

Under 'START', the total number of attempts to identify minimum validity level and to obtain new schedules for R, T, E Request types only
Under 'SCHED', the total number of schedules evaluated
Under 'EVAL', the fraction # of valid assignments divided by # of assignments in the final schedule

5.7.8 GARA BLOCK, SUMMARY OF COMMENTS, ERRORS REPORTS, XL RECORDS, OPTION SWITCHES

COMMENTS ON LOG

(No comments are logged by GARA)

ERROR FLAGS ON LOGGED RECORDS

<u>Error Flag</u>	<u>Description</u>
M	Mal-function error. Record is removed from file.

REPORTS, SUMMARIES, DOCUMENTATION ON LOG.

Resource Assignment Analysis Report. A single line summarizing GARA activity for each resource processed.

XL RECORDS REFERENCING GARA BLOCK

<u>Key Field</u>	<u>XL Record Function</u>
GARA I	determine GARA option, reset assumed parameters, for instructors
GARA R	determine GARA option, reset assumed parameters, for rooms
GARA S	determine GARA option, reset assumed parameters, for students

OPTION SWITCHES

'FRA' Run 'FULL' GARA option

'SRA' 'SKIP' (bypass) both the TATA and GARA blocks entirely.

5.8.1 GUEB PROGRAM BLOCK

Since all assignments (and user corrections) have been made by the time that the GUEB block is reached on a run, the file is complete and will not be changed in any way in blocks following GUEB. The GUEB block insures that the GASP file is in its proper format and provides the user with an 'expanded' listing of the file on the log for the run. Again, equipment malfunctions in the form of tape or disk failures can result in error conditions.

The format of the file listing is a printed line for each record in the file (or possibly several lines in the case of CL or RE records). The listing is 'expanded' by printing all resource assignments containing a class key immediately following the associated CL record. Therefore, in this listing, the user has printed all resource assignments by resource key (RA fields in RE records) and all resource assignments by class key.

5.8.2 GUEB EDITS, ERROR CONDITIONS

If a record is involved in an equipment mal-function error, the record will be listed with a flag of 'M' if the record has been deleted from the file; or with a flag of 'F' if the record has not been removed from the file. Further, error flags are used on records in the listing for easy identification of possible trouble spots regarding assignments as they exist in the file, as follows:

<u>Assignment</u>	<u>Record Type</u>	<u>Error Condition</u>	<u>Error Flags</u>
Time	CL	A time assignment (TA field) for the class is invalid	T
Time	CL	A time pattern key (TA field) in an assignment does not exist in the file, i.e. is not the key of a TP record	N
Instructor	CL	At least one invalid instructor assignment exists for the class OR no instructor assignments exist for the class	I
Room	CL	At least one invalid room assignment exists for the class OR no student assignments exist for the class	R
Student	CL	At least one invalid student assignment exists for the class OR no student assignments exist for the class	S
Resource	RE	At least one invalid resource assignment exists for the resource element	V
Resource	RE	A class key (RA field) in one or more assignments does not exist in the file, i.e. is not the key of a CL record	N

5.8.3 FILE LISTING CONTROL, XL RECORD OPTIONS

Ordinarily, the GUEB block prints the entire file in the expanded form described. Optionally, the user may cause parts of this listing to be suppressed; also, the error flags can be used to partially control the listing of records. A further option allows the user to 'kill' the listing of any of the error flags possible on records except for the 'M' flag.

The XL record controlling these options has the following format:

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GUEB', the XL block reference
13- 17	Must be blank
18- 20	Ignored
21	'.' causes suppression of TP records on the listing, except for possible TP records with an M or F flag
22- 24	Ignored
25	'/' causes suppression of CL records on the listing, except for CL records with error flags (see next field)
	'X' causes suppression of only the expanded part of the listing for CL records
26- 32	Any of the possible error flags for CL records except the M or F flags (T, N, I, R or S) which occur in any position of this field will not be regarded as errors. If '/' occurs in position 25, the only CL records which will appear on the listing are those having flags not specified in this field.
33	'I' causes suppression of RE records for instructors, except for RE records with error flags (see next field)
34- 36	Any of the possible error flags for RE records except the M or F flags (V or N) which occur in any position of this field will not be regarded as errors. If "I" occurs in position 33, the only RE records which will appear on the listing are those having flags not given in this field

5.8.3(2) FILE LISTING CONTROL, XL RECORD OPTIONS (Continued)

Positions

Description

37	'R' causes suppression of RE records for rooms, except for RE records with error flags (see next field)
38- 40	Any of the possible error flags for RE records except the M or F flag (V or N) which occur in any position of this field will not be regarded as errors. If 'R' occurs in position 37, the only RE records which will appear on the listing are those having flags not given in this field
41	'S' causes suppression of RE records for students, except for RE records with error flags (see next field)
42- 44	Any of the possible error flags for RE records except the M or F flag (V or N) which occur in any position of this field will not be regarded as errors. If 'S' occurs in position 41, the only RE records which will appear on the listing are those having flags not given in this field
45- 80	Ignored
81- 84	yyye, the record suffix

The SFRXL correction record differs from the above XL record only in positions 1-6:

Positions

Description

1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

If the user has not supplied this record, GASP will create one for the file as follows:
(unspecified positions are made blank)

Positions

Description

1- 4	XLus, record preface
9- 12	'GUEB'
81- 84	yyye

5.8.4 FILE LISTING EXAMPLE, GUEB BLOCK

GASP LOG FROM GUEB BLOCK PAGE 34 06/18/67 14.38.57

	ICOUNT	.P006	.S 70	.S 82	.S 93		
R	CLIU /TYP 2	01	EIC TYP 2	3			11
	**RS1	51 L					
	.MTWRF	4					
	IBUSTON	.RBUS B	*S 16	.S 22	.S 31	.S 43	
R	CLIU /TYP 2	02	EIC TYP 2	3			11
	**RS1	51 L					
	.MTWRF	3					
	IBUSTON	.RBUS H	*S 14	.S 17	.S 25	.S 33	
	REIU	ARTING	E	MISS ARTING			
	/ART 3	01./ART 3	02./ART 3	03./ART 4	01./ART 4	02./ART 4	03./ART AP 01.
	REIU	IBUSTON	C	MRS BUSTON			
	/BS LAW	01./BS LAW	02./OFF PR	01./TYP 2	01./TYP 2	02.	
	KLIU	ICACUL	M	MISS CALCUL			
	/ALG 1	01./ALG 2	02./ALG 2	03./ALG 2	04./GEND	01.	
	REIU	ICOUNT	M	MR COUNT			
	/ALG 2	01./CALC	01./CALC	02./TRIG	01./TRIG	02.	
	REIU	IRNGS	G	MR ENGS			
	/EA 11	13./EN 11	14./EN 12	01./EN 12	02.		

GASP LOG FROM GUEB BLOCK PAGE 15 06/18/67 14.38.57

XLIC	GPROSCHDR	M	*		
XLIC	GPROSCHDS	M			
XLIC	GPROSORTI				
XLIC	GPROSUPTS	S00101SN			
XLIC	GSEQ				
XLIC	GSTOCONF1	IRS 1	R	S	
XLIC	GSTOUIST1	I	R	S	
XLIC	GSTOLDADI	I I			
XLIC	GSTOLOADR	R R			
XLIC	GSTOLUADS	S S			
XLIC	GUEA				
XLIC	GUEB				
TPIC	.	XXXX(TIME NOT ASSIGNED)			
TPIC	.F	17X F			
TPIC	.F 1	11M F 1			

5.8.5 GUEB BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS, OPTION SWITCHES

COMMENTS ON LOG

EXPANDED CL LISTING IS INCOMPLETE DUE TO LACK OF STORAGE SPACE. I, R, S FLAGS ON CL RECORDS ARE AFFECTED ACCORDINGLY

F FLAGS HAVE OCCURRED ON THE LISTING DUE TO I/O MAL-FUNCTION. ASSIGNMENT FIELDS ARE PROBABLY MISSING

I/O MAL-FUNCTIONS HAVE LED TO LOSS OF GASP FILE INFORMATION. N FLAGS AND MISSING REQUESTS AND ASSIGNMENTS HAVE RESULTED

NEW FILE IS PROBABLY UNUSABLE AND REMAINING OUTPUT WILL BE INCOMPLETE. JOB SHOULD BE RERUN USING OLD FILE

GUEB BLOCK COMPLETED. NNNNN RECORDS IN GASP FILE

ERROR FLAGS ON LOGGED RECORDS

<u>Error Flag</u>	<u>Description</u>
M	Mal-function error. Record deleted from file
F	Mal-function error. Record remains in file although probably in error
T	Invalid time assignment for class
N	An assignment contains a key which is not in the file
V	An invalid resource assignment is present
I	Instructor assignments for a class are questionable
R	Room assignments for a class are questionable
S	Student assignments for a class are questionable

5.8.5(2) GUEB BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS, OPTION SWITCHES (Continued)

REPORTS, SUMMARIES, DOCUMENTATION ON LOG

(None are logged by the GUEB block)

XL RECORD REFERENCING GUEB BLOCK

<u>Key Field</u>	<u>Description</u>
GUEB	Record for controlling file listing

OPTION SWITCHES

'EDL' Run is suspended at end of GUEB

5.9.1 GSTO PROGRAM BLOCK

The GSTO block provides the user with a variety of optional statistical outputs (reports). These reports are generally designed to aid the user of GASP in analyzing the assignments present in a GASP file; such reports are of interest to the appropriate administrators of a school but are generally useless as outputs for distribution to students, teachers, or the general public.

