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THE UNIVERSITY OF NORTH CAROLINA GRADE POSTING SYSTEM

by

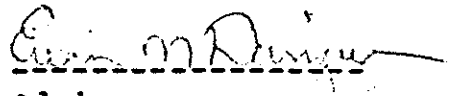
Surry P. Everett

A Thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Science in the Department of Computer Science.

Chapel Hill

1979

Approved by:



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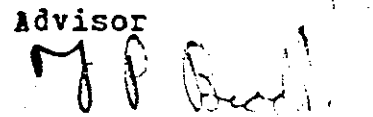

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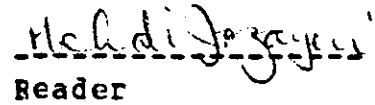

Reader

SUSAN PARKER EVERETT. The University of North Carolina Grade Posting System (Under the direction of EDWIN M. DANZIGER.)

ABSTRACT

The University of North Carolina Grade Posting System is designed to enter student grades into the automated records system. This thesis describes the design of the system and implementation of selected functions.

ACKNOWLEDGEMENTS

I would like to thank Mr. Erwin Danziger, Director, UNC Administrative Data Processing, for the opportunity to observe a practicing data processing center in operation while studying the theory of computer science. I also would like to thank Mr. William F. Gryder of Sperry Univac and Mr. Gordon Fitz-Simons, UNC Administrative Data Processing, for their assistance and information, without which this thesis would not have been written.

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Chapter I

INTRODUCTION

1.1 SCOPE OF THIS THESIS

The purpose of the University of North Carolina Grade Posting System (GPS) is to enter student grades into the automated records system. The scope of this thesis is limited to the design of the GPS and the implementation of selected functions which it performs. A master student file for each academic term is created on a Sperry Univac 90/80 (host computer or 90/80), one of two large general purpose computers which are used by UNC Administrative Data Processing (ADP). The master student file is written onto two eight inch diskettes of a dual diskette subsystem. The diskette subsystem is part of the UTS 400, an intelligent terminal system which is connected to a host computer.

Data entry specialists enter and verify student grades by using the ENTER and VERIFY functions of the GPS. The SEND function of the GPS initiates a program on the host computer in order to transfer the verified grades from the UTS 400 terminal system to a file in the secondary storage of the host computer. Student grades are then entered into the automated records system.

1.2 THESIS ORGANIZATION

The remainder of this thesis is organized as follows: Chapter Two contains a description of the current method of grade entry into the automated records system. Chapter Three describes the operation of the proposed method of grade entry. Chapter Four explains the decisions made while designing the GPS. Chapter Five describes the implementation of selected functions of the GPS. Finally, Chapter Six contains some conclusions of the author on this thesis project.

It is assumed that the reader has some familiarity with MAC80 assembly language and the UTS 400 terminal system architecture. If not, he is referred to the attached bibliography on page 31. Appendix A, File Layout and Source Code of the GPS, describes the program logic of the GPS. Appendix B, The UNC GPS User's Manual, contains a detailed description of the GPS from the data entry specialist's point of view.

Chapter II

CURRENT METHOD FOR ENTERING GRADES

Official class roll and grade reports for each section are printed in multiple copies by ADP and sent to the appropriate department or school for distribution to the individual instructors. A page of an official class roll and grade report (see Figure 1) contains space for the name, social security number, sequence and ID number, grade, and credit hours of twenty-five students. Each section's class roll and grade report consists of one or more pages, numbered sequentially by section, with student names listed in alphabetical order by section. A student's sequence number (01 thru 25) is his position on the page of the class roll and grade report which contains his name. A student's ID number is the last two digits of his social security number. Instructors complete the class rolls by entering a grade for each student, by making any changes, and by returning the completed class rolls to ADP. It should be noted that the rolls are returned by section and not by course. Changes which instructors may make to the rolls are exception transactions and consist of the following:

1. Additions or deletions of students

OFFICIAL CLASS ROLL AND GRADE REPORT

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

_____ TERM 19_____

COURSE TITLE _____ COURSE NO. _____ SECTION _____ CR. HRS. _____

SCH.	SOC. SEC. NO.	NAME (LAST) (FIRST)	CD. ID.	GRADE	HRS.	REMARKS

NUMBER OF

H ___ P ___ L ___ A ___ B ___ C ___ D ___

F ___ PS ___ CO ___ IN ___ AB ___ OTHER ___

CLASS HOURS EACH WEEK:

LECTURE ___ LAB ___

THE ABOVE CLASS ROLL IS COMPLETE AND CORRECT SIGN HERE _____

INSTRUCTOR

Figure 1: Blank Cfficial Class Roll and Grade Report

2. Changes to a student's credit hours

3. Changing the title of a course

Data entry specialists prepare OCR-A typed input to the optical scanner for each section which consists of header information and information for each student in the section. Header information consists of the following:

1. Section control number

2. Page number

Individual student information consists of the following:

1. Sequence number on a page

2. Last two digits of social security number

3. Grade

The optical scanner accepts the typed input and prepares a tape file consisting of transactions for each student per section and a transaction per exception. After a desired amount of data has been accumulated, the tape file is printed and manually checked by comparing it to the class rolls. The tape file is then subjected to two validation runs on the 90/80 which check for authorized students in a section, correct courses, and authorized grades. Exception transactions are extracted from the file during the first

validation run and written to a separate file. Once the validation runs are completed, the two files are processed into the automated student records system. This cycle is repeated until all desired sections have been entered into the automated records system.

Chapter III

GPS - PROPOSED SYSTEM TO ENTER GRADES

3.1 INTRODUCTION

The proposed method to enter grades into the automated records system will replace the steps of the current method which involve the optical scanner, including the preparation of input for the scanner. All of the checks made during the two validation runs will be duplicated except for the removal of exception transactions. The reader may wish to read the User's Manual contained in Appendix B before continuing in order to understand the functions performed by the GPS.

3.2 DESIGN GOALS

Under the current method, grades are entered into the automated records system from a magnetic tape file which is prepared by an optical scanner. The optical scanner prepares the data on the tape from typed data which is prepared by data entry specialists. Data are not validated until the output of the scanner is processed by the automated records system which operates on the 90/80. If the 90/80 is not operating, input for the optical scanner

may be prepared by data entry specialists but the validity of the data cannot be checked until the 90/80 is operating. If data are lost on the 90/80, the input to the optical scanner may be resubmitted in order to obtain the input to the automated records system.

A UTS 400 terminal system consists of a master or primary slave terminal (see Figure 2) and from one to five slave terminals. A master or primary slave terminal is distinguished in that it is allowed to partition UTS 400 memory and to load programs into UTS 400 memory as explained in Appendix B. Other than these two functions, the slave terminals can perform the same UTS 400 functions which the master or primary slave can perform. The UTS 400 system now in use consists of a primary slave terminal, two slave terminals, a dual diskette subsystem, and a dual tape cassette subsystem. Cassette tapes and diskettes which are mounted are referred to by the first letter of the type of device concatenated with a one or two. For example, C1 refers to the tape mounted in tape drive number one, and D2 refers to the diskette which is mounted in diskette drive number two. ADP has determined that if the system developed in this thesis is adopted, one to three additional slave terminals may be purchased.

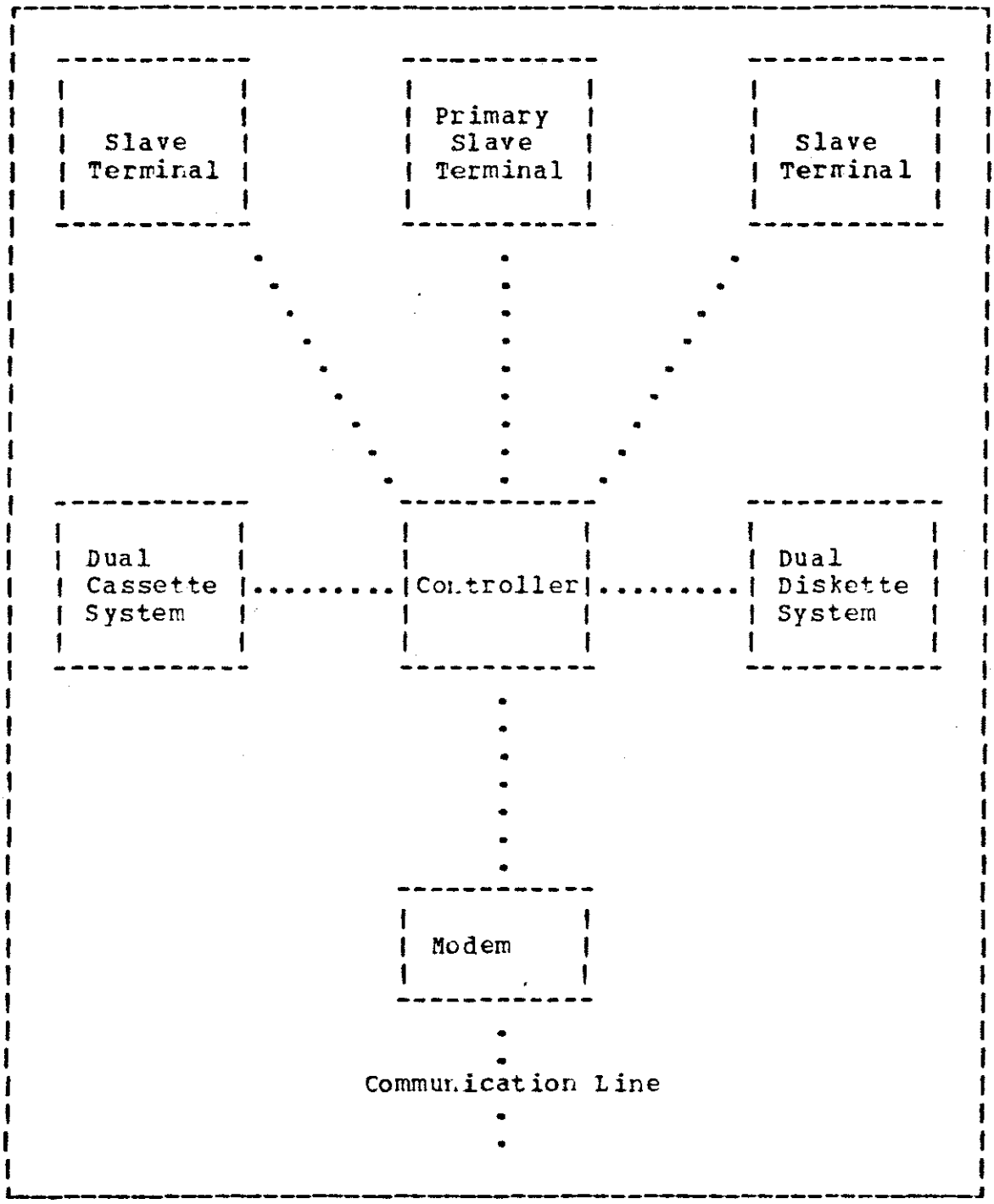

Figure 2: UTS 400 Hardware Configuration

The number of student grades which has to be posted during a term is the sum of the number of students enrolled in each course. Each course is divided into one or more sections of students. Hereafter, the term 'section' will be used to mean a course section of students. Approximately eighty-five thousand student grades, divided into four thousand sections, have to be posted during each fall and spring semester. Fewer grades, from fewer sections, have to be posted during the two summer sessions. ADP has determined that any new system should allow for expansion of the number of student grades to one hundred thousand grades divided into six thousand sections.

