

Introduction

Since 1970 the U. S. Census Bureau has distributed decennial census information as machine readable files with demographic data ordered as tables of related variables. In the late 70's SAS was overtaking PLI as the language of choice at the Urban Information Center. It was an excellent file management tool for our large public data files. We already used SAS databases to store local extracts of 1970 decennial census files or "counts" as they were called at that time. It was natural for us to convert 1980 Summary Tape Files to SAS databases and efficient as well given the ease and speed of access to the converted files. The number of variables was not a particular deterrent to the use of SAS, although in certain cases it was necessary to partition the information. Creating mnemonic names for the multitude of variables on STF's would have made them awkward to use in arrays and double-dash lists. We instead adopted the Census Bureau's table organization and named our variables according to their table number and position within the table eg. T111 for table 1 item 1.

In the early 1980's, as is the case now, there were no SAS procedures to handle the display of large numbers of variables from huge datasets. The split tableau from PROC PRINT can only handle a few variables. A custom organization is critical in presenting variables whose meaning is clear only in the presence of adjacent variables. Table outlines were distributed by the Census Bureau in the technical documentation for each STF and were even available in machine-readable data dictionaries. It was a format familiar to many census data users. The following is an example of a table outline for 1980 STF1 table 14:

14. SEX (2) BY MARITAL
STATUS (5) {10}

Universe: Persons 15 Years
And Over

Male:

Single
Now married, except
separated
Separated
Widowed
Divorced

Female:

(Repeat Marital Status)

The Table Solution

To solve the problem of presenting the massive numbers of variables in a coherent fashion we again chose to use the Census Bureau's table convention. Presenting the information in the table above individually is not difficult. Our goal, however, was to allow a user to select any subset of the 59 tables on 1980 STF1 or the larger more complex STF's to follow. To allow the same report generator to work efficiently for any STF, we stored the table software

for each STF in a separate member of a partitioned data set to be included selectively based on the STF being processed. The subsetting by table was accomplished by storing the software for each table in a separate macro to be invoked only when desired. A fixed 44 character column limit was adopted for all tables. The file option "N=PAGESIZE" was used to allow whole page access and the table macros' "PUT" statements contained "@C" at the start of each line to permit any table to be positioned in the current column on the page. Tables were customized to print percents as well as data items. 1980 STF1 Table 14, the table whose outline appears above, is shown here as it would be seen in a report of tables for the St. Louis SMSA:

TABLE 14: PERSONS 15 YEARS AND OVER
BY SEX AND MARITAL STATUS

STATUS	MALE		FEMALE	
SINGLE	245,363	29.0%	227,476	23.5%
MARRIED	515,307	60.8%	515,075	53.2%
SEPARATED	15,951	1.9%	25,548	2.6%
WIDOWED	23,179	2.7%	127,661	13.2%
DIVORCED	47,528	5.6%	73,258	7.6%

In addition to selecting tables within STF's, a user was to determine whether the tables for a single geographic unit should appear separated by a page break, a column break or consecutively in the report, with appropriate geographic labelling provided for each case. A concession to aesthetics forced us to skip to a new column if the table would not fit in the current one, provided the table would fit in one column. The print modes, column skipping and general form of the report was controlled by code in header and link routines at the end of the report generation data step. These compared table size with lines left to initiate column and page breaks, advance the column pointer and invoke geographic headings. Geographic headings were simplified because the geographic hierarchies had been aggregated to data sets with only one type of geography. The report layout could be pictured as in the diagram below where "GGGGGG"s are geographic identifiers and clusters of numbers represent tables in a "telephone book" style report:

TITLE		
GGGGGG		
111111	444444	666666
	444444	666666
222222	444444	666666
222222	444444	666666
		666666
333333	555555	
333333	555555	
333333	555555	
	555555	
	555555	

The example above shows how each page of a report would appear if the six tables were selected in "page break" mode. If the user selected tables "111111" and "222222" above in "column mode" the first page of output might appear as

follows:

TITLE		
GGGGGG	GGGGGG	GGGGGG
111111	111111	111111
222222	222222	222222
222222	222222	222222

The same two tables in consecutive "table" mode could result in the following page:

TITLE		
GGGGGG	GGGGGG	GGGGGG
111111	111111	111111
222222	222222	222222
222222	222222	222222
GGGGGG	GGGGGG	GGGGGG
111111	111111	111111
222222	222222	222222
222222	222222	222222

Originally the report generation was initiated by a CLIST which invoked SAS and FSEDIT interactively to create a parameters dataset. This data set was read by an included job generation data step which output a job to create the report. The generated job included and invoked the "table" macros and "link" routines mentioned above. The SAS portion of the generated job looked like the example below, where underscores begin "old-style" macro invocations:

```
%INCLUDE MACLIB(STFLINKS)/NOSOURCE2;
%INCLUDE MACLIB(F81TABS)/NOSOURCE2;
MACRO _COLS 3%
MACRO _GEOCODE TRACT%
MACRO _COLHDR
PUT @C STATE= COUNTY= TRACT= / @CAREANAME=;
PUT @C ' ';%
MACRO _PAGEHDR % MACRO _TABHDR %
MACRO _BRKOPT 'C'%
DATA _NULL_ ; SET STFFILE.TRACTS;
FILE PRINT N=PS= 66 LINESLEFT=LEFT LINE=L
HEADER=HDR;
  _ARRAYS
  RETAIN C L PSLEFT NI SELECT 0 CURGEO ;
  IF TRACT='1';
  _F81T2
  _F81T3
  _F81T6
  _LINKS
  TITLE1
  'ST. LOUIS CITY 1980 STF1A TRACT DATA';
```

The sample above shows invocations for selected STF1 "table" macros and the link routines. The "arrays" macro contained table element arrays used by table macros in processing percents and table line count arrays used by the link routines in placing tables on the page. By the end of 1982 we had developed table macros for STF's 1, 2 and 3. The databases were generally too large to store on line and as time passed we began to code batch setups from models

and from memory.

In 1984 we recoded the system as a "new-style" %macro application. The table macros remained unchanged, but the data step, link routines and geography headings became part of the macro. The invocation was considerably more compact:

```
TITLE 'STF3 DATA FOR SELECTED BLOCK GROUPS';
%MACRO FILTER;
IF TRACT='2132.01' ] TRACT='2132.02';
%MEND FILTER;
```

```
%STFRGENB(STF=3, TABLES=ALL, PGSZ=60,
SLCTEDIT=FILTER, COLS=3, LNSZ=132, BREAKOPT=P,
GEOCODE=BLKGRP); RUN; PAGE;
```

This version offered formalized parameters with defaults, but little additional capability. The "SLCTEDIT" parameter automated the editing and subsetting of the input data set. An "AUXGEO" parameter allowed the user to replace the list of hardcoded geocodes to appear with the argument to the "GEOCODE" parameter. The "TABLES" argument could still be specified as table numbers eg. 1 2 3... or as ranges eg. 1-59. Lack of demand slowed the development of "table" macros, but the 1980 Equal Employment Opportunity, 1970 Fifth Count and the National Planning Data Corporation Age by Income tables were coded by the end of 1986. These were not high priority data sets and the processing code was added to a special version of STFRGENB called STFRGENT in order not to clutter the more commonly used macro. STFRGENT was also able to process different summary levels in the same run by printing geographic headers appropriate to the summary level on the observation. Summary levels were present on what we termed "level 1" data sets. These data sets kept the hierarchy of the original STF's and served as intermediates in our conversion process.