The user controls the activity of GSTO by insuring that appropriate XL records are a part of the file; these XL records may be considered requests for the various reports that GSTO can produce. All reports prepared by GSTO are written on the log for the run.

5.9.2 REQUESTS FOR STATISTICAL REPORTS, XL RECORD OPTIONS

All XL records referencing the GSTO block are requests for reports; one XL record causes one report to be prepared as a part of the run log for GSTO. All of these records have essentially the same format, as described below:

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GSTO', the XL block reference
13- 16	May be 'CONF', 'DIST', 'LOAD' or 'REQU'. See following sections for details concerning the four <u>types</u> of reports identified by this field
17	Must be a numeric digit or an alphabetic character (not blank). Since this is a part of the key for the record, the user must insure that this character is different for all records which have the same report type specification in 13-16
18- 20	Ignored
21- 24	Any position in this field may contain blank, 'I', 'R' or 'S' (or in the case of 'DIST' report type, 'C' may also be used). In the following sections which describe GSTO reports, this field will be referred to as the <u>detail</u> field. The detail field has various meanings for the various report types, but 'I' always refers to instructors, 'R' to rooms, 'S' to students, and 'C' to classes
25	May be blank, 'I', 'R', 'S' or 'C' ('C' may only be used for 'DIST' report types). An 'I', 'R' or 'S' in this field indicates that elements for the specified resource set (Instructors, Rooms, Students) are to be included in reports prepared. A 'C' in this field indicates that classes are to be included in reports prepared

5.9.2(2) REQUESTS FOR STATISTICAL REPORTS, XL RECORD OPTIONS (Continued)

<u>Positions</u>	<u>Description</u>
26- 33	A group designator selector, dddddmmm, for the resource group specified in position 25 (if 'I', 'R' or 'S') or for the set of classes (if position 25 is 'C' on a 'DIST' report type record). If this field is non-blank, only those resource elements or classes selected by dddddmmm will be included in the report prepared
37	As for 25 above, blank, 'I', 'R', 'S' or 'C'
38- 45	As for 26-33 as above, dddddmmm modifying the resource or class specification in position 37
49	As for 25 above, blank, 'I', 'R', 'S' or 'C'
50- 57	As for 26-33 above, dddddmmm modifying the resource or class specification in position 49
58- 80	Ignored
81- 84	yyyye, the record suffix

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Position</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

The user need not include any XL records in the file referencing the GSTO program block; in this case, GSTO will prepare no reports.

The three locations in these records, positions 25-33, positions 37-45 and positions 49-57 will be referred to as selection fields. Should the three separate positions 25, 37 and 49 all contain blank (or characters other than 'I', 'R', 'S' or 'C'), no resource elements or classes will be selected so such records are ignored by GSTO. Any three selector fields may be used; that is, each of the positions 25, 37 or 45 may contain blank, 'I', 'R', 'S' or 'C'

5.9.2(3) REQUESTS FOR STATISTICAL REPORTS, XL RECORD OPTIONS (Continued)

('C' may be used only in the case of 'DIST' report types) and in any combination.

It should be noted that up to 36 (10 digits plus 26 alphabetic characters in position 17) different XL records requesting the same type of report (positions 13-16) may be present simultaneously in the file. It should also be remembered that completely blank group designator selectors select an entire resource or class set (positions 25, 37 or 45).

5.9.3 CONFLICT ANALYSIS REPORTS

The conflict analysis report type is requested with 'CONF' in positions 13-16 of an XL request record referencing GSTO.

This report will generally contain one or more sections. Each section will include:

- 1) A single class key or a pair of class keys. If a pair of class keys is given, the two classes have been assigned conflicting time patterns and at least one of the resource elements selected by the selector field(s) on the XL request record has been assigned to both classes. If a single class key is given, at least one of the resource elements selected by the selector field(s) on the XL request record has an invalid but non-conflicting assignment to the class.
- 2) For each class key or class key pair, a count of the resource elements involved in the invalid assignment or conflict as described in 1) above.
- 3) If detailing is specified in the detail field on the XL request record (positions 21-24), a list of resource keys will be included with each class key or class key pair giving the resource elements involved in the invalid assignment or conflict as described in 1) above. Detailing will only occur for those resource sets designated in the detail field.

5.9.4 CONFLICT ANALYSIS REPORTS, EXAMPLE

The XL record:

XLus GSTOCONFA I IM3 M4 RMR MR

would cause a report of the following form to be prepared for the third and fourth year Math instructors, and Math recitation rooms:

/MATH 3 02 /MATH 4 06	INSTS- 2	ROOMS- 0
INSTS- ISMITH MRS ITAYLOR DR		
/MATH 3 04 /MATH 1 02	INSTS- 0	ROOMS- 1
/MATH 4 01	INSTS- 1	ROOMS- 0
INSTS- IDAVIS MR		

The distribution report type is requested with 'DIST' in positions 13-16 of an XL request record referencing GSTO. Each such request produces one distribution report for the schedule cycle.

1) For each set of elements selected by a resource group designator selector field on the XL request record a bar describing the percentage of resource elements assigned to classes during the module; the numerical value of the percentage is also given with the bar.

2) For each set of classes selected by a class group designator selector field on the XL request record, a bar describing the percentage of classes assigned during the module; the numerical value of the percentage is also given with the bar

3) If detailing for a resource set has been specified in the detail field ('I', 'R', or 'S' in positions 21-24), a list of resource keys will be included with the bar giving the resource elements which are free (unassigned) for the module. Detailing will only occur for those resource sets designated in the detail field.

4) If detailing for classes has been specified in the detail field ('C' in positions 21-24), a list of class keys will be included with the bar giving the classes which have time assignments involving the module.

The XL record:

XLus	GSTODISTX	R
------	-----------	---

would cause a report of the following form to be prepared for the room resource elements:

```
M 1     ROOMS    40 RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  
M 2     ROOMS    37 RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  
M 3     ROOMS    38 RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  
(Several lines are excluded)  
W 3     ROOMS    45 RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  
W 4     ROOMS    45 RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  
W 5     ROOMS    40 RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  
(Several lines are excluded)  
F 5     ROOMS    42 RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  
F 6     ROOMS    44 RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR  
F 7     ROOMS    38 RRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRRR
```

If the XL record had included classes, and class and room detail:

XLus GSTODISTX RC R C LA LA

the report would have been extended to detail the first year advanced placement classes running during the modules, and the rooms free for each module:

```
(Several lines are excluded)
```

W 3 CLASS 20 CCCCCCCCCCCCCCCCCCCC
ROOMS 45 RR
CLASS- /BIOL AL02 /CALC AL01
ROOMS- R101 R107 R221 RGYMNASIUM

W 4 CLASS 10 CCCCCCCCCC
ROOMS 45 RR
CLASS- /BIOL AL02
ROOMS- R101 R205 R226 RAUDITORIUM

```
(Several lines are excluded)
```

The load report type is requested with 'LOAD' in positions 13-16 of an XL request record referencing GSTO. Each such request prepares one load report for the resource elements selected by the selector fields on the request.