As a result of the factors cited in the preceeding paragraphs, the design goals of the GPS are as follows:

1. Verify as much of the data as possible at time of initial entry.
2. Allow operation of the GPS even if the 90/80 is not operating.
3. Minimize loss of data in the event that the GPS crashes.
4. Allow operation of the GPS with one to six terminals.
5. Allow for expansion of the system to handle one hundred thousand student grades, divided into six thousand sections.

3.3 BEGINNING OPERATION OF THE GPS

The GPS may be loaded into the UTS 400 from the host computer or from a peripheral device. The capability of being loaded from a peripheral device gives the GPS the ability to function when the host computer is not in operation. Data cannot be transferred to the host computer unless it is working, but all other functions of the GPS may be performed. When the GPS begins operation every terminal of the UTS 400 terminal system is initialized, but only the primary slave terminal is connected initially to the GPS. After initialization any slave terminal may be connected to the GPS by pressing its F14 key. When the GPS is in operation and a terminal other than the primary slave is not connected to the GPS, its ability to use the diskette or tape drives is inhibited. It is only allowed to communicate with the host computer. The GPS initialization routines meet the design goal of allowing any number of terminals to operate under the GPS. These routines have a side effect of requiring a buffer of 137 bytes to be set aside for each possible terminal which may or may not exist. The memory is wasted if the terminals do not exist, but these routines allow terminals to be added to the system without having to reassemble the program.

3.4 DATA ENTRY

Pages of section data are required to be entered in order. After an operator has selected a section for which he desires to enter grades, the page of file data obtained is the data for the first page which has not yet been entered for that section. The page number of the first page not entered is not updated until a page is completely entered. Thus, if operator A is entering data and operator B attempts to enter data for the same section before operator A completes his page, operator B obtains the file data for the same page. If by chance the file data (students' last two social security digits) is exactly the same as that on the page which operator B is attempting to enter, the data on the page which is completed last will replace the data on the diskette file. As a result, returned class roll and grade reports are given to data entry specialists in groups of entire sections in order to avoid concurrent processing problems.[1] As the grade data from each page of a section roll is completely entered, the master file on the diskette is updated. The social security digits which are entered by the data entry personnel are compared to the digits contained in the diskette master file. If the two do not match, data entry will be stopped. The reader may refer to

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[1] David Kroenke, Database Processing. (Chicago, 1977), pp. 249-251.

page 30 of the User's Manual to obtain a detailed explanation of the actions to be taken as a result of incorrect data entry. Each grade is compared to the authorized grade table when it is entered by data entry personnel. Only authorized grades are allowed to be entered. An authorized grade is any grade contained in the authorized grade table. If a grade is missing or an unauthorized grade is on the class roll, either a dummy entry may be made or further processing of this section may be halted until the instructor can be contacted. In the event of the latter case, the only data lost are that currently on the screen. The same situation occurs if the GPS crashes or if power to the UTS 400 is discontinued. Thus, another design goal, minimizing loss of data, has been met.

3.5 DATA VERIFICATION

Data is verified by a data entry specialist other than the one who originally entered the data. The data entry specialist chooses the function to be performed, gives the control number of the section to be verified, and enters only the grade, since the social security digits were verified when the grades were entered. An alarm sounds if the grades do not match, and the grade is not accepted. In order to allow changes during the verification function, a total of three tries is allowed, and then the first

authorized grade which is entered becomes the verified grade. The diskette master file is updated as verification of each page is completed. Only the data on the screen is lost if a power loss occurs or if the GPS crashes. It should be noted that the GPS does not allow exception transactions to be verified. ADP has determined that the total number of exception transactions generally do not exceed three hundred per term. Exception transactions are verified manually after being separated from the regular transactions on the host computer by examination of a code contained in each transaction.

3.6 EXCEPTION TRANSACTIONS

Exception transactions are also entered by the GPS data entry specialists. The exception transactions are written to cassette tape C2 from which they will be transmitted to the host computer. Exception transactions are not written to the diskette file. Any operator of a terminal connected to the GPS may enter exception transactions by choosing one of the following functions:

1. ADD-ON. This function processes students who have been added to class rolls by the instructors.

2. TITLE. This function handles the changing of a course title.

3. HOURS. Here, an instructor has changed the credit hours for a particular student. A student may be permitted to omit part of a course on material which he has studied previously. Thus, a student might receive different credit hours than other students in the same course.

The GPS will return to the master menu as each function is completed in order that the terminal operators may choose another function. If the previous function was ADD-ON, however, the ENTER function will be initiated. The GPS does not process the removal of students from sections who were deleted from class rolls by instructors. Such deletion is processed by other parts of the automated records system. In order for the GPS to process sections containing deleted students, dummy grades are entered for the deleted students.

3.7 DATA BACK-UP

Back-up for all data is maintained by writing each transaction, including exceptions, to cassette tape C1 as the diskette file is being updated for regular transactions and as exception transactions are written to tape C2. This tape is maintained until the current term is completed. If a diskette file becomes damaged, lost, or destroyed, it may be rebuilt using the back-up tapes and the previous diskette. Each set of diskettes is maintained for three generations.

3.8 ENDING OPERATION

Each session of the GPS is terminated from the primary slave terminal only. The primary slave terminal insures that the other slave terminals are not performing input/output and waits until the slave terminal operations are completed.

The primary slave terminal then rewinds all tapes, writes a warning message on the screen which states that the terminal may be connected to the host, and disengages the GPS from the UTS 400 terminal system. The GPS cannot be restarted without being reloaded into the UTS 400 user memory.

Chapter IV

GPS DESIGN DECISIONS

4.1 MASTER FILE CREATION AND DESCRIPTION

The master file is created on the host computer with the layout given in Appendix A. The first record of the file contains the date of file creation, a device label, and a table of authorized grades. The last record of the file contains the date of file creation and a device label. Other records contain the actual section information. All information concerning sections for a particular term is known at the time of file creation, approximately one or two weeks before the end of the grading period. Thus, there will be no insertions into the file once it is created. An ISAM file organization is used with embedded keys. Each section has one or more records with each record containing the last two social security digits for fifty or fewer students and space for a two character grade for each student. Each record can hold two pages of class rolls. The first record of a section also contains the course and section information. Each record's key is a unique section control number concatenated with a two digit set number computed by adding a one to the page number of the first page contained in the record and dividing the resulting sum by two. The

first set number of a section, therefore, is always '01'. The key for the first record of a term's file is always all 0's. The key for the last record is always all 9's. The indices for the file are interspersed throughout the data such that the first record of any section may be accessed within three accesses. High level indices are read into main memory of the UTS 400 when the master file is opened. Hidden from the user is the fact that the file may sometimes be contained on only one diskette. This was done in order that standard procedures could be developed for the data entry specialists. Ordinarily, the only time that the entire file could be on one diskette is the first six weeks term for freshmen. The master file contains variable length records of 6 to 121 bytes with fixed length data blocks of 13 sectors (1/2 track). This means that when a data block is read, it does not span two tracks and does not consume the time to move the disk head from one track to another.

4.2 UPDATING THE MASTER FILE

Two records are required to be read for any page other than the first two pages because the section status information is contained in the first record. First, the initial section record is read. Second, the key of the record containing the next page to be entered or verified is computed. Third, the desired record is read after saving the section status information. The first record of the section

is updated with the current section status after a page has been completed, and the record containing the current page is also updated. If most sections contained more than two pages, this access method would take too long. However, a study by ADP of the number of students per section revealed that of four thousand sections, only four hundred sections contained more than fifty students. The time necessary to access either page one or page two is 2.5 seconds, but to access any other page requires 5 seconds.

4.3 MAXIMUM SIZE OF THE MASTER FILE

Each diskette of the dual diskette subsystem contains space for 250,000 bytes and has 72 usable tracks. Six thousand sections require 21 bytes each for course and status information for a total of 126,000 bytes. One hundred thousand students require two hundred thousand bytes for social security digits and grade index. The last two digits of the social security number and the two digit grade index are packed into one byte each. Thus, the total space needed for data in the master file is 326,000 bytes which is within range of the 500,000 bytes of available space. Mr. William Gryder of Sperry Univac, who wrote the file access routine, states that the routine needs no more than 70,000 bytes for index blocks. With each data block occupying one-half track, there can be no more than 288 (72 tracks x 2 data blocks per track x 2 diskettes = 288) data blocks. Records are not

allowed to span blocks. If there is insufficient space for an entire record in a block, the space is not used, and the record is placed in the next data block. The largest possible record (121 bytes) is the initial record of a section which has fifty or more students. The maximum amount of unused space per block is the space required for the largest possible record minus one byte (121 - 1 = 120). Since there can be no more than 120 unused bytes per block, unused space accounts for no more than 34,560 bytes (288 blocks x 120 bytes = 34,560 bytes) for a grand total of 430,560 bytes. Actually, there can't be 288 data blocks because of the index blocks which are always 128 bytes long. By using the above figures, however, the computations show that the required space is available.

