Academic Computing Support of Clemson University has developed an IDMS database application to record the information associated with the activities of the Computer Center. Along with an online system to update the database, there was a need to develop a reporting system to generate a variety of reports. SAS Institute does not provide a way to retrieve data from IDMS directly. Therefore, a procedure was developed at Clemson which will read the IDMS database, create a SAS dataset and allow processing by SAS on that SAS dataset. This paper will describe the database layout, the reports that are generated from the database and the procedure that was used to create the SAS dataset that is used in generating the reports.

The two areas that are currently in the Computer Center database are the address area and the short course preregistration area. The address area contains the mailing address of people who want to be sent the Computer Center Newsletter, the Computer Center bulletins, or who are registered for one of the Computer Center short courses. The short course preregistration area contains all the Computer Center short courses, the teachers who are teaching these courses, and information on the people who wish to attend the courses.

The layout of the database is in the Bachman diagram that follows:

![Database Diagram](image-url)
One report that is generated reads the preregistration area of the database and extracts all teachers and the courses that they are teaching. The program in figure 2 shows how this is done using the SAS/IDMS procedure developed at Clemson.

```sas
/* THIS JOB EXTRACTS TEACHERS FROM THE PREREGISTRATION DATABASE AND PRINTS THEM ALONG WITH THE DATES AND TIMES OF THE COURSES THAT THEY ARE TO TEACH. */
PARMS TO REG0208 :
PROC REG0208 PROD;
DATA; SET DATA1(RENAME=(START=CSTART END=CEND));
LENGTH MN DY 8;
TIME1=SUBSTR(CSTART,1,2);
TIME2=SUBSTR(CSTART,3,2);
TIME3=SUBSTR(CEND,1,2);
TIME4=SUBSTR(CEND,3,2);
START=HMS(TIME1,TIME2,0);
STOP=HMS(TIME3,TIME4,0);
ARRAY DATE (SEQ) DATE1 DATE2 DATE3 DATE4 DATES;
DO SEQ=1 TO NDATES;
END;
MN=SUBSTR(DATE,1,2);
DY=SUBSTR(DATE,3,2);
DAY=MDY(MN,DY,81);
OUTPUT;
PROC SORT; BY TEACHER DAY START;
DATA _NULL_; RETAIN PAGE 1;
FILE ISCHED LS=75 NOTITLES LL=LINES;
CDAY=PUT(DAY.WEEKDATE32.); CDAY=INPUT(CDAY $32.)' IF FIRST. TEACHER THEN ';
PAGE=PAGE+1;
PUT PAGE #3 'SCHEDULE FOR' +1 TEACHER II;
IF LINES < 8 THEN DO;
    PAGEL=
    PAGE=PAGE+1;
    PAGEL=
    PAGE=PAGE+1;
END;
IF FIRST.DAY THEN PUT // @67 TPAGE1 @72 PAGE 1. //;
IF LAST.TEACHER THEN PAGE=1;
```

Figure 2
Sample SAS Program

When the procedure is called, the following parsing module is invoked

```sas
TITLE 'PARSING MODULE FOR PROC REG0208'
PRINT NOGEN
PROC SASPROC NAME=REG0208,LOADMOD=REG0209,
   DATA=GIVEN,ABUF=NO
DATASETS SASLIST OUT,1,MODE=DOSOUT
OPTS SASLIST PROD,1,TEST,2,STUDENT,3
DEFAULT SASBLT NO=1,NAME=DATA_,MODE=DOSOUT
SASEND
```

Figure 3
Parsing Module

This parsing module in turn executes the program in figure 4 which reads the IDMS database and creates a SAS dataset containing all the information that is needed for the report. The main program then proceeds to process that SAS dataset to give the output report that is shown in figure 5.

The DEFINE_SAS_NAME which is found in the PL/1 program in figure 4 is a compile time procedure which is used to make the process of defining variable names to SAS easier. The DEFINE_SAS_NAME procedure itself, along with the other PL/1 code required for SAS procedures, is copied into the program with the INCLUDE IDMS(IDMS_SAS_ENV) statement.