The TABRGEN System

The decision to develop TABRGEN, our newest table report generator, was influenced by many factors:

- 1990 STF1 mixes population and housing tables.
- Data-related code in a report generator is awkward.
- Information for table displays might be useful elsewhere.
- Limitations of supporting only 44 character table.
- Need for explanatory text prior to printing tables.
- A desire to add the ability to select tables by subject.
- Need to make use of the "WHERE" facility in SAS 6.06.
- SAS 6.06 will not accept the "old-style" table macros.
- All these facilities are implemented in the TABRGEN system.

Like its predecessors the TABRGEN macro permits the inclusion and selective invocation of custom-coded table display macros, coordinates their columnwise display, and labels the data with user selected or predetermined identifier variables at the page, column or table level. TABRGEN is intended to be a general solution to "custom" table displays of data in SAS format. Unlike its predecessors TABRGEN separates the data-specific components from the report generator placing them in the "TABLE MODULE" and in a new entity, the "DESCRIPTOR MODULE." "TABLE MODULES" contain table display macros and size arrays as in earlier systems. "DESCRIPTOR MODULES" contain enough information on table macros for the FILETYPE to permit their

invocation and all information on identifiers and summary levels necessary to produce a report. This isolates the report generator from the data making it stable while the other two components change with each new application. The TABRGEN system will run under SAS V5 or V6.

The TABRGEN Macro

The TABRGEN macro retains the general structure of its forerunners with some enhancements:

- File specific information is no longer coded in the report generator, but is included from the "DESCRIPTOR MODULE" to permit geographic/identifier variable processing.
- A data step is generated setting to the desired data set.
- There are provisions for editing and subsetting the input data set in the form of an optional user-provided SLCTEDIT macro and a "WHERE" statement parameter.
- Table lists are expanded and table macros are invoked with multiple types permitted.
- Geographic/identifier variable processing allows data sets to be single unit or multi-level.
- Three print modes are handled by link and header routines.

The TABRGEN macro supports the following parameters:

- FILETYPE- Name of descriptor module in MACLIB (below)
 TYPES- List of currently valid FILETYPES.
 MACLIB- Fileref of descriptor and table module library.
 RECTYPE- Letter indicating record type (where a single FILETYPE has multiple record types.
 SETIN- Libname.data set for SAS input data.
 Note: If plural of LEVELS argument (below) a single level of geography is assumed.
 WHERE- Text of "where" expression (see samples)
 LEVELS- (alias GEOCODE) List of numeric values or corresponding mnemonics (variable names).
 Note: See also SETIN note above.
 IDNAME- (alias AREANAME) Override for observation descriptor variable provided by the "DESCRIPTOR MODULE."
 NONAME- "1" suppresses printing of IDNAME (above).
 AUXVARS- Override for list of header variables from the "DESCRIPTOR MODULE."
 TABLES- List of table identifiers and/or ranges.
 KEYWORDS- List of keywords or keyword groups (KW*KW) to be used to select tables.
 Note: Mutually exclusive with TABLES parm.
 SLCTEDIT- Name of user-provide macro to filter or edit the incoming (SETIN above) data set.
 BREAKOPT- Print mode: "P" for page, "C" for column and "T" or "N" for consecutive tables.
 LNSZ- Override for default linesize (132).
 PGSZ- Override for default pagesize (60).
 COLS- Override for default number of columns.
 (Computed from descriptor info & linesize)
 PRETEXT- Fileref for file containing text to print prior to table displays.
 MACSIN- "1" cause table macros not to be included.
 Note: Used after first invocation.
 SOURCE- "1" turns on source for included macros.
 PUTPARMS- "1" displays parameter arguments. "2" displays arguments before and after inclusion of the

"DESCRIPTOR MODULE."