4.4 CRITICAL ACTIONS

Critical actions are actions which if allowed to occur may not be undone. Included in this category are the following actions:

1. Restarting the GPS program
2. Reusing the cassette tapes from the current term
3. Ending the current session of the GPS program

All of the above actions must be initiated from the primary slave terminal. Once the operator of the primary slave terminal indicates that he wants to perform a critical

action, he is given a short warning message and asked if he really wants to perform that action. If the response is negative, his terminal returns to the master menu screen. If the response is affirmitive, the critical action begins operation. If the critical action is reusing the cassette tapes from the current term and a negative answer is given, the GPS returns to the restart point and not to the master menu. If a critical action is requested from any terminal other than the primary slave terminal, the request is ignored and that terminal returns to the master menu.

4.5 USER FEEDBACK

After the functions to be performed by the GPS were identified, limited pilot implementation was performed in order to present a demonstration to the prospective user and client. As a result of the demonstration, both the client and prospective user indicated that the proposed system would greatly enhance their capability to provide service. Each had suggestions which were later added to the GPS. The client stated that he wanted the data entry specialists to be prompted for added students after every section had been entered. He felt that it might be too easy to forget about penciled-in names at the end of class rolls. The user added that a data entry specialist would either be entering or verifying data in groups of sections. Thus, if the ENTER or VERIFY functions were being performed and a section was

completely entered or verified, the function should be restarted automatically without the terminal operator having to request the function from the menu screen. This capability and the capability to return to the master menu at any time were added to the GPS.

During the demonstration, a data entry specialist stated that all of the UIS 400 terminals might not always be used for posting grades and that it would be desirable if the terminals could be used for other tasks. She explained that at times there are insufficient class roll and grade reports on hand to require the use of all available UTS 400 terminals and that there are other applications which may require data entry. Thus, one or two data entry personnel might be posting grades, and another person might be entering data for other applications which require only that the user be allowed to communicate with the host computer. The capability to disconnect a terminal from the GPS and the capability to reconnect a terminal to the GPS were also added to the program.

Chapter V

IMPLEMENTATION OF SELECTED FUNCTIONS

5.1 STATUS

The STATUS function accesses the first record of a section in the same manner as the ENTER or VERIFY functions. No data is written to the file. Course information such as department and course number is displayed on the terminal's screen. The first page not entered, the first page not verified, and the total number of pages in the section are also displayed. A zero appears in the screen position for the first page not entered or the first page not verified if all pages have been entered or verified. This function may be performed at any terminal connected to the GPS.

5.2 GRADES

The GRADES function is not described in the User's Manual, nor does it appear in the GPS master menu because the client desired to conceal its existence from the terminal user. The GRADES function allows the authorized grade table to be replaced. Changing the authorized grade table in the middle of processing a term's grades could invalidate previously entered student grades, but it is a

client-desired capability. Thus, this function exists, but its use is not to be taken lightly. The grade table is originally created when the master file is created and is placed into the first record of the file. It should only be changed when the list of authorized grades changes between the time of file creation and the first input of grades into the student master file.

The authorized grade table may be changed by entering GRADES from the primary slave terminal when the GPS master menu is on the screen. The user will be asked if he really wants to change the authorized grades. If a negative answer is given, the master menu appears on the screen and no other action is taken. If an affirmative answer is given, the GRADES function begins. Up to fifty-seven new grades may be entered in any order, but the last entry must be a zero followed by a blank. Each grade should be left justified and two characters in length. The second character may be a blank. Once the last entry is made, the new grades are written to the first record of the student master file and appear on the screen as if attention key F8 had been pressed. It should be noted that if this function is terminated before the last grade entry is made, the authorized grade table has not been changed. The entire process must be begun again from the master menu in order to change the authorized grades.

5.3 COPY

The User's Manual contains a complete description of the GPS COPY function. Described herein is the reason for including such a function in the GPS program itself. I/O functions which cannot be performed manually on the UTS 400 usually cannot be performed using the UTS 400 programming capability. The COPY function is a counterexample of this generalization. For example, the manual COPY function cannot copy a record on a peripheral device which contains binary zeroes because a binary zero is an end of record signal. The GPS student master file on diskettes is an example of a file which contains binary zeroes and which has to be copied for back-up purposes. A diskette has to be copied sector by sector in order to copy a file which contains binary zeroes. A diskette can be copied sector by sector only if the sector control byte is set. The sector control byte can be set only by using the UTS 400 programming capability. Thus, the copying of the student master file is an example of an I/O function which can be done using the UTS 400 programming capability, but which cannot be performed manually.

The manual copy function copies only the sectors which actually contain records. This is a nice way to ensure that an entire disk is used, but it may wreak havoc on an ISAM file whose index blocks contain track and sector addresses

if the copied diskette contains blank sectors. The diskette which contains the GPS program may be copied manually, but the diskettes containing the student master file can be copied only by using the COPY function provided by the GPS.

5.4 ENTER

The ENTER function is initiated from any terminal connected to the GPS by entering ENTER when the master menu is on the screen. The terminal operator is prompted for the control number of the section which he desires to enter. The operator enters the desired control number and the first record of that section is read into a buffer for that terminal. The GPS examines the first page not entered and if it is not zero, puts that page number on the screen. The GPS then computes the key of the record which contains that page, reads that record into the terminal buffer, and returns control back to the operator to enter the data. No other record is read if the first page not entered is one or two. A message is displayed which states that all pages for that section have been entered if the first page not entered is zero. After all messages which are displayed on the screen, the operator is required to press TAB-FWD in order to continue execution of the GPS. An error message is displayed if the control number does not exist. If there is no message displayed, the operator enters the data for each page as it appears on the screen. The master file is updated

after each page is entered. A message will be displayed after all pages have been entered. After the operator presses TAB-FWD, he is prompted for any ADD-ON students. If the response is no, the operator is prompted for another section control number. If the response is yes, the ADD-ON function is automatically initiated. The operator is prompted for another section control number when the ADD-ON function is completed. This precludes the operator from having to choose the ENTER function from the master menu each time. An interesting thing about the ENTER function is that the students' last two social security digits and grades from the master file are stored on the screen with the display intensity turned off. By using the screen memory approximately six hundred bytes of random access memory (RAM) are saved which would otherwise have to be used for temporary storage. The display intensity is switched off in order to conceal this information from data entry personnel.

5.5 VERIFY

The VERIFY function operates similarly to the ENTER function described in the previous section except that if a section has not been entered, it obviously cannot be verified. Only the grades are entered for the VERIFY function. A message will be displayed on the screen when all pages of a section have been verified. After the operator presses TAB-FWD the VERIFY function is again initiated.

Chapter VI

CONCLUSIONS

6.1 FUNCTIONS STILL TO BE IMPLEMENTED

The most important function still not implemented is the SEND function which is designed to transmit data to the host computer. Other functions not yet implemented include the RECREATE and WRITE functions. Before the GPS can be put into production, there must be a way of re-creating the diskette master file if it is damaged or destroyed. RECREATE is designed to re-create the master student file if it is damaged or destroyed. The WRITE function is designed to re-create tape C1 if it is damaged or destroyed. If both the diskette and tape files are lost, destroyed, or damaged, work will have to resume from the last good copy of the master file.

Unmentioned until now is the routine to access the diskette file. It has yet to be made available by Sperry Univac. The parts of the GPS which have been implemented used the technique of information hiding[2] in order to assume that the file access routine worked.

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[2]David L. Parnas, "The Use of Precise Specifications in the Development of Software" (1977), p. 864.

6.2 ADDING ADDITIONAL FUNCTIONS TO THE GPS

Additional functions may be added to the GPS if memory exists. The menu screen is modified so easily that no discussion is needed. The new function name must be added to the function master menu list and jump pad. A jump pad is a group of fixed memory locations in a program which contain branch instructions to the entry points of internal routines. Such instructions normally enable an internal routine to be reassembled at a different memory location without requiring the external calling routine to be reassembled. In addition to changing the jump pad, either a routine will have to be written to perform the new function or extra field definitions will have to be added.

6.3 LESSONS LEARNED

This section should probably be titled, "He Was Right, But I Didn't Believe Him." This quote refers to topics discussed in two computer science courses. In COMP 145 it was often said that computer scientists were optimists. I certainly was, especially in computing the time necessary to complete this thesis. I originally thought it could be done in three or four months. Was I wrong! It took another three months with lots of overtime.

In COMP 135 we were taught that we should purchase hardware without software only with our eyes wide open and with the greatest of care. I should have taken COMP 135 before beginning this thesis. The UTS 400 terminal system was purchased with very little software. Of the software which was available, most was not supported by Sperry Univac. That which was not supported, as one might suspect, was crawling with bugs. Consequently, I spent much time in correcting software on which I depended for help. This in turn slowed progress on my project immeasurably. In December of 1978 Sperry Univac finally announced a new set of fully supported software which ADP hopes to use for future UTS 400 applications. If my thesis doesn't result in a better method of posting grades, I fervently hope that it does help someone avoid the same two pitfalls of optimism and of unsupported software.

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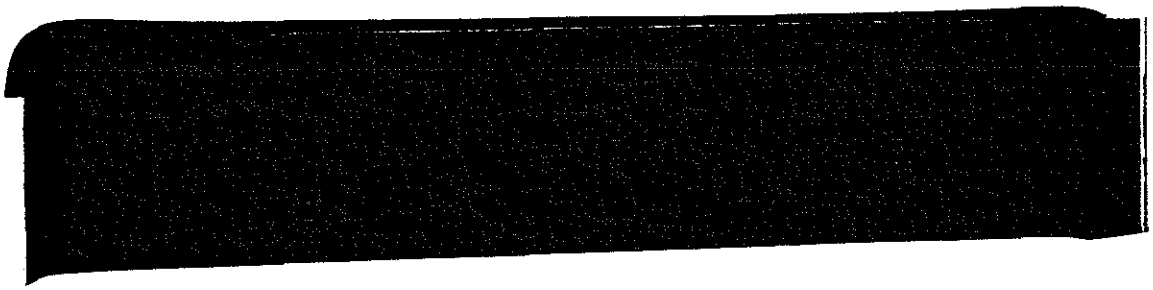
Appendix A

FILE LAYOUT AND SOURCE CODE FOR THE GRADE POSTING SYSTEM

This appendix is contained on the enclosed microfiche.