- 1) The average load for the elements selected will be computed and reduced to a percentage. This percentage, the total number of periods which could have been assigned, and the total number of periods actually assigned is listed.
- 2) If detailing is specified in the detail field ('I', 'R' or 'S' in positions 21-24 of the XL request), a list of resource element keys will be included with the above statistics together with a bar graph for the keys describing the percentage of modules assigned in the cycle. Detailing will only occur for those resource sets designated in the detail field.

[illegible]

5.9.9 REQUEST ANALYSIS REPORTS

The request analysis report type is requested with 'REQU' in positions 13-16 of an XL request record referencing GSTO.

This report will present request information as follows:

- 1) For every subject phase, a tally is given showing the number of selected resource elements which have one or more RQ fields referencing that phase. (If no selected resource elements have requests for a phase, the phase will not appear on the log).
- 2) For all resource elements selected by a selector field on the XL request record, RQ fields on the RE record for each element are used to generate all pairs of unique (different) subject phases for the record; pairs which are alike for all resource elements selected are counted and the counts are reported. Counts appear twice, once following the tally described in 1) above for each member of the pair. If several RQ fields reference the same subject phase, only the first reference is made a part of the REQU report. Group designator requests are in their expanded form when this report is generated. Separate counts are given for each of the resource sets which are a part of the selection.
- 3) If detailing is specified in the detail field on the XL request record (positions 21-24, a list of resource keys will be included giving the resource elements involved in each pair of requests. Detailing will only occur for those resource sets designated in the detail field.

(It should be noted that this report is essentially the 'conflict matrix' used by secondary schools to help generate schedules manually. The terminology 'conflict matrix' is misleading so has not been used in GASP).

5.9.10 REQUEST ANALYSIS REPORTS, EXAMPLE

The XL record:

XLus GSTOREQUS I I R S

would cause a report of the following form to be prepared for all resources of the school:

/ALGEBRA	INSTS-	4	ROOMS-	3	STUDS-	30
/ALGEBRA /BIOLOGY	INSTS-	0	ROOMS-	0	STUDS-	30
/ANATOMY	INSTS-	2	ROOMS-	1	STUDS-	10
/ANATOMY /BWEAVE	INSTS-	0	ROOMS-	0	STUDS-	10
/ANATOMY /HOME EC	INSTS-	2	ROOMS-	1	STUDS-	2
INSTS- IJEKYL DR IHYDE MR						
/BIOLOGY	INSTS-	17	ROOMS-	10	STUDS-	31
/BIOLOGY /ALGEBRA	INSTS-	0	ROOMS-	0	STUDS-	30
/BIOLOGY /CHEM	INSTS-	0	ROOMS-	2	STUDS-	25
/BIOLOGY /GYM	INSTS-	1	ROOMS-	1	STUDS-	0
INSTS- IBYO MR JIM						
/BWEAVE	INSTS-	1	ROOMS-	1	STUDS-	105
/BWEAVE /ANATOMY	INSTS-	0	ROOMS-	0	STUDS-	10
/BWEAVE /CHINESE	INSTS-	1	ROOMS-	1	STUDS-	98
INSTS- IMANCHU FU						

(Many lines omitted from example)

5.9.11 GSTO BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS

COMMENT ON LOG

(No comments are logged by GSTO)

ERROR FLAGS ON LOGGED RECORDS

(No records can be logged by GSTO)

REPORTS, SUMMARIES, DOCUMENTATION ON LOG

- 1) Conflict analysis reports, as requested
- 2) Distribution reports, as requested
- 3) Load reports, as requested
- 4) Request analysis reports, as requested

XL RECORD REFERENCING GSTO BLOCK

<u>Key Field</u>	<u>XL Record Function</u>
GSTOCONFa	Request for conflict analysis report
GSTODISTA	Request for distribution report
GSTOLOADa	Request for load report
GSTOREQUa	Request for request analysis report

5.10.1 GPRO PROGRAM BLOCK

The GPRO block provides the user with a variety of optional 'production' documents; these outputs are suitable for distribution to all the users of a schedule: teachers, students, office staff persons, etc. Outputs include timetable listing, class lists, and individual schedules for instructors, rooms and students. Punched cards may also be produced by GPRO for use as class cards.

The user controls the activity of GPRO by insuring that appropriate XL records are a part of the file as requests for the various outputs that GPRO can produce. All documents produced by this block may be prepared as a special part of the log for the run, or may then be saved in separate files for later printing/punching on special forms.

XL records referencing the GPRO block are either

- 1) Requests for documents
- 2) Specification of sequencing for documents, or
- 3) Format specifications for documents

All XL records for GPRO are optional; they need not appear in the file. If no XL request records are present, GPRO will produce no documents.

5.10.2 GENERAL DESCRIPTION OF FORMAT FIELDS USED ON XL RECORDS FOR THE GPRO BLOCK

Format fields are used on various XL records with the GPRO block reference in order that the user can have a very flexible control over the format and sequence of various outputs.

Each format field has the general form:

RFnnss

where

R specifies a file record to be used,
F specifies a field on the record to be used,
nn specifies the number of characters to be taken,
ss specifies the first character location in the field to be taken,

(i.e., nn characters are taken beginning in character position ss of the field F in record R).

The following table describes the possible 'RF' combinations:

	<u>Key Field</u>	<u>NA Field</u>	<u>GD Field</u>
TP record	TK	TN	
CL record	CK	CN	CD
RE record (Instructor)	IK	IN	ID
RE record (Room)	RK	RN	RD
RE record (Student)	SK	SN	SD

An additional format field is 'BLnn '. Here, 'BL' stands for 'BLANKS' and nn gives the number of blank positions to be used.

5.10.2(2) GENERAL DESCRIPTION OF FORMAT FIELDS USED ON XL RECORDS FOR THE GPRO BLOCK (Continued)

Examples of format fields are,

<u>Format Field</u>	<u>Interpretation</u>
TK1101	Use time pattern key, positions 1-11
CD0103	Use position 3 of class group designator
IN1221	Use last 12 positions of instructor name
BLO3	Use 3 blank characters

Reasonable assumptions are made if an nn or ss portion of the field is unspecified or illegal. For example, if the ss portion is blank, '01' will be assumed. If both the nn and ss positions are blank, the entire field will be used.

5.10.3 OUTPUT SORT CONTROL, XL RECORD OPTIONS

Optional XL records allow the user to specify:

- 1) For class outputs (class lists or timetables), the sequencing or ordering of the classes on the report. This same sequencing is always used for any classes listed on the output for a single resource (resource schedules).
- 2) For resource outputs (resource schedules), the ordering of the resources on the report. Instructors, rooms and students always appear separately, in 'I-R-S' sequence, but the user can control ordering within each of the 3 resource types. This same sequencing is always used for resources listed on any output for a single class.

These 'SORT' XL records have the following format:

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GPRO', the XL block reference
13- 16	'SORT'
17	'C', 'I', 'R', or 'S', for classes, instructors, rooms and students
18	Ignored
19- 24	Format fields, as described in section 5.10.2
25- 30	....
.....	.... up to 10 fields may be specified (blank fields are ignored)
73- 78	....
79- 80	Ignored
81- 84	yyyy. the record suffix

5.10.3(2) OUTPUT SORT CONTROL, XL RECORD OPTIONS (Continued)

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

If included, the format fields on this record specify 'a sort control field' for the classes or resource group described in position 17. For example, if 'GPROSORTS' is the contents of positions 9-17 of the XL record and 'SD0102SN1101' are 2 format fields in positions 19-30, all student output from GPRO will be sequenced first by the second position of the GD field (SD0102) and second by positions 1-11 of student name fields (SN1101).

The following should be noted:

- 1) The first character of all format fields (except for unused blank ones) should be the same as the character in position 17 of the SORT XL record
- 2) The nn portions of all format fields should not sum to more than 12. (The first few characters of name fields are generally sufficient for alphabetic sorts).
- 3) The GPRO block will always include the format field 'xK1101' as the rightmost field of user specified format fields on SORT XL records ('x' is C, I, R or S depending upon position 17 of the record). These 11 positions are not included in the limitation of 12 for user specified sort fields.