TABRGEN may be used with any data for which suitable DESCRIPTOR and TABLE MODULES have been developed. The following sample invocations are for decennial census file applications for which TABRGEN was originally developed:

This invocation prints all PL94 tables at state level:
 TITLE 'EXAMPLE 1: 1988 PL94-171 - FILETYPE PL9490';
 %TABRGEN(FILETYPE=PL9490,SETIN=PL94.DHMO,
 LEVELS=STATE,TABLES=ALL)

Tables P1 & H1 for counties consecutively in 2 columns:
 TITLE 'EXAMPLE 2: 1988 PL94-171 - FILETYPE PL9490';
 %TABRGEN(FILETYPE=PL9490,SETIN=PL94.DHMO,
 LEVELS=COUNTY, BREAKOPT=T,TABLES=P1
 H1,PGSZ=50,LNSZ=112)

Three 1980 STF1 tables for two tracts in county 510 with column breaks:
 %MACRO FILTER;
 IF COUNTY='510' & (TRACT='1152.00')
 TRACT='1161.00');
 %MEND FILTER;
 TITLE 'EXAMPLE 3: 1980 STF1 - FILETYPE STF801';
 %TABRGEN(FILETYPE=STF801,LEVELS=TRACT,
 SETIN=STF801.TRACTS,
 TABLES=1-3 5,BREAKOPT=C,SLCTEDIT=FILTER);
 RUN;

Three dress rehearsal tables for County 510 and Tract 1152 on two columns with page break:
 TITLE 'EXAMPLE 4: 1988 STF1 - FILETYPE STF881';
 %TABRGEN(FILETYPE=STF881,
 LEVELS=050140,PGSZ=50,LNSZ=112,
 SETIN=STF881.STF881L1,TABLES=P23-P25 H12,
 WHERE=%STR(COUNTY='29510' AND (SLVL='050' OR
 SLVL='140' AND TRACT='1152.00',BREAKOPT=P));

The report generated by TABRGEN is output to the SAS procedure output file (SASLIST:V6, FT12F001:V5). Titles specified in the invoking source are therefore used in the report. The report generated by the invocation in example 1 above (title shifted left) is shown below:

EXAMPLE 1: 1988 PL94-171 - FILETYPE PL9490
 STATE=29
 AREANAME=Missouri

P1: TOTAL PERSONS.....	849,971	
P2: PERSONS BY RACE		
WHITE.....	628,710	74.0%
BLACK.....	207,903	24.5%
AMERICAN INDIAN, ESKIMO, OR ALEUT.....	1,936	0.2%
ASIAN OR PACIFIC ISLANDER.....	7,911	0.9%
OTHER RACE.....	3,511	0.4%
P3: RACE		
UNIVERSE: PERSONS 18 YEARS AND OVER		
WHITE.....	483,858	76.3%
BLACK.....	140,725	22.2%
AMERICAN INDIAN, ESKIMO, OR ALEUT.....	1,406	0.2%

ASIAN OR PACIFIC		
ISLANDER.....	5,844	0.9%
OTHER RACE.....	2,140	0.3%

P4: HISPANIC ORIGIN BY RACE

UNIVERSE: PERSONS

HISPANIC ORIGIN.....	8,337	1.0%
NOT OF HISPANIC ORIGIN:		
WHITE.....	624,076	73.4%
BLACK.....	207,291	24.4%
AMERICAN INDIAN, ESKIMO,		
OR ALEUT.....	1,838	0.2%
ASIAN PACIFIC		
ISLANDER.....	7,699	0.9%
OTHER RACE.....	730	0.1%

P5: HISPANIC ORIGIN BY RACE

UNIVERSE: PERSONS 18 YEARS AND OVER

HISPANIC ORIGIN.....	5,816	0.9%
NOT OF HISPANIC ORIGIN:		
WHITE.....	480,528	75.8%
BLACK.....	140,321	22.1%
AMERICAN INDIAN, ESKIMO,		
OR ALEUT.....	1,344	0.2%
ASIAN PACIFIC		
ISLANDER.....	5,682	0.9%
OTHER RACE.....	282	0.0%

H1: HOUSING UNITS..... 396,190

Descriptor Modules

DESCRIPTOR MODULES hold data on table macro names and corresponding table names, counts of tables/table macros, table width, a verify level macro, the name of the tables module, the name of the summary level variable and keywords associated with each table.