Appendix B

USER'S MANUAL

Because the USER'S MANUAL is intended to be used by itself, it is formatted and paginated as a separate document.

THE UNIVERSITY OF NORTH CAROLINA

GRADE POSTING SYSTEM

USER'S MANUAL

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Chapter I

INTRODUCTION

The University of North Carolina Grade Posting System (GPS) is designed to enter student grades into the automated records system. It includes methods for original data entry as well as for verification. Improvements include the following:

1. Ease of data entry
2. Speed of data entry
3. Easily understood input symbols
4. Invalid data discovered at time of entry
5. Capability to prepare grades for entry into the system although the Sperry Univac 90/80 (90/80 or host computer) may not be in operation
6. Capability to verify input easily

This manual describes the functions of the GPS and how it may be used by the people who will operate the system, the data entry specialists. By following the enclosed steps, one will be able to operate this system in a minimum of time. Organized in the order that each function is normally performed, the manual describes all functions of the GPS and the methods used by the operators to perform them.

Chapter II

EQUIPMENT USED IN THE GPS

2.1 INTRODUCTION

The following equipment (see Figure 1) is used in the Grade Posting System:

1. A communications-line connection point (called a modem)
2. Either a UTS 400 master terminal or controller
3. One to six UTS 400 slave terminals
4. A dual tape cassette system
5. A dual diskette system
6. A 'grandfathered' set of diskettes containing the student file
7. A set of tapes containing updates to the student files
8. A set of blank tapes
9. Three diskettes containing the GPS program

Currently, the GPS uses a master terminal and two slave terminals. Plans are being made to replace the master terminal station with a controller and a primary slave terminal. Distinguishing characteristics of the master or primary slave terminal will be explained in other parts of this manual.

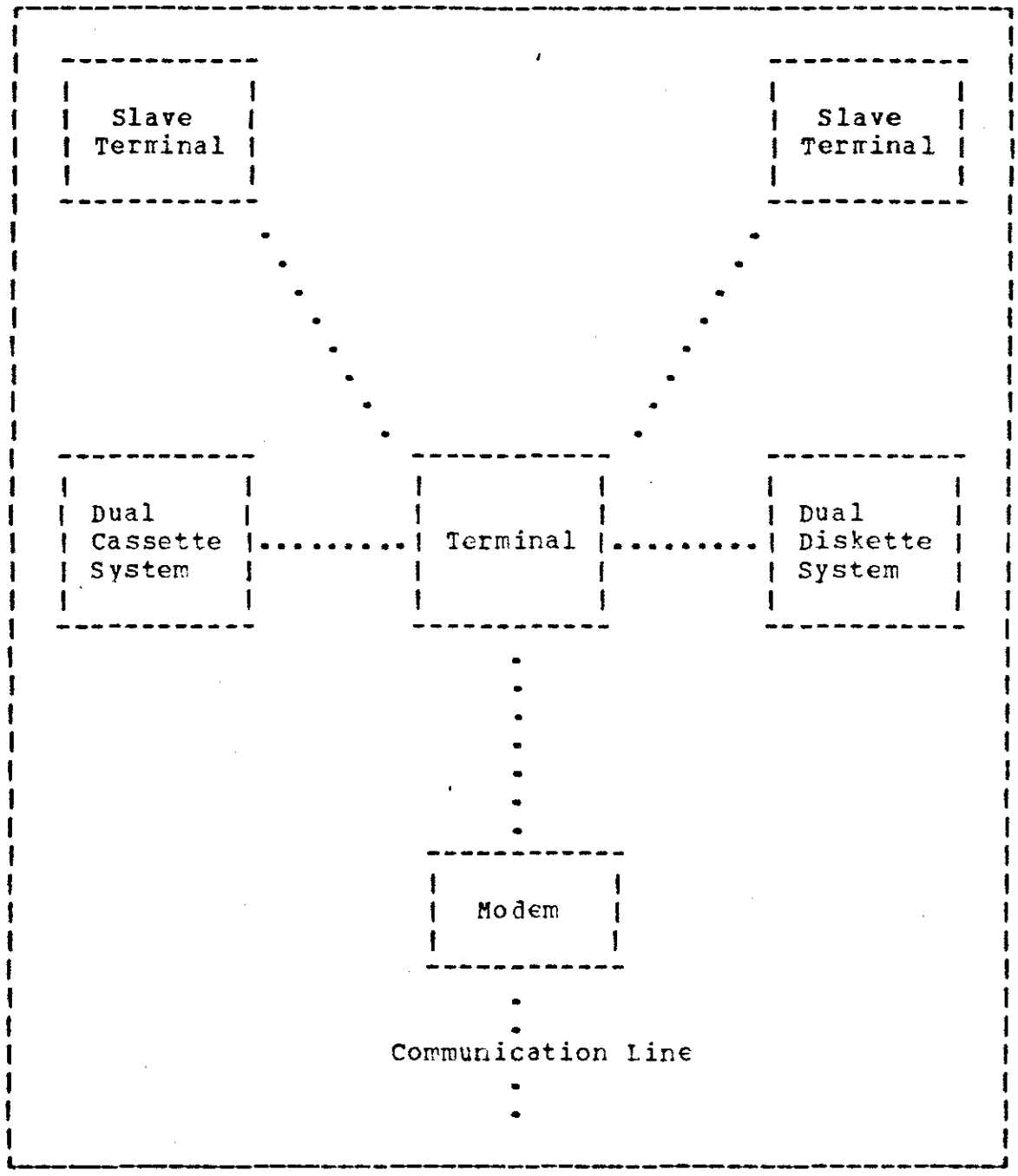

Figure 1: DTS 400 Hardware Configuration

For the purposes of this manual, the GPS will be described with a master terminal. If the master terminal is replaced, however, all functions which are particular to it will be performed by the primary slave terminal.

2.2 MODEM

The only thing about the modem with which an operator should be concerned is how to connect or disconnect the power. Location of the power switch varies from modem to modem, however, it is generally well marked. The modem is required to be on when the GPS needs to communicate with the host computer, but it may be off when the UTS 400 system is being used alone. The purpose of the modem is to convert data into a form which can be sent over a communication line to the host computer. It also converts data received from the host computer into a form which is understood by the UTS 400.

2.3 UTS 400 MASTER AND SLAVE TERMINALS

The master terminal is the heart of the UTS 400 terminal system. It contains the memory used by all terminals in addition to performing all functions which a slave terminal performs. The terminals consist of a typewriter-like keyboard and a CRT. There are keys similar to those on a typewriter, a numeric keypad, and keys to control the cursor

on the CRT. The cursor is a small square on the screen which indicates where the next character will be entered. The power switch for each terminal is located at the bottom in the front of the CRT and is normally covered by the keyboard. It may be necessary to move the keyboard forward in order to locate the power switch. The power indicator lights when power is applied to the terminal. Use of the shift key is like that of a typewriter. Function of other keys which are used in the GPS will be explained later in this manual.

2.4 THE TAPE CASSETTE SYSTEM

The tape cassette system is a magnetic storage device using tape cassettes. Each tape cassette records on two tracks which have a total capacity of approximately 700,000 characters. The terminals over-ride most of the functions of the cassette system's front panel controls and the GPS controls most tape functions internally. However, it may be necessary to rewind a tape using the front panel controls. All that is required is to push the rewind control. Tapes must be rewound before being removed from the tape deck. One can tell that the tapes need rewinding by visually checking the track and address counter located on the front of the tape deck between the two tapes. The tapes need to be rewound if the reading is not 10000. The power switch is located on the front panel of the tape deck. The green power indicator lights whenever power is applied.

Certain tapes may be for reading only (these tapes are called write protected). To write protect a tape, it is necessary to insure that the write protect tabs are withdrawn from the back edge of each tape cassette. If the tape is write protected, the WRITE 1 PROTECT or WRITE 2 PROTECT indicator lights. The WRITE 1 PROTECT indicator applies to tape transport 1 and WRITE 2 PROTECT indicator applies to tape transport 2 (tape located on the right). You will be told which tapes are to be write protected.

2.5 THE DISKETTE SUBSYSTEM

The diskette system is also a magnetic storage device using diskettes. Each diskette is capable of containing about 250,000 characters. Although the diskette system will always be operated remotely either by the GPS or by you at the terminal, you must do the following tasks before the diskette system can be used:

1. Turn the power on.
2. Insert one or two diskettes. Insert a diskette only when this manual instructs you to do so.

It should be noted that the power should be on before you attempt to load a diskette. Conversely, diskettes should be removed before power is disconnected. The power switch is located on the bottom right of the diskette system. The power indicator will light when power is applied.

Certain diskettes may be for reading only (like their tape counterparts, these are called write protected). To write protect a diskette it is necessary to expose the write protect hole located on the diskette. The WRITE PROTECT indicators apply to the diskette drive located below the indicators. If a diskette is to be write protected, insure that the appropriate indicator is lighted. You will be informed which diskettes are to be write protected.

2.6 A GRANDFATHERED SET OF DISKETTES

The 'grandfathered' set of diskettes contains the student files. Each day that the Grade Posting System is in operation, the set of diskettes with the oldest date will be used for that day's input. The two diskettes will be copied at the end of the day. The originals will be retired for back up purposes until two more sets have been retired. The oldest set of retired diskettes will be used to copy the current day's diskettes and then used for the next day's input. The file can be re-created by using the previous day's diskettes and the current day's tapes should the current day's input diskette file become damaged, destroyed, or lost.

2.7 A SET OF TAPES CONTAINING UPDATES TO THE STUDENT FILE

Each day that the Grade Posting System is used, two tapes are produced:

1. A tape containing all pages which have had grades entered or verified
2. A tape containing all sections for which verification of grades was completed (This is the tape from which information will be sent to the host computer once a day or as often as desired.)

After the contents of the tape containing verified grades have been sent to the host computer, both tapes are removed, write protected, labeled, and maintained for back up purposes until the end of the grade posting cycle for that academic term. If the UTS 400 diskette files become damaged, destroyed, or lost, they can be re-created with a minimum loss of time and effort.

2.8 A SET OF BLANK TAPES

A set of blank tapes are maintained and used at the rate of two per day/session of the GPS. These are the tapes which are to be used to contain the updates to the student file contained on the diskettes.