5.10.3(3) OUTPUT SORT CONTROL, XL RECORD OPTIONS (Continued)

4) If no SORT XL record is included for a resource or class, the following table specifies the standard assumed format fields:

Classes : None
Instructors: IN1201
Rooms : RN1201
Students : SN1201

5.10.4 TIMETABLES AND CLASS LISTS, XL RECORD OPTIONS

Both of these documents contain at least two lines for each class to be listed. Included on the first line will be 1) the class name, NA fields, CL record; 2) the resource maximums, RM field; 3) corresponding to the resource maximums, the actual number of assignments made for each of the resource sets; 4) the class tie, CT field; 5) the class key; 6) the class group designator, GD field. On the second line will be the time pattern name(s) associated with the time assignments for the class.

Optional additional lines will identify the instructors, rooms and students assigned to the class, by resource name (NAfield, RE records). The user may optionally specify that resource keys be printed with the name. The user may also specify which of the resource sets (instructors, rooms, students) are to be included in this listing; if instructors and rooms only are specified, a 'timetable' listing is achieved and if all resources are specified, 'class lists' result.

The classes are ordered on the listing according to the specifications on the 'GPROSORTC' XL record if any is present in the file; otherwise, ordering is by class key. Resources, within each of the 3 types, are ordered according to the resource 'GPROSORTx' XL records in the file. Group designator selection on classes allows printing of only a part of the classes in the file if desired.

5.10.4(2) TIMETABLES AND CLASS LISTS, XL RECORD OPTIONS (Continued)

The following 'CLAS' XL record provides the request for a timetable or class lists:

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GPRO', the XL block reference
13- 16	'CLAS', the report type
17	Must be blank
18- 19	Ignored
20	If '1', a new page will be given for each class
21	'I', 'R' or 'S', indicating that instructor, room or student assignments are to be listed with the class
22	'K' indicates that resource keys corresponding to position 21 be listed as well as resource names
23	'1' or '2' indicates the resources listed on the basis of position 21 will be in one or two columns on the listing for each class. '2' is assumed if this position is blank or not '1' or '2'
24	Ignored
25- 28	Correspond to 21-24, for a second resource set, if desired
29- 32	Correspond to 21-24, for a third resource set, if desired
33- 40	Class group designator selector, dddmmmm, providing selection for classes to be included in the listing. If this field is blank, all classes will be listed.
41- 42	Ignored
43- 50	'punch selector'. This field is a group designator selector used in conjunction with the PNCH XL records. See section 5.10.8

5.10.4(3) TIMETABLE AND CLASS LISTS, XL RECORD OPTIONS (Continued)

<u>Positions</u>	<u>Description</u>
51- 80	Ignored
81- 84	yyyye, the record suffix

The SFRXL correction record differs from the above XL record only in position 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

The following should be noted:

- 1) Only one XL request of this type can be in the GASP file. If group designator selection is used and only a part of the classes are selected, there is no provision for GASP to give class lists or timetables for other classes on the same run
- 2) If students are included on class lists, the user will ordinarily want to punch a '1' in position 20 of this record. If '1' is not punched here, new classes will ordinarily not begin at the top of a new page
- 3) The form width for class lists on timetables should be at least 90 print positions (9 inches)
- 4) Invalid resource assignments are listed in the same format as valid assignments but are 'flagged' with an asterisk

5.10.5 TIMETABLE AND CLASS LISTS, EXAMPLE

The XL record:

XLus GPROCLAS II 1'R'1 SRI

would cause a report of the following form to be prepared for each class (CL record) in the GASP file.

ENGLISH 9 t=1/1 R=1/1 S=9/ 12 KEY= /ENGL 9HS03 TIE= /ENGL 9HLO1 GRP= E1HR

TIME-	MTWRF 4
INSTRUCTOR-	MR JAMES Q ENGLISHMAN
ROOM-	255
STUDENTS- *	S00001 JOHN GALT
	S00007 JAMES BOND
	S33334 RINGO STARR
	S33335 JANET BAKER-CARR
	S46732 PAUL MONTINI
	S53869 ROBERT BURNS
	* S57833 ORVILLE WRIGHT
	S69883 ROBIN HOOD
	S89361 KATE SMITH

5.10.6 RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS

Resource element schedules consist of one page for each resource element (one for each RE record) displaying class assignments, times, etc. for the element. The user has the option of specifying a 'tabular' or 'matrix' format for these schedules; he also has options on the printing of invalid assignments.

The first line of each schedule, whether tabular or matrix, contains a heading provided by the user (usually the school name). The second line of each schedule, whether tabular or matrix, contains information from the key, name (NA) and/or group designator (GD) field(s) on the RE record. The user may control the specific format of this line.

For tabular schedules, the remainder of the schedule consists of one line for each class assignment; these lines may contain parts of the class name, group designator or key fields; parts of the time pattern name or key fields; parts of the instructor and/or room name, group designator or key fields. The user may control the specific format for each of these lines.

For matrix schedules, the remainder of the schedule consists of appropriately labeled columns for days and appropriately labeled rows for periods; entries are made in the pertinent row and column for each module during which a class has been assigned. There are as many entries on a matrix schedule as there are modules in the cycle. The topmost row of entries on such a schedule represents the assignments for the first period name for each of the days. The leftmost column of entries provides the assignments for the first day of the cycle. The exact format of each entry in such a schedule can be specified by the user.

5.10.6(2) RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS (Continued)

Resource schedules are ordered on the listing according to the specifications on the 'GPROSORTI', 'GPROSORTR', or 'GPROSORTS' XL records if they exist in the file; otherwise ordering is by resource name. Group designator selection on resources allows the user to print only a part of the resources represented in the file if he so desires. The user may also select only those schedules with invalid assignments, or only those without invalid assignments if he so desires.

Any schedules printed which involve invalid class assignments are ALWAYS identified with an asterisk at the right-hand end of the NAME (second) line on a schedule.

The following 'SCHD' XL record provides the request and partial format specification for resource element schedules:

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GPRO', the XL block reference
13- 16	'SCHD'
17	'I', 'R', or 'S' for instructor, room or student schedules
18- 19	Ignored
20	If 'M', matrix format schedules will be given
21- 22	(Used for matrix format schedules only) An integer giving the number of positions in each column (day) on the user's form
23- 24	Ignored

37

5.10.6(3) RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS (Continued)

<u>Positions</u>	<u>Description</u>
25	If 'I', schedules will be printed only for resource elements with 1 or more <u>invalid</u> assignments If 'V' schedules will be printed only for resource elements with no <u>invalid</u> assignments
26	If not 'I' or 'V', invalidity does not enter into the selection If not blank, invalid assignments will be listed on the schedule If blank, invalid assignments are not listed
27- 32	Ignored
33- 40	Resource group designator selector, ddddmnnnn. providing selection for resource elements (I, R or S depending upon position 17) to be included on the output If this field is blank, all resource elements will be given
41- 80	Ignored
81- 84	yyyy, the record suffix

The SFRXL correction record differs from the above XL record only in positions 1-6;

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

5.10.6(4) RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS (continued)

For the SCHD XL record, it should be noted that:

- 1) Only one XL schedule request can be included in the GASP file for each of the 3 resource types. If group designator selection, or validity selection (position 25) is specified, it is not possible to prepare schedules on the same run of GASP for resource elements not selected.
- 2) A SCHD XL record blank in positions 18-80 prepares tabular form schedules (position 20) for all resource elements of the type given in position 17 (no selection specified in positions 25 or 33-40). However, invalid assignments would not occur on such schedules (position 26).
- 3) Any invalid assignments listed on tabular schedules are flagged with an asterisk to the left of the entry on the listing.
- 4) In the case of matrix schedules, the user's form must be at least d.w+7 positions wide (d = number of days in cycle; w = integer in positions 21-22). There are 10 print positions per inch. If positions 21-22 are blank, or non-numeric, '11' is used.