The following is an example of a DESCRIPTOR MODULE for the 1990 P.L. 94-171 file. Although this is a small file it incorporates most of the possible DESCRIPTOR MODULE features:

```
%PUT *&FILETYPE DESCRIPTOR MODULE REVISED
16JAN91 INCLUDED* ;
```

—THIS FILE DESCRIPTOR MODULE DEFINES MACRO VARIABLES WHICH ACT AS PARMS TO UTILITY MACROS WHICH MANIPULATE THE FILE DESCRIBED—;

```
*FILETYPE - 1 TO 8 CHARACTER FILETYPE CODE EG.
STF801, EEO80, AG87ADV.... ;
%LET FILETYPE=PL9488;
```

```
*NTGRPS - NUMBER OF TABLE GROUPS: CORRESPONDS
TO THE NUMBER OF TABLE PREFIXES (EACH WITH A
UNIQUE 1 TO N TABLE SEQUENCE).;
%LET NTGRPS=2;
```

```
*NTTGRPS - LIST OF COUNTS OF TABLES IN TABLE
GROUPS IN GROUP ORDER.;
%LET NTTGRPS=5 1;
```

```
*TGRPS - LIST OF PREFIX VALUES FOR TABLE GROUPS
IN GROUP ORDER, USED TO SPECIFY & VERIFY TABLES
```

TO BE PROCESSED BY THE MACRO.;

```
%LET TGRPS=P H;
```

*MPRFS - LIST OF PREFIX VALUES FOR THE TABLE MACROS IN GROUP ORDER, USED TO FORM THE NAMES OF TABLE DISPLAY MACROS TO BE INVOKED.

```
%LET MPRFS=_P_H;
```

*KWTGRPU,I=1-NTGRPS,J=1-NTTGI - ARRAY OF MACRO VARIABLES WHERE EACH VARIABLE CONTAINS THE KEYWORDS ASSOCIATED WITH THE JTH TABLE IN THE ITH TABLE GROUP(&&&&KW&&TGRP&K&&J);

*<KEYWORD ENTRIES (SUGGESTED BY APPENDIX B HEADINGS IN PL94-171 TECHNICAL DOCUMENTATION);

```
%LET KWP1=PERSONS POPULATION;
```

```
%LET KWP2=RACE;
```

```
%LET KWP3=RACE AGE;
```

```
%LET KWP4=HISPANIC ORIGIN RACE;
```

```
%LET KWP5=HISPANIC ORIGIN RACE AGE;
```

```
%LET KWH1=HOUSING UNITS;
```

*TABLMAC - MEMBER OF MACRO LIBRARY WHICH CONTAINS THE SOURCE FOR TABLE GENERATION MACROS FOR THE CURRENT FILETYPE.;

```
%LET TABMEM=PL94TABS;
```

*ALLTABS - NAME OF MACRO WHICH INVOKES ALL TABLE MACROS FOR THE CURRENT FILE TYPE;

```
%LET ALLTABS=_PL94ALL;
```

*LVLSVAR - VARIABLE WHICH CONTAINS THE OBSERVATION SUMMARY LEVEL;

```
%LET LVLSVAR=SLVL;
```

*IDNAME - CHARACTER VARIABLE WHICH DESCRIBES OBSERVATION ID;

```
%LET DIDNAME=AREANAME;
```

*NAMEFMT - FORMAT FOR VARIABLE WHICH DESCRIBES OBSERVATION ID;

```
%LET NAMEFMT=;
```

*ID2NAME - CHARACTER VARIABLE WHICH DESCRIBES OBSERVATION WHERE MORE THAN ONE OBSERVATION HAS THE SAME ID EG. RACE FLAG.;

```
%LET ID2NAME=;
```