2.9 A SET OF DISKETTES CONTAINING THE GRADE POSTING SYSTEM

Three identical copies of the Grade Posting System, contained on three separate diskettes, are maintained in a

write protected status. These copies are used as back up for the program once it is placed into operation. These diskettes will be used to restart the GPS if it fails or crashes. If one of the three diskettes fails to load the program successfully, a second will be copied before reloading is attempted again.

Chapter III

PUTTING THE SYSTEM INTO OPERATION

3.1 INTRODUCTION

Before the GPS can be placed into operation, it is necessary to perform the following tasks:

1. Power up equipment
2. Insert diskette containing GPS program
3. Home the diskette
4. Partition Random Access Memory (RAM)
5. Load the GPS program
6. Insert student file tapes and diskettes

3.2 POWERING UP EQUIPMENT

Turn the power on all equipment as described in Chapter 2:

1. Turn on the modem
2. Turn on the master terminal
3. Turn on the slave terminals
4. Turn on the cassette deck
5. Turn on the diskette system

3.3 INSERTING PROGRAM DISKETTE

Place the program diskette into disk drive number one. Remember that power should be applied to the diskette drive before you insert the diskette. Insure that the WRITE PROTECT indicator lights.

3.4 HOMING THE DISKETTE

Home the diskette after it has been inserted. Use the master terminal to home the diskette and follow these steps:

1. Press the CONTROL PAGE key. The display shown in Figure 2 should be on the screen. If the control page display is not blank, press the CURSOR TO HOME key and then press the ERASE TO EOF key.

```
(**PRINT*)STA-  (**XFER**)PRNT(    )XFER(    )XMIT(  )P6
(  /  /  )ADP-  (  /  /  )SEARCH(                 )***
```

Figure 2: Blank Control Page Display

2. The cursor is automatically positioned in the PRNT( ) field. Enter 'PRNT' in this field.

3. Now the cursor automatically moves to the XFER( ) field. Enter 'ALL' in this field.

4. Press the RETURN key and the cursor automatically moves to the first blank space on the second line of the control page display.

5. Enter 'D1' in the first field, leave the second blank, and enter 'HO' in the third field of the second line. The display shown in Figure 3 should be on the screen. If not, correct the display before proceeding.

6. Press the CONTROL PAGE key and the display will disappear.

7. Press the PRINT key and the diskette will return to the beginning position (this action is called homing the diskette).

```
(**PRINT*) STA-   (**XFER**) PRNT(PRNT) XFER(ALL) XMIT(  ) P6
(D1/  /HO) ADR-   (  /  /  ) SEARCH(                )***
```

Figure 3: Correct Control Page To Home a Diskette

3.5 MANUALLY COPYING A DISKETTE

At times it may be necessary to copy the diskette containing the GPS program. You cannot manually copy the diskettes containing the student file; they must be copied using the GPS program. In order to manually copy a diskette containing the GPS program, follow these instructions:

1. Insert the diskette to be copied into disk drive number one. Insure that it is write protected.

2. Insert a blank diskette into disk drive number two. Insure that it is not write protected.

3. Home both diskettes by following the procedures in the previous section except 'D2' is substituted for 'D1' in order to home the diskette in drive number two.

4. Press the CONTROL PAGE key. The display shown in Figure 4 should be on the screen. If the control page display is not blank, press the CURSOR TO HOME key and then press the ERASE TO EOF key.

```
(**PRINT*) STA-   (**XFER**) PRNT(     ) XFER(    ) XMIT(  ) P6
(  /  /  ) ADR-   (  /  /  ) SEARCH(                  )***
```

Figure 4: Blank Control Page Display

5. The cursor is automatically positioned in the PRNT( ) field. Enter 'PRNT' in this field.

6. The cursor automatically moves to the XFER( ) field. Enter 'ALL' in this field.

7. Press the RETURN key and the cursor automatically moves to the first blank space on the second line of the control page display.

8. Enter 'D1' in the fourth field, 'D2' in the fifth field, and enter 'CO' in the sixth field of the second line. The display shown in Figure 5 should be on the screen. If not, correct the display before proceeding.

```
(**PRINT*) STA-   (**XFER**) PRNT(PRNT) XFER(ALL) XMIT(  ) P6
(  /  /  ) ADR-   (D1/D2/CO) SEARCH(                  )***
```

Figure 5: Correct Control Page To Copy a Diskette

9. Press the CONTROL PAGE key and the display will disappear.

10. Press the XFER key and the WAIT light will be turned on. Copying is complete when the WAIT light is turned off.

3.6 PARTITIONING RAM

Ensure that the Random Access Memory (RAM) is properly partitioned by completing these tasks:

1. Call the control page to the screen by pressing the CONTROL PAGE key on the master terminal.
2. If the last two characters on the top line are not 'P6', place the cursor in the MM field and enter 'P6'. You place the cursor in the MM field by spacing. The last place the cursor stops on the top line, before it goes to the second line, is the MM field.
3. Return the control page by pressing the CONTROL PAGE key.

3.7 LOADING THE GPS PROGRAM

The GPS program may be loaded by one of two methods:

1. Manually from a diskette
2. By executing a program on the 90/80

Regardless of which method is used, the RAM must be properly partitioned. If the GPS is to be loaded from a diskette, insert the diskette containing the GPS program into disk drive number one, home it and then place D1 in the fourth field of the second line of the CONTROL PAGE. Remove the CONTROL PAGE from the screen and press the LOAD PROGRAM key. The UTS 400 will place the program into RAM. The WAIT and AUXILIARY BUSY indicators will light during this operation and will go out when the program is loaded. If the load is

not successful, an alarm will sound. Press the KEYBOARD UNLOCK key and call the control page to the screen. Record the time that the alarm sounded and the code in the ADR field of the control page in the session log. The ADR field is located on the second line of the control page. Repeat all steps including homing the diskette. Upon completion of the second attempt, call your supervisor if the alarm sounds again.

To load the GPS program from the 90/80 it is first necessary to log on the 90/80 system, partition RAM, and execute 'UTS400.UTILITY.FUTS1' by using the 90/80 EXECUTE function. The module, 'UTS400.UTILITY.FUTS1', is stored in the 90/80 system library. After this program begins execution on the 90/80 it will ask the user if a 'load' or 'dump' is desired and if translation to extended ASCII is desired. Enter an 'L' to the first question and press the XMIT key. Enter a 'Y' to the second question and again press the XMIT key. The user will be asked for the name of the program to be loaded. Enter 'UTS400.GPS.ABS'. The WAIT and AUXILIARY BUSY indicators will light and will go out when the loading is completed. If the load is successful, the GPS welcoming display (see Figure 6) will appear on the master terminal screen. The message, 'BAD LOAD AT TRANSFER ADDRESS,' will be displayed if the load is not successful. Repeat all steps if this occurs.

3.8 LOADING THE STUDENT FILE TAPES AND DISKETTES

If the load is good, the display in Figure 6 will appear.

```
                        WELCOME

                        TO THE

                UNIVERSITY OF NORTH CAROLINA

                    GRADE POSTING SYSTEM



PLEASE FOLLOW THESE INSTRUCTIONS:

    1.  REMOVE THE DISKETTE CONTAINING THE GPS PROGRAM.

    2.  INSERT THE TWO DISKETTES CONTAINING THE STUDENT
        FILE. PUT DISKETTE NUMBER ONE IN THE DRIVE #1.

    3.  INSERT TWO BLANK OR REUSABLE TAPE CASSETTES IN
        THE TAPE DECK.

    4.  ENTER THE TERM AND YEAR:

        a) TERM (ENTER ONE DIGIT) /./

        b) YEAR (ENTER THE LAST TWO DIGITS) /../

    5.  PRESS THE 'CARRIAGE RETURN' KEY
```

Figure 6: Welcome Display to the GPS

It is a welcoming display to the Grade Posting System which instructs you to remove the diskette containing the program, to insert the two diskettes containing the student file, and to enter the term and year for the grades being posted. Be

sure that the diskette labeled number one is inserted in the left drive and that the diskette labeled number two is inserted into the right drive. Two blank or reusable tapes should be inserted into the tape deck. Prior to inserting the diskettes or tapes, insure that the write protect tabs are in the tapes and that the write protect holes on the diskettes are not exposed. Check the write protect indicators on both the tape deck and the diskette drives. Enter one of the following digits which represents the term whose grades are being entered:

1. FALL 1
2. SPRING 2
3. 1ST SS 3
4. 2ND SS 4

Now enter the last two digits of the year for which the above term's grades are being posted. Press the RETURN key and the Grade Posting System is now in operation. The display in Figure 7 should be on the screen. It is the function master menu for the GPS program.