5.10.6(5) RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS (Continued)

The following 'HEAD' XL record provides the means to include a constant heading line on each schedule printed:

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GPRO', the XL block reference
13- 16	'HEAD'
17	'I', 'R', or 'S' for instructor, room or student schedules
18	If '0' (zero) or blank, no blank lines will be printed <u>after</u> the line containing the heading; if '1', one blank line will occur between the first (heading) and second (name) lines. For other possibilities, see note 1) immediately after this format description
19- 77	Heading, exactly as it is to appear on all schedules for the resource type given in position 17 (See note 5 below)
78- 80	Ignored
81- 84	yyye, the record suffix

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

5.10.6(6) RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS (Continued)

Note that:

- 1) In all cases where spacing controls between lines are specified on XL records, zero or blank, indicates NO blank lines, i.e. 'single spacing' 1 indicates one blank line, i.e. 'double spacing' 2,3,....., 9 indicates that a skip will occur to channel 2, 3,, 9 on the printer carriage tape. IF other than single or double spacing is mandatory, this section of the write-up should be discussed with the staff of the center providing the computer service for GASP
- 2) If forms are used with a heading preprinted on them, positions 19-77 of the HEAD XL record may be left blank
- 3) If schedules are requested, and no HEAD XL record is present in the GASP file, 'INSTRUCTOR SCHEDULE', 'ROOM SCHEDULE' or 'STUDENT SCHEDULE' will be used as headings. In this event double spacing will occur after the heading
- 4) Print positions 1-59 are used for the specified heading. For the assumed headings, the assumptions are left adjusted and not centered on the form
- 5) If the 8 characters '\$M/DD/YY' appear anywhere in the heading, they will be replaced with the date at the time the schedules are produced with month/day/year format; e.g. 06/27/67

5.10.6(7) RESOURCE ELEMENT SCHEDULES, XL RECORD-OPTIONS (Continued)

The following 'NAME' XL record may be included in the GASP file to specify the format of the second (name) line of schedules (both matrix and tabular):

<u>Position</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GPRO', the XL block reference
13- 16	'NAME'
17	'I', 'R', or 'S', for instructor, room, or student schedules
18	If '0' (zero) or blank, no blank lines will be printed <u>after</u> the name line; if '1', one blank line will occur between the name line and the third line on the schedule. See note 1) after the HEAD XL format description.
19- 24	Format fields:
25- 30	....
.....	.... up to 10 fields may be specified (blank fields are ignored)
73- 78	....
79- 80	Ignored
81- 84	yyyy, the record suffix

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

No blank format fields are scanned from left to right on the above record

5.10.6(8) RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS (Continued)

The name line printed is built from left to right (starting in position 1), from fields or partial fields (or blanks) as indicated by the format fields. Blanks are NEVER automatically inserted between fields specified by format fields.

Note that:

- 1) The no portions of all format fields may not sum to a number greater than 59
- 2) Any schedules printed which contain invalid assignments ALWAYS receive the character asterisk in position 61 of the line
- 3) The 'R' character in the first position of each format field must match the resources type character located in position 17 of the XL record. Format fields which do not follow this rule are ignored.
- 4) If no NAME XL record is included for a resource, the following table specifies the standard assumed format fields:

Instructors: IN3201
Rooms : RN3201
Students : SN3201

The following 'FMAT' XL record may be included in the GASP file to specify the format of 1) all lines on tabular schedules or 2) all entries on matrix schedules. Options 1) or 2) are always determined by the associated SCHD XL record in the file.

5.10.6(9) RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS (Continued)

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GPRO', the XL block reference
13- 16	'FMAT'
17	'I', 'R', or 'S' for instructor, room or student schedules
18	Ignored
19- 24	Format fields
25- 30	....
.....	.... up to 10 fields may be specified (blank fields are ignored)
73- 78	....
79- 80	Ignored

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

Non-blank format fields are scanned from left to right on the above record. FOR TABULAR SCHEDULES, each line printed is built from left to right (starting in position 1), from fields or partial fields (or blanks) as indicated by the format fields. Blanks are NEVER automatically inserted between fields specified by format fields.

5.10.6(10) RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS (Continued)

Note that:

- 1) The nn portions of all format fields may not sum to a number greater than 59
- 2) Any line printed representing an invalid assignment, receives the character asterisk in position 61 of the line
- 3) RF portions of format fields may be 'CN', 'CD', 'CK', 'TN', 'TK', 'IN', 'ID', 'IK', 'RN', 'RD', or 'RK'
- 4) If more than 1 instructor and/or room is assigned to a class, the lowest key (GASP file order) will be used
- 5) If more than 1 time pattern is assigned to the class, 'TN' refers to a concatenation of all time pattern names. However, if 'TK' is used, only the lowest time pattern key (GASP file order) will be used
- 6) If no FMAT XL record is included for a resource, the following table specifies the standard assumed format fields:

Instructors:	CN0801BL03	TN3201RN1201
Rooms	: CN0801BL03	TN3201IN1201
Students	: CN0601BL05	TN3201RN1201
- 7) The standard assumptions allow 5 day - 7 period schedules to be printed on standard continuous form IBM cards

5.10.6(11) RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS (Continued)

FOR MATRIX SCHEDULES, each entry (for each module) is built from left to right from fields or partial fields (or blanks) as indicated by the format fields. The column of entries for the first day always begins in position 7. The column of entries for the second day begins in position 7+w where w is the integer specified in positions 21-22 of the corresponding SCHD XL record; the third column of entries begins in position 7+2w, etc. Note that:

- 1) If the nn portions of the format fields sum to a number greater than w two lines will automatically be used for each entry; the first w characters will occur on the first line and the remainder of the characters on the second (immediately under the first line). The nn portions of all format fields may never sum to a number greater than 2w or 48, whichever is less
- 2) If the nn portions of format fields sum to exactly w, single line entries will be given with no blanks between columns (unless the first or last format field is BLnn). If two line entries are being printed, the user may need a BLnn format field to insure that w characters are printed on the first line so that the desired information occurs on the second line.
- 3) Invalid assignments, if printed, are not identified. However, invalid assignments due to conflicts never appear in entries where the valid assignment appears
- 4) RF portions of format fields may be 'CN', 'CD', 'CK', 'IN', 'ID', 'IK', 'RN', 'RD', or 'RK'

5.10.6(12) RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS (Continued)

5) If more than 1 instructor and/or room is assigned to a class, the resource with the lowest key (GASP file order) will be used

6) If no format card is included for a resource, the following table specifies the standard assumed format fields:

Instructors: CN0601BL01 RN03

Rooms : CN0601BL01 IN03

Students : CN0601BL01 RN03

7) The standard assumptions allow 5 day - 7 period schedules to be printed on standard continuous form IBM cards

Ordinarily, columns on matrix schedules will be labeled with the day names specified on the 'GASPDAYS' XL record referencing the GASP block; similarly, rows on matrix schedules will be labeled with the period names specified on the 'GASPMODnn' XL records referencing the GASP block. Optionally, the user may specify alternate labels for any or all of the rows or columns on matrix schedules. The following XL record format allows the user to 'rename' days or periods for use as column or row labels on matrix schedules. One XL record must be inserted for each day or period to be renamed:

5.10.6(13) RESOURCE ELEMENT SCHEDULES, XL RECORD OPTIONS (Continued)

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GPRO', the XL block reference
13- 17	'ROWnn' or 'COLnn' nn is the row or column number on the matrix schedule
18	Used on 'ROWnn' records only. If '0' (zero) or blank, no blank lines will be printed <u>before</u> the (first) line corresponding to the row; if '1', one blank line will occur before this (first) line is printed. For other possibilities, see note 1) under the HEAD XL description
19- 20	Ignored
21- 30	Label to be used for the row or column specified in positions 13-17 above; all 10 characters will be used for columns, only the first 5 for rows; this label will be used in place of the module or day name associated with the row or column
31- 80	Ignored
81- 84	yyye, the record suffix

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record
1)	Day names are printed at the top of the column; actual print positions are determined by the w specified by the user in positions 19-20 of the 'GPROSCHD' XL record
2)	Period names appear in print positions 1-5; position 6 is always blank

5.10.7 RESOURCE ELEMENT SCHEDULES, EXAMPLE

Suppose that a 'GPROSCHD' XL record is in the file requesting the standard tabular schedule for students. Assuming that no heading line was specified, a typical student schedule would look like:

STUDENT SCHEDULE

COSETTE BERGE LN347 HR 344

ENG 9	MTWRF 1	107
SOC ST	MTWRF 5	125
ALG I	MTWRF 2	201
SCI 9	MT 6	LAB
SCI 9	WRF 6	210
BAND	MWF 7	MUSIC
HMKG	TR 7	HMKG
BWEAVE	MTWRF 3	GYM
LUNCH	MTWRF 4	CAF

If there had been a 'GPROSCHD' XL record in the file requesting the standard matrix schedule for students, schedules such as the following would be produced. Further assume that heading and labeling XL records are supplied as follows:

XLus	GPROHEADS	EAST HIGH SCHOOL STUDENT SCHEDULE, FALL 1965.
XLus	GPROCOLO1	MONDAY
XLus	GPROCOLO2	TUESDAY
XLus	GPROCOLO3	WEDNESDAY
XLus	GPROCOLO4	THURSDAY
XLus	GPROCOLO5	FRIDAY