The second example shows a report that is generated which lists, in alphabetical order, all the people who are in the mailing area. The parsing module is shown in figure 6, the program that is called from the parsing module is shown in figure 7, and the program which invokes this procedure is shown in figure 8. Figure 9 shows the actual printout of the report.
/* PL/I RETRIEVAL PROGRAM */
REG0209: PROC OPTIONS(MAIN);
DECLARE IOMS EXTERNAL ENTRY OPTIONS(ASM,INTER);
DECLARE (AMO126 SUBSCHEMA, AMO100 SCHEMA)
MODE(PLOPT);
INCLUDE IOMS(SUBSCHEMA_CTRL);
INCLUDE IOMS(CRSE_COURSE);
INCLUDE IOMS(SSJT_SEC STU JCT);
INCLUDE IOMS(STUD.Student);
INCLUDE IOMS(SECT_SECTIONS);
INCLUDE IOMS(TCHR_TEACHER);
INCLUDE IOMS(IOMS SAS ENV);
DECLARE NDATES FLOAT BIN(53);
/* CANNOT PASS FIXED BIN TO SAS */
DEFINE SAS NAME
(COURSE,CRSE_COURSE_NUMBER, 2,04);
DEFINE SAS NAME
(TITLE,CRSE_COURSE_TITLE, 2,44);
DEFINE SAS NAME
(BLDG,CRSE_BUILDING_NAME, 2,35);
DEFINE SAS NAME
(ROOM,CRSE_ROOM_NAME, 2,15);
DEFINE SAS NAME
(SECTION,SECT SECTION_NUMBER, 2,02);
DEFINE SAS NAME
(START,SECT_MEETING_START_TIME, 2,04);
DEFINE SAS NAME
(END,SECT_MEETING_END_TIME, 2,04);
DEFINE SAS NAME
(NDATES,NODATES, 1,08);
DEFINE SAS NAME
(ANTE1,SECT_MEETING_DATE(1), 2,04);
DEFINE SAS NAME
(ANTE2,SECT_MEETING_DATE(2), 2,04);
DEFINE SAS NAME
(ANTE3,SECT_MEETING_DATE(3), 2,04);
DEFINE SAS NAME
(ANTE4,SECT_MEETING_DATE(4), 2,04);
DEFINE SAS NAME
(ANTE5,SECT_MEETING_DATE(5), 2,04);
DEFINE SAS NAME
(TCHR,TCHR_LAST_NAME,2,15);
IF IOPT(1) = 1 THEN DO;
BIND RUN UNIT SUBSCHEMA(AMO126);
END;
IF IOPT(2) = 1 THEN DO;
BIND RUN UNIT SUBSCHEMA(AMO122);
END;
BIND RECORD(CRSE_COURSE);
BIND RECORD(STUD.Student);
BIND RECORD(SECT_SECTIONS);
BIND RECORD(TCHR_TEACHER);
READY AREA(REQ_SHORT_COURSE);
IF IOPT(3) = 1 THEN DO; /* ONLY IF STUDENTS WANTED */
OBTAIN FIRST RECORD(SSJT_SEC STU JCT) SET(SECTIONS_JCT);
DO WHILE (ERROR STATUS = '0000');
OBTAIN NEXT RECORD(SSJT_SEC STU JCT) SET(SECTIONS_JCT);
END;
ELSE CALL POUTOUT(OUTVEC(I));
ELSE CALL POUTOUT(OUTVEC(1));
END;
RETURN;
END REG0209;
END;
Figure 4
SAS/IDMS Procedure
307
SCHEDULE FOR ALEXANDER

MONDAY, FEBRUARY 9, 1981
9:05-9:55 1240-05 TSO AND CLEMSON EDITOR FOR TEXT FORMATTING
19:00-20:00 1300-03 BEGINNING JOB CONTROL LANGUAGE

WEDNESDAY, FEBRUARY 11, 1981
9:05-9:55 1240-05 TSO AND CLEMSON EDITOR FOR TEXT FORMATTING

WEDNESDAY, FEBRUARY 18, 1981
19:00-20:30 1510-02 USING FORTRAN AT CLEMSON UNIVERSITY

MONDAY, FEBRUARY 23, 1981
9:05-9:55 2600-02 INTRODUCTION TO SAS

WEDNESDAY, FEBRUARY 25, 1981
9:05-9:55 2610-02 SAS FOR USE WITH TAPE AND DISK

MONDAY, MARCH 9, 1981
9:05-9:55 2640-02 SAS/GRAPH

TUESDAY, MARCH 10, 1981
19:00-20:00 1730-01 THESIS WRITING USING THESIS

WEDNESDAY, MARCH 11, 1981
9:05-9:55 2640-02 SAS/GRAPH

Figure 5
Sample Output
TITLE 'PARSING MODULE FOR PROC REG0206'
PRINT NOGEN
PROC SASPROC NAME=REG0206,LOADMOD=REG0207,
DATA=GIVEN,ABUF=NO
DATASETS SASLIST OUT=,MODE=DOUT
OPTS SASLIST PROO,14,TEST,15
DEFAULT SASDFLT NO=1,NAM=_,MODE=DOUT
SASEND --