*NAM2FMT - FORMAT FOR VARIABLE WHICH DESCRIBES OBSERVATION WHERE ID APPEARS IN MORE THAN ONE OBSERVATION EG. RACE FORMAT.;

```
%LET NAM2FMT=;
```

*WIDTH - MAXIMUM WIDTH OF PRINT FOR TABLE MACROS ASSOCIATED WITH CURRENT FILE TYPE. USED TO VERIFY OR COMPUTE THE NUMBER OF COLUMNS TO PLACE ON THE PAGE.;

```
%LET TWIDTH=43;
```

THE FOLLOWING CONTAIN HEADER GEOGRAPHY FOR EACH LEVEL, SLASHES SHOW COLUMN BREAKS FOR COLUMNS OF WIDTH TWIDTH, THESE ARE CONVERTED TO HEADER CODE IN THE TABRGEN MACRO;

```
%LET L040=STATE /;
```

```
%LET L050=STATE COUNTY /;
```

```
%LET L060=STATE COUNTY COUSUBCE /;
```

```
%LET L140=STATE COUNTY TRACT /;
```

```

%LET L150=STATE COUNTY TRACT BG /;
%LET L160=STATE PLACE /;
%LET L170=STATE CCCE /;
%LET L700=STATE COUNTY VTD /;
%LET L710=STATE COUNTY VTD / COUSUBCE PLACE /;
%LET L720=STATE COUNTY VTD COUSUBCE /
COUSUBFP PLACE PLACEFP /;
%LET L730=STATE COUNTY VTD COUSUBCE /
COUSUBFP PLACE PLACEFP / TRACT /;
%LET L740=STATE COUNTY VTD COUSUBCE /
COUSUBFP PLACE PLACEFP / TRACT / BG /;
%LET L750=STATE COUNTY VTD COUSUBCE /
COUSUBFP PLACE PLACEFP / TRACT / BLK /;
%LET L210=STATE AIANACE AIANAFP / AIANACC /;
%LET L211=STATE AIANACE AIANAFP / AIANACC ARTLI /;
%LET L212=STATE AIANACE AIANAFP / AIANACC ARTLI /;
%LET L215=STATE AIANACE AIANAFP / AIANACC ARTLI /;
%LET L216=STATE AIANACE AIANAFP / AIANACC ARTLI /;
%LET L220=STATE COUNTY AIANACE / AIANAFP
AIANACC ARTLI /;
%LET L221=STATE COUNTY AIANACE / AIANAFP
AIANACC ARTLI /;
%LET L230=STATE ANRC /;

```

HEADER INFO FOR UIC LEVEL 2 DATA SETS OR OTHER, DATA SETS REPRESENTING A SINGLE LEVEL OF GEOGRAPHY, SLASHES SHOW COLUMN BREAKS FOR COLUMNS OF WIDTH TWIDTH, THESE ARE CONVERTED TO HEADER CODE IN THE TABRGEN MACRO;

```

%LET STATE=STATE /;
%LET COUNTY=STATE COUNTY /;
%LET VTD=STATE COUNTY VTD /;
%LET MCD=STATE COUNTY COUSUBCE /;
%LET COUSUBCE=STATE COUNTY COUSUBCE /;
%LET COUSUBFP=STATE COUNTY COUSUBFP /;
%LET TRACT=STATE COUNTY TRACT /;
%LET BG=STATE COUNTY TRACT BG /;
%LET PLACE=STATE PLACE /;
%LET CCCE=STATE CCCE /;
%LET AIANACE=STATE AIANACE AIANAFP / AIANACC /;
%LET AIANAFP=STATE AIANACE AIANAFP / AIANACC /;
%LET ANRC=STATE ANRC /;
%LET CD=STATE CD /;