5.10.7(2) RESOURCE ELEMENT SCHEDULES, EXAMPLE (Continued)

The matrix schedule for the same student as was used above in the tabular form is:

EAST HIGH SCHOOL STUDENT SCHEDULE, FALL 1965

COSETTE BERGE LN347 HR 344

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1	ENG 9 107	ENG 9 107	ENG 9 107	ENG 9 107	ENG 9 107
2	ALG I 201	ALG I 201	ALG I 201	ALG I 201	ALG I 201
3	BWEAVE GYM	BWEAVE GYM	BWEAVE GYM	BWEAVE GYM	BWEAVE GYM
4	LUNCH CAF	LUNCH CAF	LUNCH CAF	LUNCH CAF	LUNCH CAF
5	SOC ST 125	SOC ST 125	SOC ST 125	SOC ST 125	SOC ST 125
6	SCI 9 LAB	SCI 9 LAB	SCI 9 210	SCI 9 210	SCI 9 210
7	BAND MUS	HMKG HMK	BAND MUS	HMKG HMK	BAND MUS

5.10.8 PUNCHED CARD OUTPUTS

The following 'PNCH' XL record may be included in the GASP file to specify the format of punched card output.

<u>Positions</u>	<u>Description</u>
1- 4	XLus, the record preface
5- 6	Ignored
7- 8	Must be blank
9- 12	'GPRO' the XL block reference
13- 16	'PNCH'
17	'I', 'R', 'S' or 'C' for instructor, room, student or class
18	Ignored
19- 24	Format fields:
25- 30	....
.....	.... up to 10 format fields may be given (blank fields will be ignored)
.....	
73- 78	....
79- 80	Ignored

The SFRXL correction record differs from the above XL record only in positions 1-6:

<u>Positions</u>	<u>Description</u>
1- 5	SFRXL
6	Action character: may be C, U, R, I, A, H, D or P
7- 80	As given for above XL record

5.10.8(2) PUNCHED CARD OUTPUTS (Continued)

Non-blank format fields are scanned from left to right on the above record. Each card is built from left to right (starting in card column 1) from fields or partial fields (or blanks) as indicated by the format fields. Blanks are NEVER automatically inserted between fields specified by format fields.

NOTE THAT:

- 1) Cards punched on the basis the PNCHC XL record will be 'class master cards'; cards punched on the basis of the PNCHI, PNCHR or PNCHS XL records will be 'class cards'. Class cards roughly correspond to lines on a tabular schedule
- 2) The nn portions of format fields on a PNCH XL record may not sum to a number greater than 78
- 3) Any class card punched which represents an invalid assignment receives an asterisk in position 79 of the card. Position 80 is always blank
- 4) Any class master card punched receives a dash character in position 80 of the card. Position 79 is always blank
- 5) No card will be punched referencing a class unless that class is selected by the 'punch selector' in positions 43-50 of the CIAS XL record
- 6) Resource element selection is on the basis of the schedule selector in positions 33-40 of the corresponding (I-R-S) SCHD XL record

5.10.8(3) PUNCHED CARD OUTPUTS (Continued)

7) RF portions of format fields for class master cards may be 'CK', 'CN', 'CD', 'TK', 'TN', 'IK', 'ID', 'IN', 'RK', 'RD' or 'RN'. RF portions of format fields for class cards may be 'CK', 'CN', 'CD', 'TK', 'TN', 'IK', 'ID', 'IN', 'RK', 'RD', 'RN', 'SK', 'SD', or 'SN'. 'IK', 'ID', 'IN', 'RK', 'RD' or 'RN' always refer to the 'principal' instructor or room assigned to the class. 'SK', 'SD' or 'SN' always refer to the instructor, room or student key, group designator or name for the resource involved in the assignment

5.10.9 THE GASP LOG FROM GPRO

Since production output from the GPRO block may require special forms the user may specify that production output be placed in special output files for subsequent printing or punching. Portions of production output not placed in special files will be printed as part of the log. Refer to section (6.1.2) TITLED DATA SET REQUIREMENTS for details.

5.10.10 GPRO BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS

POSSIBLE COMMENTS ON LOG

NAMES ON CLASS LISTS TRUNCATED DUE TO LACK OF STORAGE

AT LEAST ONE CLASS LIST HAS MISSING RESOURCES DUE TO LACK OF STORAGE

MATRIX SCHEDULES OR TIME PATTERN NAMES ON TABULAR SCHEDULES MAY BE IN ERROR DUE TO LACK OF STORAGE

AT LEAST ONE SCHEDULE HAS MISSING CLASSES DUE TO LACK OF STORAGE

ERROR FLAGS ON LOGGED RECORDS

(No records are logged by the GPRO block)

REPORTS, SUMMARIES, DOCUMENTATION PRINTED

- 1) Timetables, as requested
- 2) Class lists, as requested
- 3) Resource element schedules (tabular or matrix), as requested

XL RECORDS REFERENCING GPRO BLOCK

<u>Key Field</u>	<u>XL Record Function</u>
GPROCLAS	Request for timetable or class lists
GPROSCHDX	Request for resource element schedules (tabular or matrix)
GPROSORTX	Optional specification for ordering of output
GPROHEADX	Optional heading line for resource element schedules
GPRONAMEx	Optional specification of format for name lines on schedules
GPROFMATX	Optional specification of format of schedule lines or entries
GPROPNCHX	Optional specification of format for punched card

5.10.10(2) GPRO BLOCK, SUMMARY OF COMMENTS, ERRORS, REPORTS, XL RECORDS (Continued)

<u>Key Field</u>	<u>XL Record Function</u>
GPROROWNn	Optional labels for rows and columns of matrix schedules
GPROCOLnn	

6.1.1 CONFIGURATION

The following configuration is regarded as minimal for running GASP:

- A) System /360 Model 40 with 128 K bytes of addressable storage
- B) Universal Instruction Set
- C) OS compatibility (hardware and software to support OS)
- D) Direct Access Storage Devices
 - 2311 Disk Storage Drives (two)
 - 2302 Disk Storage
 - 2303
or Drum Storage
 - 2301
 - 2321 Data Cell Drive
 - 2314 Direct Access Storage Facility

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6.1.1(2) CONFIGURATION (Continued)

REMARKS

- 1) Many schools will be able to run with 128 K storage, but larger core capacity may be required for individual applications. GASP will automatically avail itself of any larger core storage.
- 2) In particular, certain reports and options of GASP require more core capacity than the most basic use of GASP. Use of these reports and/or options may require more than 128 K storage in an individual application.
- 3) The presence of at least one Magnetic Tape Drive will allow the user to maintain his GASP FILE on magnetic tape. In the absence of such a device, the GASP FILE will require space allocation on a DASD.
- 4) GASP will take advantage of the faster storage speed and CPU timing on the higher numbered models, but is sensitive in several blocks to the access and transmission timing of the DASD devices.
- 5) Optimal arrangement of the configurations DASD's is extremely important to GASP, particularly on the larger machines. Drum Storage, although rarely available, is greatly advantageous. The capacity of 2321 Data Cells is not useful to GASP while its low speed is most unattractive. GASP will take advantage of multiple - channel configurations.

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6.1.2 DATA SET REQUIREMENTS

To run GASP, the user must identify, and provide space allocation for, the different input/output files required for the run. Most of these data sets are required for every run but several are optional. The files required for each run are as follows:

- 1) A DD statement named IFFILE that defines a GASP FILE to be the input file for the run; on the first GASP run (in the absence of an old GASP FILE) the "DUMMY" convention may be used.
- 2) A DD statement named OFFILE that defines a GASP FILE to be the output file for the run. The DD statement for this file should specify a disposition of 'KEEP'. The OFFILE file for one run becomes the IFFILE for the next run.
- 3) DD statements naming seven work files and allocating temporary DASD space. The contents of these files are briefly described to assist the user in determination of space allocation requirements.