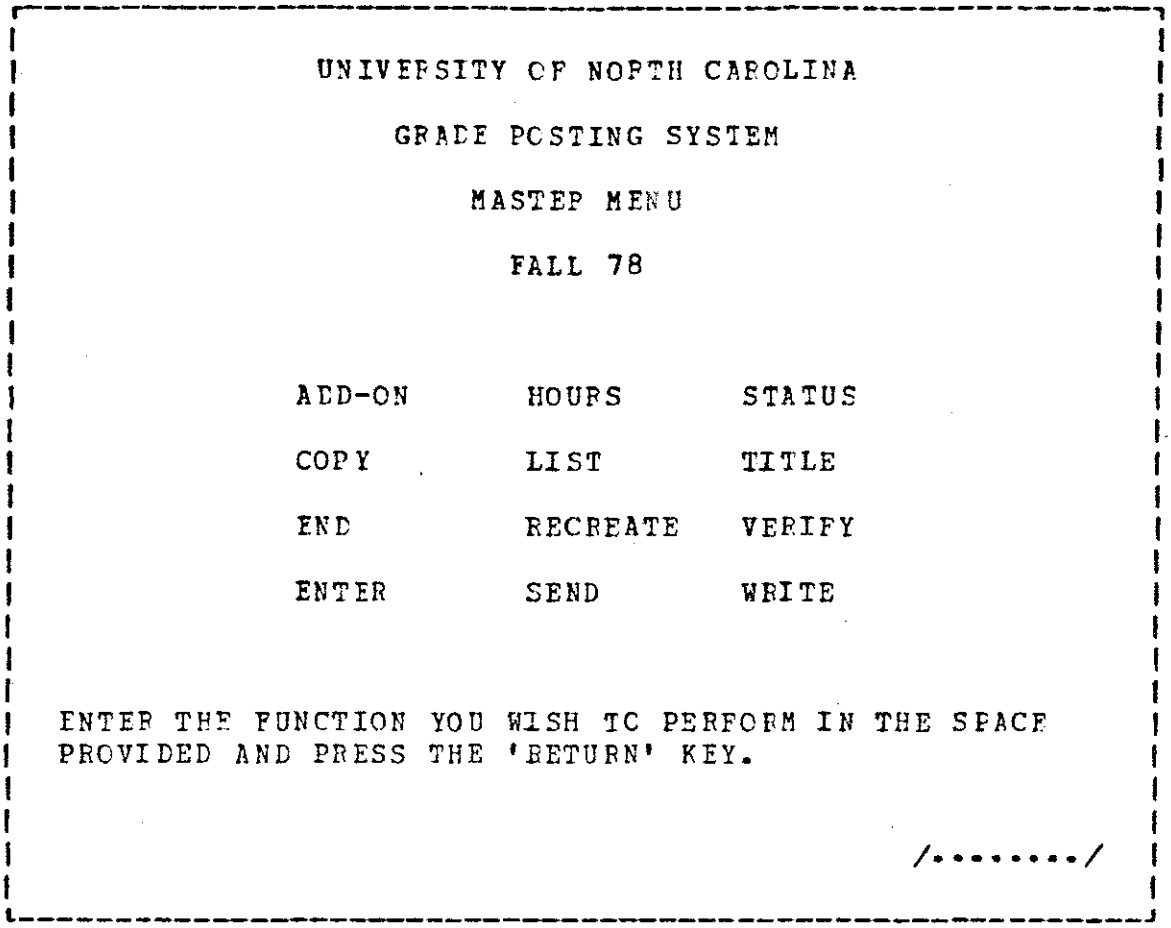

Figure 7: Grade Posting System Function Master Menu

3.9 ATTENTION KEY DEFINITIONS

Keys F5, F6, F7, F8, F9, F10, F11, F14, F15 are called attention keys and have the following definitions:

1. F5: Restart the GPS program.
2. F6: Display the GPS function master menu on this screen.
3. F7: Terminate this session of the GPS program.

4. F8: Display the list of authorized grades on this screen.

5. F9: Remove the list of authorized grades from this screen.

6. F10: Disconnect all terminals from the GPS program.

7. F11: Connect the master terminal to the GPS program.

8. F14: Connect this terminal to the GPS program.

9. F15: Disconnect this terminal from the GPS program.

It should be noted that keys F5, F7, F10, and F11 work only on the master terminal. Other attention keys are reserved for future use and if pressed, are ignored by the GPS.

3.10 CONNECTING/DISCONNECTING SLAVE TERMINALS TO/FROM THE GPS

Only the master terminal is connected to the GPS after the GPS is loaded. Keys on the slave terminals which control the tape and diskette subsystems, however, have been disabled. Attention key F14 should be pressed when one desires to connect a slave terminal to the GPS. After F14 has been pressed the GPS function master menu will appear on the screen and the terminal is connected to the GPS.

Press attention key F15 in order to disconnect a slave terminal from the GPS. The terminal is disconnected from the GPS and a warning message will appear on the screen reminding the user that he/she may be logged on the 90/80.

This is just a reminder. The slave terminal may be used as a regular terminal in order to communicate with the host computer.

3.11 DISCONNECTING/CONNECTING THE MASTER TERMINAL FROM THE GPS

At times it may be desired to disconnect the master terminal from the GPS program. This may be accomplished by two methods:

1. By pressing F15: the master terminal will be disconnected like a slave terminal. The master terminal may be connected by using F14.

2. By pressing attention key F10: the master terminal and all slave terminals will be disconnected from the GPS program with all keys enabled. One should be careful to protect the GPS file diskettes and tapes when using F10. Attention key F11 is used to reconnect the master terminal. The GPS welcoming display will appear on the master terminal screen after F11 is pressed. Only the master terminal is connected to the GPS and the keys for reading and writing to the tape or diskette subsystem on the other terminals are disabled. Follow the instructions on the screen in order to continue with the GPS program.

Chapter IV

FUNCTIONS PERFORMED BY THE GPS

4.1 INTRODUCTION

The following functions are performd by the Grade Posting System:

1. Entering grades
2. Verifying grades
3. Entering add-on students
4. Entering add-on courses
5. Displaying a list of authorized grades
6. Changing credit hours for a student
7. Changing a title for a section
8. Status checking of individual sections
9. Re-creation of student file update tapes
10. Re-creation of student file on diskettes
11. Copying diskettes
12. Listing (on screen) of selected sections
    a) Verified sections
    b) Entered sections
    c) Entered but not verified sections
    d) Not entered sections
    e) Not entered pages
    f) Entered but not verified pages

13. Exiting any of the above functions

14. Ending a session

15. Transmitting data to the host computer from the UTS 400 tape cassette

Most of the above functions may be performed at any terminal at any time the Grade Posting System is in operation. Those which are required to be performed on the master terminal are identified in the detailed description for that function. When the GPS is loaded and begins execution, the display in Figure 7 will be shown on the master terminal. After connecting a terminal to the GPS, each terminal operator will be allowed to select a function by entering his choice from the keyboard. Any routine may be exited at any time by pressing the F6 attention key. A terminal will then display the list of functions which may be performed by the GPS.

4.2 ENTERING GRADES

This function may be initiated by any terminal when the master function menu is on the screen. It should be noted that data can only be entered once. However, it will only be entered for a complete page at a time. No data for a page will be entered if you exit the function before completing the page. The function master menu will disappear from the screen after the function name is entered and the user will be prompted for the control number of the desired section (see Figure 8):

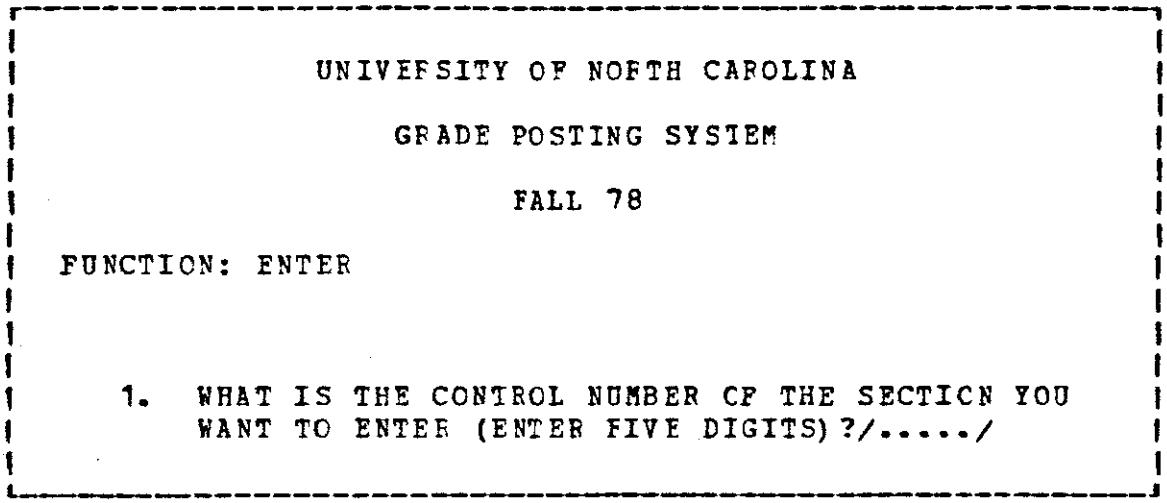

Figure 8: Screen Display at Beginning of Enter Function

At this time the display will change and show the following for the requested section (see Figure 9):

1. Function being performed
2. Department abbreviation
3. Course number
4. Section number
5. Control number
6. Page number
7. Academic term and year
8. Sequence numbers (SN) for one page

An alarm will sound if all data for the section has already been entered. A message will appear on the screen and you

will not be allowed to re-enter any data.

```
                 UNIVERSITY OF NORTH CAROLINA

                     GRADE POSTING SYSTEM
                        COMP 393X 21A
 FUNCTION: ENTER          FALL 78                 PAGE 10
                           10031

        SN SS     GRADE           SN SS     GRADE

        01                        14
        02                        15
        03                        16
        04                        17
        05                        18
        06                        19
        07                        20
        08                        21
        09                        22
        10                        23
        11                        24
        12                        25
        13
```

Figure 9: Sample Display for Entering Grades

The cursor will automatically be in position for the two digits of the first student's social security number when the blank grade report is on the screen. Perform the following tasks for each student on the page in sequence number order, 1-25:

1. Enter the last two digits of the student's social security number and the cursor automatically moves without spacing to the grade field.

2. Enter the grade, left justified. Do not enter any leading blanks. If the grade is a single character, press the space bar and the cursor will position itself for the next student.

3. If an alarm sounds, press the KEYBOARD UNLOCK key and refer to the section on 'Incorrect Data Entry.'

4. If an incorrect key is pressed and the alarm does not sound, press the BACK-TAB key and the cursor will position itself at the beginning of the social security digit or grade field in which the wrong key was pressed. Press the correct key and continue.

5. The GPS does not process the removal of students from sections who were deleted from class rolls by instructors. Such deletion is processed by other parts of the automated records system. In order for the GPS to process these sections, dummy grades are entered for students deleted by instructors. Your supervisor will provide the dummy grade to be entered for deleted students.

After all grades for the current page have been entered, the next unentered page for this section automatically appears on the screen.

If there are no other pages, the GPS asks the user if there are any add-on students for this section. If the answer is yes, the GPS will switch to the ADD-ON function and will remember the data already entered about this section. The GPS will perform as if the ADD-ON function had been initiated (see the section on Add-on Students). If there are no add-on students, the ENTER function is again initiated. You may supply the information necessary to enter another section or exit the function by pressing F6.

4.3 VERIFYING GRADES

This function may be initiated by any terminal when the master function menu is on the screen by keying 'VERIFY' and pressing the RETURN key. It should be noted that data can only be verified once and only once for a complete page at a time. Thus, if you exit the function before completing a page, no data on that page has been verified. These restrictions are imposed in order to prevent someone from quickly changing a student's grade without proper authorization.