Figure 6
Parsing Module

******************************************************************************
/*
/* THIS JOB EXTRACTS PEOPLE FROM THE MAILING AREA OF THE DATABASE,
/* SORTS THEM BY LAST NAME, AND PRINTS A REPORT LISTING THEIR NAMES, ID NUMBERS, AND ADDRESSES.
/*
/* PARMS TO REG0206 :
/* PROD THE PRODUCTION MAILING
/* TEST THE TEST REGISTRATION MAILING
/*
/* SPECIAL NOTES:
/* THE LIST DOES NOT INCLUDE VENDORS(TYPE='V'),
/* BUSINESSES(TYPE='B'), COMPANIES(TYPE='C'), OR DEPARTMENTS(TYPE='D').
/* IN ADDITION ONLY PEOPLE WITH ADDRESSES INSIDE THE STATE OR WITH INTEROFFICE ADDRESSES(STATE = ' ' ) ARE INCLUDED.
/*
/* PROC REG0206 PROD OUT=MASTER;
DATA; SET MASTER;
IF (TYPE = 'V' OR TYPE = 'B' OR TYPE = 'C' OR TYPE = 'D')
OR
( NOT (STATE = 'SC' OR STATE = ' ' ) )
THEN DELETE;
NAME = TRIM (LASTNM) || '' || TRIM (FIRSTNM) || TRIM (MIDOLENM);
PROC SORT; BY NAME;
PROC PRINT;
VAR ADDRIO ADDR1 ADDR2 CITY STATE
SHORT;
ID NAME;
TITLE COMPUTER CENTER MAILING LIST;
TITLE2 INDIVIDUALS ALPHABETIZED BY LAST NAME;

Figure 7
Sample SAS Program

309
/* ADDRESS AREA RETRIEVAL PROGRAM */
REG0207: PROC OPTIONS (MAIN);
DECLARE IDMS EXTERNAL ENTRY OPTIONS (ASM, INTER);
DECLARE (AMS0121 SUBSCHEMA, AMS0100 SCHEMA)
MODE (PL1OPT);
INCLUDE IDMS (SUBSCHEMA_CTRL);
INCLUDE IDMS (ADDR ADDRESS);
INCLUDE IDMS (IDMS SAS ENV);
DEFINE SAS NAME (ADORID, ADDR ID NUMBER, 2, 06);
DEFINE SAS NAME (GROUPID, ADDR DESTINATION, 2, 01);
DEFINE SAS NAME (NAME, ADDR PERSON NAME, 2, 32);
DEFINE SAS NAME (FIRSTNM, ADDR FIRST NAME, 2, 10);
DEFINE SAS NAME (MIDDLENM, ADDR MIDDLE NAME, 2, 10);
DEFINE SAS NAME (LASTNM, ADDR LAST NAME, 2, 15);
DEFINE SAS NAME (ADDR1, ADDR ADDRESS ONE, 2, 28);
DEFINE SAS NAME (ADDR2, ADDR ADDRESS TWO, 2, 28);
DEFINE SAS NAME (ADDR3, ADDR ADDRESS THREE, 2, 28);
DEFINE SAS NAME (CITY, ADDR CITY, 2, 20);
DEFINE SAS NAME (STATE, ADDR STATE, 2, 02);
DEFINE SAS NAME (ZIP, ADDR ZIP CODE, 2, 28);
DEFINE SAS NAME (TYPE, ADDR ADDRESS TYPE, 2, 01);
DEFINE SAS NAME (SOFTWARE, ADDR SOFTWARE CUSTOMER FLAG, 2, 01);
DEFINE SAS NAME (VENDOR, ADDR VENDOR FLAG, 2, 01);
DEFINE SAS NAME (NEWSLETTER, ADDR NEWSLETTER WANTED FLAG, 2, 01);
DEFINE SAS NAME (BULLETINS, ADDR BULLETINS WANTED FLAG, 2, 01);
DEFINE SAS NAME (SHORT, ADDR SHORT COURSE_INFO_FLAG, 2, 01);
INCLUDE IDMS (IDMS SAS ENDNAME);
SUBSCHEMA_CTRL.PROGRAM = 'AMS0202 '

IF IOPT (14) = 1 THEN DO;
BIND RUN_UNIT SUBSCHEMA (AMS0126);
END;

IF IOPT (15) = 1 THEN DO;
BIND RUN_UNIT SUBSCHEMA (AMS0122);
END;

BIND RECORD (ADDR ADDRESS);
READY AREA (AMS MAIL);

OBTAIN FIRST RECORD (ADDR ADDRESS) AREA (AMS MAIL);
CALL CHECK STATUS;
DO WHILE (ERROR STATUS = '0000');
CALL PUTOUT (OUTVEC (1));
OBTAIN NEXT RECORD (ADDR ADDRESS)
AREA (AMS MAIL);
END;

FINISH;
INCLUDE IDMS (IDMS SAS CLS);
END REG0207;

Figure 8
SAS/IDMS Procedure
<table>
<thead>
<tr>
<th>Name</th>
<th>Address ID</th>
<th>Address 1</th>
<th>Address 2</th>
<th>City</th>
<th>State</th>
<th>Short</th>
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<td>AAS C</td>
<td>000001</td>
<td>ENT &amp; ECON ZOOL</td>
<td>LEOFTSKY HALL</td>
<td>SENICA</td>
<td>SC</td>
<td>Y</td>
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<td>150 LEOFTSKY HALL</td>
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<td>SC</td>
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<td>WADDAK ESTATE DRIVE</td>
<td>BRACKETT HALL</td>
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<td>ACHENHOLTZ J.</td>
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<tr>
<td>ALUMNA SHYAM L</td>
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<td>LEHOTSKY HALL</td>
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<td>SC</td>
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<td>UNIVERSITY STATION</td>
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<td>SUB ROB 123</td>
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**Figure 9**
Sample Output