DDNAME

File Contents

TFFILE	A temporary GASP FILE, no larger than OFFILE
WLFILE	4 characters for each possible resource assignment in the school
WXFILE	The XL records for OFFILE
CFFILE	The correction file
WTFILE	120 characters for each TP record in OFFILE
WCFILE	(92 + 4N) characters for each CL record in OFFILE, where N = the number of modules in the schedule cycle
WRFILE	(92 + 4N) characters for each RE record in OFFILE, where N = the number of modules in the schedule cycle

The user may also identify up to 5 optional files into which production output will be written. In the absence of a given DD statement, that portion of the production output will be entered on the log. The five optional production files are:

6.1.2(2) DATA SET REQUIREMENTS (Continued)

DDNAME

Portion of Production Output Affected

CLASS	Class lists (if any)
SCHDI	Instructor schedules (if any)
SCHDR	Room schedules (if any)
SCHDS	Student schedules (if any)
PUNCH	Punched class and class master cards (if any)

REMARKS

- 1) The GASP log will be written into the sequential data set used for output messages defined by a DD statement named SYSPRINT in conformity with standard OS procedure
- 2) The (optional) punched output will be written into the sequential data set defined by a DD statement named SYSPUNCH. This DD statement is required if and only if 'PNCH' XL cards are present in the file and there is no PUNCH DD statement for the run
- 3) A DD statement named SYSIN defining the sequential data set used for correction record input is required
- 4) IFFILE and OFFILE DD statements may each refer to either Magnetic Tape Drives or to DASD's, as may the DD statements for the 5 optional production output files. All 7 of these files are sequential data sets. The 7 work files are direct data sets and require DASD assignments

6.1.3 JOB CONTROL, COMPLETION CODES, AND ABNORMAL TERMINATION OF RUN

GASP is executed or invoked with the symbolic name GASP and the DD statements referred to in the previous section. Successful completion of a GASP run will result in return of control to the level at which it was entered.

For any of a number of reasons, it may be necessary to abnormally terminate a GASP run. In these cases the user may have to refer to the following table of completion codes to determine the cause of the termination. These codes correspond to the USER code indicated on the log. When a SYSTEM completion code is indicated on the log, the USER code will normally be '0000' and reference should be made to IBM form C28-6631 titled "IBM Operating System 1300 - Messages, Completion Codes, and Storage Dumps" for interpretation of the SYSTEM code.

User Abnormal Completion Codes

- 1) The first (left-most) digit of the code indicates the generic cause for the abnormal termination:
 - 0xxx - Control information (job setup) BAD
 - 1xxx - Bad/incomplete data
 - 2xxx - Insufficient core space
 - 3xxx - Logic error (probably a program bug; but if a file name is indicated there is a small chance of an I/O mal-function)
 - 4xxx - I/O equipment mal-function detected by OS

6.1.3(2) JOB CONTROL, COMPLETION CODES, AND ABNORMAL TERMINATION OF RUN (Continued)

- 2) The second digit of the code indicates the program block in control during the abnormal termination:
 - x0xx - GASP BLOCK or BASIC UTILITY ROUTINES
 - x1xx - GCOR BLOCK
 - x2xx - GUEA BLOCK
 - x3xx - GSEQ BLOCK
 - x4xx - GATA BLOCK
 - x5xx - GARA BLOCK
 - x6xx - GUEB BLOCK
 - x7xx - GSTO BLOCK
 - x8xx - GPRO BLOCK
- 3) The last 2 (right-most) digits of the code specifically identify the condition resulting in the abnormal termination.
A complete listing of the 4 digit codes follows in numeric order:

<u>Code</u>	<u>Condition</u>
0004	MISSING DD JOB CONTROL STATEMENT
1224	EITHER TOO MUCH OR NOT ENOUGH DATA. SPECIFIC REASONS HAVE BEEN RECORDED ON THE LOG
2404	INSUFFICIENT CORE SPACE FOR WLFILE DATA
2456	INSUFFICIENT CORE SPACE FOR WLFILE DATA
2804	INSUFFICIENT CORE SPACE FOR WTFILE
2808	INSUFFICIENT CORE SPACE FOR WRFILE DATA
3000	ILLEGAL CALL TO I/O INTERFACE (GIO)
3004	ILLEGAL SEQUENCE OF CALLS TO I/O INTERFACE (GIO)
3012	ILLEGAL SEQUENCE OF CALLS TO I/O INTERFACE (GIO)
3016	ILLEGAL SEQUENCE OF CALLS TO I/O INTERFACE (GIO)
3104	BAD CFFILE INDEX DURING OUTPUT. CFFILE SPACE ALLOCATION (DD STATEMENT) MAY BE TOO SMALL

6.1.3(3) JOB CONTROL, COMPLETION CODES, AND ABNORMAL TERMINATION OF RUN (Continued)

<u>Code</u>	<u>Condition</u>
3204	BAD CFFILE INDEX DURING INPUT
3208	BAD TFFILE INDEX DURING OUTPUT
3212	BAD WXFILE INDEX DURING OUTPUT
3216	BAD WTFILE INDEX DURING OUTPUT
3220	BAD WCFILE INDEX DURING OUTPUT
3224	BAD WRFILE INDEX DURING OUTPUT
3304	BAD WTFILE INDEX DURING INPUT
3308	BAD WCFILE INDEX DURING INPUT
3312	BAD WRFILE INDEX DURING UPDATE
3316	BAD WCFILE INDEX DURING INPUT
3320	INCONSISTENT BOUNDS ON CLASS ARRAY
3404	BAD WTFILE INDEX DURING INPUT
3408	BAD WCFILE INDEX DURING INPUT
3412	BAD WRFILE INDEX DURING INPUT
3416	INCORRECT ARRAY SPECIFICATION DURING WCFILE INPUT
3420	BAD WCFILE INDEX DURING INPUT
3424	BAD WLFILE INDEX DURING INPUT
3428	INCONSISTENT BOUNDS ON INTERNAL ARRAY
3432	FAULTY COMPUTATION OF ARRAY SIZES
3440	BAD ASSIGNMENT INDEX IN INTERNAL ARRAY

6.1.3(4) JOB CONTROL, COMPLETION CODES, AND ABNORMAL TERMINATION OF RUN (Continued)

<u>Code</u>	<u>Condition</u>
3444	INCONSISTENT BOUNDS ON CLASS ARRAY
3448	BAD ASSIGNMENT INDEX IN INTERNAL ARRAY
3452	BAD WTFILE INDEX DURING INPUT
3456	BAD WCFILE INDEX DURING INPUT
3460	BAD WRFILE INDEX DURING INPUT
3464	INCORRECT ARRAY SPECIFICATION DURING WCFILE INPUT
3468	BAD WCFILE INDEX DURING INPUT
3472	BAD WLFILE INDEX DURING INPUT
3476	INCONSISTENT BOUNDS ON INTERNAL ARRAY
3480	BAD ASSIGNMENT INDEX IN INTERNAL ARRAY
3484	FAULTY COMPUTATION OF ARRAY SIZES
3488	BAD CLASS INDEX INTERNAL
3492	BAD CLASS INDEX INTERNAL
3496	BAD ASSIGNMENT INDEX IN INTERNAL ARRAY
3504	BAD WTFILE INDEX DURING INPUT
3508	BAD WCFILE INDEX DURING INPUT
3512	BAD WRFILE INDEX DURING INPUT
3516	BAD WCFILE INDEX DURING INPUT
3520	BAD WRFILE INDEX DURING UPDATE

6.1.3(5) JOB CONTROL, COMPLETION CODES, AND ABNORMAL TERMINATION OF RUN (Continued)

<u>Code</u>	<u>Condition</u>
3524	FAULTY COMPUTATION OF ARRAY SIZE
3552	BAD WFILE INDEX DURING INPUT
3556	BAD WFILE INDEX DURING INPUT
3560	BAD WFILE INDEX DURING INPUT
3564	BAD WFILE INDEX DURING UPDATE
3572	BAD WFILE INDEX DURING UPDATE
3576	FAULTY COMPUTATION OF ARRAY SIZE
3604	INCORRECT ARRAY SPECIFICATION DURING WFILE OUTPUT
3608	BAD OFFILE INDEX DURING OUTPUT
3704	INCONSISTENT COUNTS OF RESOURCE ELEMENTS
3804	BAD WFILE OR WFILE INDEX DURING INPUT
3808	INCONSISTENT BOUNDS ON CLASS OR RESOURCE ARRAY
3812	BAD WFILE INDEX DURING INPUT
3816	BAD WFILE INDEX DURING INPUT
3820	FAULTY COMPUTATION OF ARRAY SIZES
3824	BAD WFILE INDEX DURING INPUT
3828	INCONSISTENT BOUNDS ON INTERNAL ARRAY
3832	BAD WFILE INDEX DURING INPUT
3836	BAD WFILE INDEX DURING INPUT