The function master menu will disappear from the screen after the function name is entered and the user will be prompted for the following information (see Figure 10):

```
                UNIVERSITY OF NORTH CAROLINA

                    GRADE POSTING SYSTEM

                          FALL 78

FUNCTION: VERIFY


    1.  WHAT IS THE CONTROL NUMBER OF THE SECTION YOU
        WANT TO VERIFY (VERIFY FIVE DIGITS)?/...../
```

Figure 10: Screen Display at Beginning of Verify Function

At this time the display will change and show the following for the requested section (see Figure 11):

1. Function being performed
2. Department abbreviation
3. Course number
4. Section number
5. Control number
6. Page number
7. Term and year
8. The students' sequence and social security numbers in columns, as appropriate

If this section has already been verified or the remainder of the section has not been entered, an alarm will sound, a message will appear on the screen, and you will not be

allowed to verify this page.

```
                    UNIVERSITY OF NORTH CAROLINA

                         GRADE POSTING SYSTEM
                            COMP 393X 21A
FUNCTION: VERIFY              FALL 78                    PAGE 10
                              10031

          SN SS    GRADE          SN SS    GRADE

          01 89                   14 32
          02 76                   15 21
          03 34                   16 87
          04 77                   17 88
          05 41                   18 40
          06 00                   19 45
          07 11                   20 13
          08 27                   21 63
          09 68                   22 52
          10 55                   23 38
          11 44                   24 98
          12 17                   25 80
          13 66
```

Figure 11: Sample Display for Verifying Grades

When the grade report appears on the screen, the cursor will automatically position itself for the grade of the first student. As each student's grade is entered, the cursor will automatically position itself for the next student's grade. To verify the grade, perform the following tasks for each student in sequence number order (1-25):

1. Enter the grade, left adjusted. Do not enter any leading blanks. If the grade is a single character, press the space bar and the cursor will position itself for the next student's grade.

2. If an alarm sounds, examine the data you entered; it may be an invalid grade. The cursor will be in the position containing the invalid or incorrect grade. Check the grade on the grade report again for that student and re-enter the grade. If the alarm sounds again, the data already accepted (during the ENTER function) will appear. Compare it to the grade on the grade report. If they differ, reposition the cursor, enter the correct grade, and continue. If they still differ, try once more and then, if the alarm sounds again, take the action listed in the section, 'Incorrect Data Entry.'

3. Remember that for verification, you only enter the grades.

After all grades on the current page have been verified, the next unverified page for this section automatically appears on the screen. If there are no other pages, the VERIFY function is again initiated. You may supply the information necessary to verify another section or exit the function by pressing the F6 key.

4.4 DISPLAY OF AUTHORIZED GRADES

Any time a terminal operator desires to see a list of authorized grades which the GPS will accept, attention key F8 should be pressed. The list of grades will remain on the screen until the GPS changes the screen or the operator presses attention key F9. Displaying the grades on the screen during the ENTER or VERIFY functions will not interfer with the operation of the GPS.

4.5 INCORRECT DATA ENTRY

If digits or characters are entered incorrectly, an alarm will sound once and the cursor will not move. Check the sequence number and re-enter the data. If the alarm sounds again, examine the data you are attempting to enter. If it is the last two digits of the student's social security number, you may have skipped a student. If it is the first student of a page, check the control and page numbers, you may have entered the wrong data. If the wrong control number was entered, you will have to exit the function and begin again. If it is correct, take the following action:

1. Record in the session log (refer to Chapter VII, Session Logs), the control number, page number and sequence number (1-25) of the student whose data you are attempting to enter.

2. Record in the session log the time and date of the error.

3. Record the data you are attempting to enter.

4. Exit the function and perform another function or the same function for a different page. It should be noted that the page you were trying to enter or verify will not have been entered or verified in any manner.

5. If another function cannot be performed and the GPS appears to be working properly, re-create the student file as instructed in the section on file re-creation.

6. If another function cannot be performed because the GPS appears to be working incorrectly, notify your supervisor that the GPS needs to be reloaded.

4.6 ADD-ON STUDENTS

This function may be performed by any terminal at any time the master function menu is on the screen. To begin execution of this function, enter 'ADD-ON' and press the RETURN key. The function will then ask you for the following information:

1. Control number
2. Department abbreviation
3. Course number
4. Section number
5. Total number of students to be added for this section (all pages of students to be added for this section)
6. Descriptive title (enter not more than 19 characters)
7. Credit hours (enter 3 digits in tenths of hours, left justified if the hours are fixed, otherwise space over)

As an example of the correct manner in which to enter credit hours in tenths, three credit hours should be entered by typing '030'. After the credit hours have been entered or spaced over, a blank page for the section will appear on the screen with the appropriate number of sequence numbers (see Figure 12). If more than one page is required, the second or additional pages will appear automatically. If you gave the system too large a count of students to be added, you will have to exit the function and re-do everything for all students to be added for this section. Thus, you should be

extremely careful in entering add-on students. No data is verified for this function. The GPS does check, however, for valid data in numerical fields and for valid grades. When this function is completed, the 'ENTER' function will again be initiated.

```
                UNIVERSITY OF NORTH CAROLINA

                    GRADE POSTING SYSTEM
                       COMP 393X 21A
FUNCTION: ADD-ON          FALL 78
                           10031

      SN SSAN       NAME                    HRS  GRADE

      01
      02
      03
      04
      05
      06
      07
      08
      09
      10
      11
      12
      13
```

Figure 12: Screen Display for Add-on Students or Courses

4.7 CHANGING CREDIT HOURS FOR A STUDENT

This function may be performed at any terminal. In order to execute this function, enter 'HOURS' and press RETURN when the GPS function master menu is on the screen. The

function will then prompt the user for the following information:

1. Student's full social security number (Enter nine digits, no hyphens)
2. Part name (enter not more than 14 characters, including commas and spaces)
3. Control number
4. Credit hours (enter 3 digits in tenths of hours, left justified)

Once the above information is entered, the information will be written to the tape in order to be sent to the host computer. When this function is completed, the GPS function master menu will appear for the user's next selection. The part name consists of the first fourteen characters, including blanks, of a student's last name, first name, and middle name in that order. Press RETURN to move the cursor to the next field if the student's part name does not require all of the 14 spaces.

4.8 CHANGING A COURSE TITLE

This function may be performed at any terminal. To execute this function, enter 'TITLE' and press RETURN when the GPS function master menu is on the screen. The program will then prompt the user for the following information:

1. Control number of the section whose title is being changed (enter five digits)
2. New title (enter not more than 19 characters, including blanks)

As soon as the title is entered, press RETURN and the required information will be written to tape C2 in order to be sent to the host computer. The GPS function master menu will appear for the next function. Press RETURN to move the cursor to the next field if the new title does not require all of the 19 spaces.

4.9 STATUS CHECKING

This function may be executed from any terminal at any time the function master menu is on the screen. It provides the status of any section. The following information will be given:

1. Control number
2. Department abbreviation
3. Course number
4. Section number
5. Number of the first page not entered
6. Number of the first page not verified

To begin execution of this function, enter 'STATUS' and press RETURN. The GPS will ask the user for the control number of the section whose status you are checking. The appropriate status will be displayed.

4.10 RE-CREATING THE STUDENT FILE

In order to reconstitute the student file on a diskette, take the following action:

1. Stop all people from using the slave terminals.
2. Press the F6 function key and the GPS function master menu will appear on the screen.
3. Begin the re-creation function by entering 'RECREATE'.
4. Follow the instructions as you are prompted from the screen of the master terminal (see Figure 13). Actually all the instructions do not appear at once, instead each appears as you perform the previous instruction.
5. When the student file diskette has been re-created, the GPS function master menu will appear on the screen.
6. You may now perform any function from any terminal.

NOTE: THIS FUNCTION HAS NOT BEEN IMPLEMENTED.

```
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  FUNCTION: RECREATE        FALL 78


      1.  REPLACE TWO DISKETTES. MARK OLD ONES AS DAMAGED.

      2.  RECORD FACTS IN SESSION LOG CONCERNING DISKETTE
          FAILURE.

      3.  PRESS 'RETURN' KEY.

      4.  ARE THERE ANY MORE TAPES TO BE USED (ENTER YES
          OR NO)?

      5.  WAIT FOR TAPES TO BE REWOUND AND REPLACE WITH
          TAPES TO BE USED. PRESS THE 'RETURN' KEY WHEN
          TAPES ARE INSTALLED.

      6.  REPLACE TAPES WITH THIS SESSION'S UPDATE TAPES.
          THE GPS SYSTEM WILL POSITION THEM.

      7.  PRESS THE 'RETURN' KEY.
```

Figure 13: Instructions for Recreating Student File

If the file cannot be reconstituted, reload the GPS program and try again after recording all facts in the session log.

The diskette from the previous session and the current session update tapes are used to re-create the student file. If something happens to the previous sessions' student file

diskette, the next previous student file diskette and the two previous sessions' update tapes are used. The third diskette is used in a similar manner, if necessary, with all three session's update tapes.

4.11 RE-CREATING THE UPDATE TAPES

This function may be performed only from the master terminal. All slave terminals must be idle. This function consists of rewriting the entries for the two update tapes from the diskette file. If both the student file diskette and the update tapes are damaged or destroyed, work for this session will be lost forever and will have to be reentered. In order to execute this function, it is necessary to have recorded the control numbers and page numbers which were entered and/or verified. To start, take the following actions:

1. Press the F6 attention key at the master terminal and return to the GPS function master menu.
2. Stop all personnel from working on the slave terminals.
3. Begin execution of this function by entering 'WRITE' and pressing RETURN.
4. Follow the instructions given to you on the screen (see Figure 14).
5. After the tape has been recreated, you may again perform any function listed on the GPS function master menu.

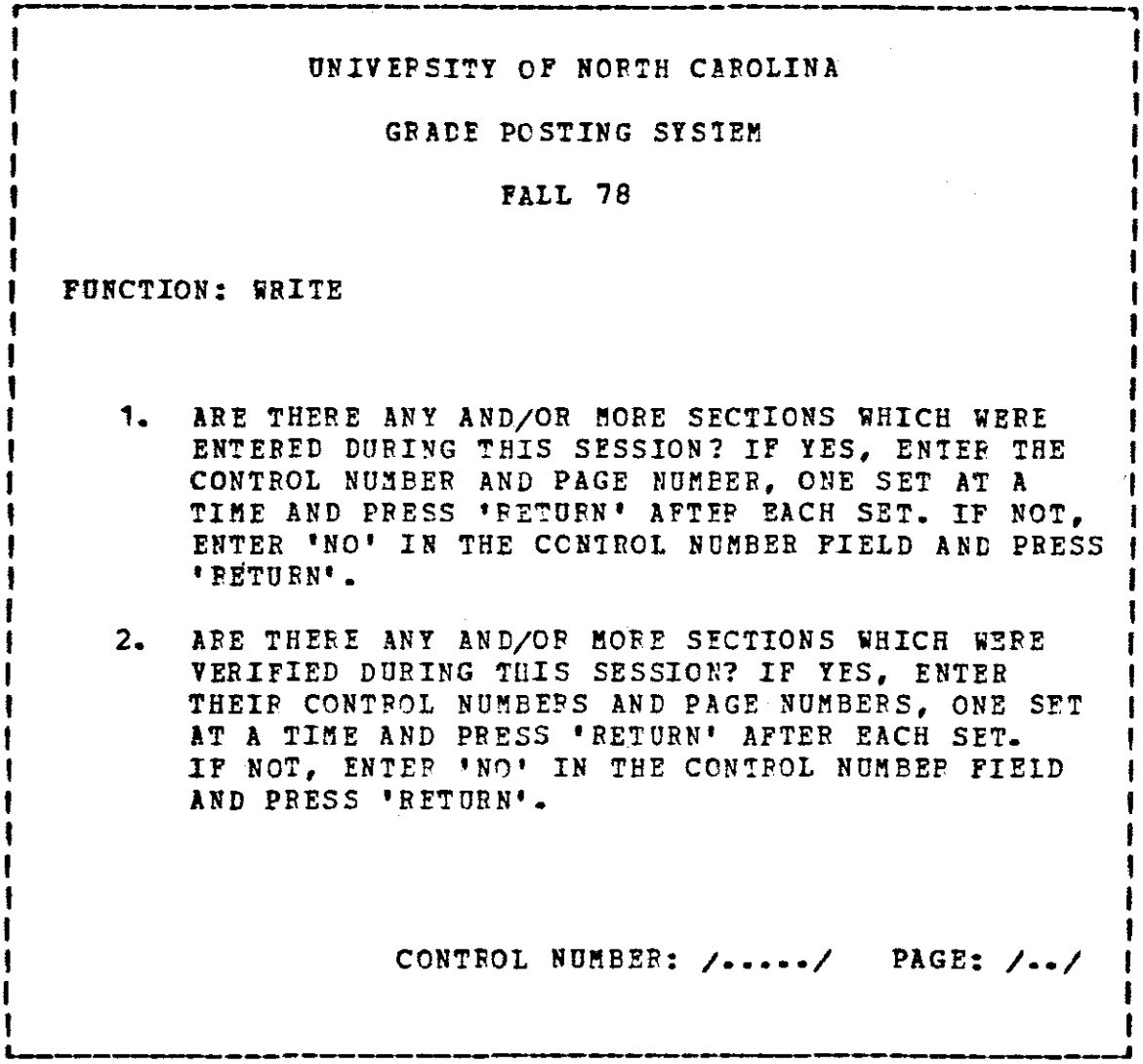

Figure 14: Instructions for Recreating Update Tapes

NOTE: THIS FUNCTION HAS NOT BEEN IMPLEMENTED.

4.12 LISTING SELECTED SECTIONS

This function may be executed from any terminal. This function will list the control numbers on the screen of the following:

1. Verified sections
2. Entered sections
3. Entered but not verified sections
4. Sections not entered

To execute this function, perform the following actions:

1. Enter 'LIST' and press RETURN on the master terminal.
2. The screen will now prompt you for the letter code given below of the type section of which you want a listing. Enter that code and press RETURN.

   a) Verified sections

   b) Entered sections

   c) Entered but not verified sections

   d) Sections not entered

3. All requested control numbers will be displayed on the screen in sequence number order. If there are more control numbers than can be displayed at once, press the RETURN for the next display. If there are no more control numbers, the GPS function master menu will return to the screen.

NOTE: THIS FUNCTION HAS NOT BEEN IMPLEMENTED.

4.13 COPYING A DISKETTE

This function may be performed only at the master terminal. The slave terminals must be idle. Any diskette may be copied for back-up purposes. To execute this function, enter 'COPY' and press RETURN. You will be given instructions on the screen and told to press RETURN when you have completed each one (see Figure 15). The keyboard will be locked while the diskette is being copied. An alarm will sound when copying is completed and more instructions will appear on the screen. When these instructions have been followed, the COPY function will again be initiated. It should be noted that this function will not work if the GPS program has failed. Instead, the GPS will have to be reloaded. Refer to Chapter Three for instructions on the copying of a diskette by manual methods.

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FUNCTION: COPY


   1.  PUT DISK TO BE COPIED INTO DRIVE #1.

   2.  PUT BLANK DISK INTO DRIVE #2.

   3.  PRESS TAB-FWD.
```

Figure 15: Copying a Diskette

4.14 ENDING A SESSION

This function should be performed only at the master terminal and all the slave terminals should be idle. This function performs the following tasks:

1. Writes an end to the tape update files.
2. Rewinds tapes for removal from the tape transport.

Upon completion of this function, the UTS 400 exits the programmed mode. It will be necessary to reload the GPS program in order to restart the GPS. Tapes and diskettes should be dismounted and stored according to instructions

from your supervisor. To execute this function, enter 'END' and press RETURN. When the keyboard unlocks, this session of the Grade Posting System is ended. It is not possible to use the F6 attention key after this function has started execution.

4.15 WRITING COMPLETED SECTIONS ON TAPE C2

Sections which have been completely verified are written to tape C2 using the SEND function. Once written onto tape C2, the section status is changed on the diskette file in order that a section will not be written twice to tape C2.

NOTE: THIS FUNCTION HAS NOT BEEN IMPLEMENTED.

Chapter V

BACK-UP PROCEDURES

5.1 INTRODUCTION

The following methods are used to back-up the Grade Posting System:

1. Grandfathered records
2. Another UTS 400 terminal system which may be available on an emergency basis only
3. The past method of posting grades using an optical scanner

All methods except the first are beyond the scope of this manual and will not be discussed further. The primary back up method consists of the following tapes and grandfathered diskettes:

1. A set of three copies of the GPS program contained on three diskettes
2. A grandfathered set of student files contained on three diskettes
3. All tapes containing updates to the student file contained on the diskette for the current academic grade posting cycle

5.2 MULTIPLE COPIES OF THE GPS PROGRAM

Three copies of the GPS program are maintained on separate diskettes. Each diskette is write protected. Strictly speaking, this set of copies is not grandfathered, instead it consists of three duplicates. The GPS program was assembled, compiled, linked and loaded by the host computer. It was then sent to the UTS 400 terminal system and written on a diskette which was then copied twice. When the GPS program has to be loaded into the UTS 400 terminal system, copy 1 is used. If the load is not successful, the following procedures should be followed:

1. Record the type of error and diskette number on the session log.
2. Using a blank diskette, manually copy the GPS program contained on diskette number two.
3. Attempt to load the GPS program using copy two, following the instructions contained in the section 'Loading the GPS Program.'
4. If necessary, repeat the above instructions for copy number three.
5. If the load is still unsuccessful, the GPS program will have to be reloaded by the host computer. Record all facts concerning the failure in the session log and ask your supervisor for instructions.

5.3 GRANDFATHERED STUDENT FILES ON DISKETTES

The original student file is created by the host computer and sent to the UTS 400 terminal system where it is written

on two diskettes. It is also copied twice by using the GPS COPY function. When each session is completed, the student file contained on the diskettes is copied. This copy will be used as the student file diskettes for the following session. The old diskettes will be retired until two more sets of diskettes have been retired. The oldest retired diskettes are used to copy the current session's diskettes. The current student file and the student files from the two previous sessions are maintained as back up. If the current student file fails and has to be re-created, take action as described in the section, 'Re-creating the Student File.'

5.4 TAPES CONTAINING UPDATES TO THE STUDENT FILES

Each session of the GPS creates two tapes:

1. A tape containing exception transactions and all pages entered and verified during this session
2. A tape containing exception transactions and all sections for which verification was completed during this session if the SEND function has been executed

Both tapes are removed at the end of a session, write protected and stored until the end of the grade posting cycle for the current academic term. Thus, the tapes can be used in conjunction with previous student file diskettes to re-create a current student file diskette. The number of each tape should be recorded in the session log. To use the tapes, follow the instructions given in the section,

'Re-creating the Student File'. Tape C1 contains the following:

1. Copies of all pages entered or verified during this session.

2. Copies of Add-on, Title, and Hours transactions.

Tape C2 contains the following:

1. Copies of Add-on, Title, and Hours transactions.

2. Copies of all sections which have been completely verified since the last time completed sections were written to tape C2. It should be noted that this information is not written to tape C2 unless the SEND function is executed on the master terminal.

Chapter VI

ERROR REPORTING PROCEDURES

Each time an error other than invalid or incorrect data entry occurs, record the following information in the session log:

1. Day and time error occurred
2. Terminal being used
3. Function being performed
4. Any data you were attempting to enter or obtain
5. Your name
6. Corrective action taken and/or attempted

At the end of a session, the log becomes a means to determine what happened and why. If an error causes the system to fail or the student file becomes damaged, inform your supervisor in addition to recording the above information.

Chapter VII

SESSION LOGS

The session logs are an extremely important record. They record the following information:

1. Time and date each session began
2. Time and date each session ended
3. Successful/unsuccessful transmission to the host computer of sections verified during this session
4. Occurrence of diskette, cassette, or GPS failures
5. Recreation of student files or tape updates
6. Reloading of the GPS program
7. Occurrence of any uncorrected error and a short description of attempted corrective action

The session logs are important; they were not created to increase the workload of data entry personnel. The logs may be recorded on an ordinary pad of paper as long as the required information is maintained. Session logs should be numbered in order beginning with the first one for each academic term. They should be maintained until the successful conclusion of the grade posting cycle of the current academic term.