6.1.3(6) JOB CONTROL, COMPLETION CODES, AND ABNORMAL TERMINATION OF RUN (Continued)

<u>Code</u>	<u>Condition</u>
3840	BAD WFILE INDEX DURING INPUT
3844	BAD WFILE INDEX DURING INPUT
4000	OS DETECTED I/O MAL-FUNCTION FOR IFFILE
4008	OS DETECTED I/O MAL-FUNCTION FOR OFFILE
4016	OS DETECTED I/O MAL-FUNCTION FOR TFFILE
4024	OS DETECTED I/O MAL-FUNCTION FOR CFFILE
4032	OS DETECTED I/O MAL-FUNCTION FOR WXFILE
4040	OS DETECTED I/O MAL-FUNCTION FOR WFILE
4048	OS DETECTED I/O MAL-FUNCTION FOR WFILE
4056	OS DETECTED I/O MAL-FUNCTION FOR WFILE
4064	OS DETECTED I/O MAL-FUNCTION FOR WFILE

7.1.1 TRANSMITTAL TAPE FORMAT

The 360 GASP III program is distributed by SHARE on one 9-track NRZI magnetic tape reel, with volume serial GASP31. The OS Utility IEHMOVE has been used to copy six data sets onto this volume. Each data set has a blocksize of 800 and a logical record length of 80. These six data sets, in the order in which they are recorded on the transmittal tape, are:

<u>Data Set Name and</u> <u>IEHMOVE SERIAL</u>	<u># of</u> <u>blocks</u>	<u>Description</u>
GASP.LODLIB (GASP31,1)	179	(Unloaded) partitioned data set; link-editted load modules for program execution; running GASP requires copy onto a DASD volume for use as a job library (JOBLIB DD statement)
GASP.MACLIB (GASP31,2)	262	(Unloaded) partitioned data set; macros for GASP routines; reassembly requires copy onto a DASD volume for concatenation with SYSLIB
GASP.OBJLIB (GASP31,3)	311	(Unloaded) partitioned data set; object modules, assembler output for GASP routines, suitable for link-edit input
GASP.SAMPLE (GASP31,4)	60	Sequential data set; GASP III Sample School Test Data; may be used as SYSIN input to GASP for testing and illustrative purposes
GASP.SORLIB (GASP31,5)	1621	(Unloaded) partitioned data set; source library containing card images for GASP routines, suitable for assembler input
GASP.SRCLIB (GASP31,6)	645	(Unloaded) partitioned data set; special compressed source library containing encoded source for GASP routines; THIS LIBRARY IS OF INTEREST ONLY TO USERS ANTICIPATING EXTENSIVE MODIFICATION OF GASP, AND REQUIRES DOCUMENTATION NOT INCLUDED IN THIS WRITE-UP

Use of the above data sets is described in the following three sections. All users will be concerned with copy of GASP.LODLIB onto a DASD volume (temporarily or permanently). Most will want to use GASP.SAMPLE at least once, probably directly from the transmittal tape.

7.1.2 USE OF A "TEMPORARY" GASP JOB LIBRARY

In order to execute the GASP program, it is necessary to use OS Utility IEHMOVE to copy the load library GASP.LODLIB onto a DASD volume. IEHMOVE requires that the DASD volume serial be known in advance. Since DASD space may not be available to users on a permanent basis, this copy may well have to be part of every GASP job as an initial job step. In such a case, the user will have to discuss this matter with his computation center, and will have to arrange for space on a predetermined DASD volume into which he may temporarily copy his load library. "Temporary" in this context means that scratch space will be allocated from the predetermined DASD volume for the duration of the user's job, and will be deleted after the job; the first job step of the GASP job will effect the copy of GASP.LODLIB from the transmittal tape onto the appropriate DASD volume. Space allotment of 6 cylinders on a 2311 disk pack, or 11 tracks on a 2301 magnetic drum, is required to hold GASP.LODLIB. It is expected that most centers will allow the user temporary DASD space, but arrangements must be made in advance. In particular, the particular DASD volume to be used must be identified by volume serial prior to the run.

As an example of a job using a temporary GASP job library, assume that the user has obtained permission to use a 2311 disk volume serial SSSSSS for temporary load library space. Further assume that it is customary for OS Utilities to use work-area data sets on a 2301 drum volume serial CCSYDR. Then the following IEHMOVE and job control statements would perform the JOBLIB generation.

7.1.2(2) USE OF A "TEMPORARY" GASP JOB LIBRARY (Continued)

```
//GASP JOB (M3196,1358;15,5000,0), 'LINDERMAN'
//JOB LIB DD DSN= GASP.LODLIB, SPACE=(800, (300, ,10)), DISP=(NEW,PASS), -
//          UNIT=2311, VOLUME=SER=SSSSSS
//TEMPCOPY EXEC PGM=IEHMOVE
//SYSPRINT DD SYSOUT=A
//DISK DD UNIT=2311, VOLUME=SER=SSSSSS, DISP=(OLD,PASS)
//TAPE DD UNIT=2400, VOLUME=SER=GASP31, DISP=(OLD,PASS)
//SYSUT1 DD UNIT=2301, VOLUME=SER=CCSYDR, DISP=OLD
//SYSIN DD *
//          COPY PDS=GASP.LODLIB, TO=2311=SSSSSS, FROM=2400=(GASP31,1)
/*
//RUN EXEC PGM=GASP
... DD statements for the GASP run ...
```

NOTE: The SPACE parameter on the JOBLIB statement is given in device-independent terms in the example. The following would be an acceptable alternative for 2311 disk space:

...SPACE=(CYL, (6, ,10))...

and the following would be an acceptable alternative for 2301 magnetic drum space:

...SPACE=(TRK, (11, ,10))...

7.1.3 USE OF A "PERMANENT" GASP JOB LIBRARY

To avoid the necessity of copying the load library from the transmittal tape to a DASD volume as the first job step of every GASP job, the user may want to effect this copy once and for all into permanently allocated space. This would require his receiving permission from his computation center in the form of space allocation on a 2311 disk pack (or its equivalent). In some applications, the user may "own" his DASD volume -- literally or figuratively -- and in other cases may share DASD volumes with other center users. While such "permanent" space allotment will somewhat simplify matters for the user, it should be pointed out that not all computation centers make it a practice to allocate such space (some do not even allow users to mount their own DASD volumes because of small configurations). Thus, it may be necessary to resort to use of a "temporary" library as described in the preceding section.

The following IEHMOVE and job control statements illustrate copy of two data sets from the transmittal tape into permanent libraries. The example assumes that these libraries are to reside on a 2311 disk volume serial ISOS01, and that it is customary for OS Utilities to use work area data sets on a 2311 disk volume serial CCSY00. Space allocation will be performed automatically by IEHMOVE as part of the copy; should the user anticipate modification of the libraries, preallocation of space may be necessary in order to accommodate member replacement.

7.1.4(2) USING THE GASP III SAMPLE SCHOOL TEST DATA (Continued)

NOTES AND COMMENTS

- (3) The same space is being used for both the CFFILE and the WRFILE. The WRFILE requires SPACE=(200,200). Since the work files (those with names beginning with the letter 'W') are not used until GASP is completely through with the CFFILE, and since the space required for the WRFILE is less than that required for the CFFILE, this gimmick works. BE CAREFUL; THIS WORKS ONLY FOR CFFILE AND THE WORK FILES, AND THEN ONLY IF SPACE REQUIREMENTS ALLOW.
- (4) IFFILE is declared to be a DUMMY since this is a first run. On subsequent test runs, it will have to be specified if running from an old file.
- (5) An OFFILE is being generated, but if the user does not intend to use such a file (as IFFILE input to a subsequent run), the DD DUMMY convention could have been used.
- (6) Punched output is being directed to a 2311 disk file for later printing (or punching). Use of the special PUNCH DD statement would have allowed the same function.
- (7) GASP.SAMPLE is being used as SYSIN directly from the transmittal tape; note the use of the LABEL parameter to indicate the data set sequence number.
- (8) PLEASE remember that the SPACE parameters listed are tailor-made for the GASP III Sample School, and will probably NOT be applicable for other applications. Estimate this space requirements carefully for your own school, and allowing secondary quantity specification in the SPACE parameter to allow for overflow may be a good idea.