```

```

*LINKMODS - LIST OF MACROS WHICH ARE LINK
ROUTINES NEEDED FOR THE CURRENT FILE TYPE;
%LET LINKMODS=%STR(FORMATS);
*NEED TO OVERRIDE TWO FORMATS TO OUTPUT CODE
NOT NAME*;
%MACRO FORMATS;FORMAT COUNTY $CHARS.
MSACMSA $CHAR4;
%MEND FORMATS;

```

RETURN A BEST SUMMARY LEVEL WHEN THE LEVEL IS MNEMONIC, RETURN THE MNEMONIC FOR LEVEL 2 WHOLE UNIT DATA SETS..., OR THE LEVEL ITSELF DISPLAYING A MESSAGE IF INVALID, LVLSVAR SET TO NULL IF DATA SET NAME & LEVEL NAME AGREE;

```

%MACRO VERIFID(NAME=);
%IF &NAME=%STR(ALL) %THEN %STR(040 050 060 140
160 170 700 710 720 730 740 750 210 211 220 212 221
215 216 230);
%ELSE %IF &LVLSVAR=%STR() AND
(&NAME=%STR(STATE) OR &NAME=%STR(COUNTY) OR
&NAME=%STR(TRACT) OR &NAME=%STR(BG) OR

```

```

&NAME=%STR(PLACE) OR &NAME=%STR(COUSUBCE)
OR &NAME=%STR(MCD) OR
&NAME=%STR(COUSUBFP) OR &NAME=%STR(CCCE)
OR &NAME=%STR(ANRC) OR &NAME=%STR(AIANACE)
OR &NAME=%STR(AIANAFP)) %THEN %STR(&NAME);
%ELSE %IF &LVLSVAR NE %STR() AND
&NAME=%STR(040) OR &NAME=%STR(050) OR
&NAME=%STR(060) OR &NAME=%STR(140) OR
&NAME=%STR(160) OR &NAME=%STR(170) OR
&NAME=%STR(700) OR &NAME=%STR(710) OR
&NAME=%STR(720) OR &NAME=%STR(730) OR
&NAME=%STR(740) OR &NAME=%STR(750) OR
&NAME=%STR(211) OR &NAME=%STR(220) OR
&NAME=%STR(212) OR &NAME=%STR(221) OR
&NAME=%STR(215) OR &NAME=%STR(216) OR
&NAME=%STR(230) OR &NAME=%STR(210) %THEN
%STR(&NAME);
%ELSE %IF &LVLSVAR NE %STR() AND
&NAME=%STR(STATE) %THEN %STR(040);
%ELSE %IF &LVLSVAR NE %STR() AND
&NAME=%STR(COUNTY) %THEN %STR(050);
%ELSE %IF &LVLSVAR NE %STR() AND
&NAME=%STR(VTD) %THEN %STR(700);
%ELSE %IF &LVLSVAR NE %STR() AND
(&NAME=%STR(MCD) OR
&NAME=%STR(COUSUBCE) OR &NAME=%STR(CCD))
%THEN %STR(060);
%ELSE %IF &LVLSVAR=%STR() AND
&NAME=%STR(TRACT) %THEN %STR(140);
%ELSE %IF &LVLSVAR NE %STR() AND
(&NAME=%STR(BG) OR
&NAME=%STR(BLKGRP OR &NAME=%STR(BLOCKGRP)
OR &NAME=%STR(BLKGROUP)) %THEN %STR(150);
%ELSE %IF &LVLSVAR NE %STR() AND
&NAME=%STR(PLACE) %THEN %STR(160);
%ELSE %IF &LVLSVAR NE %STR() AND
&NAME=%STR(CCCE) %THEN %STR(170);
%ELSE %IF &LVLSVAR NE %STR() AND
&NAME=%STR(ANRC) %THEN %STR(230);
%ELSE %IF &LVLSVAR NE %STR() AND
(&NAME=%STR(AIANACE) OR
OR &NAME=%STR(AIANAFP)) %THEN %STR(210);
%ELSE %DO;
%PUT WARNING: A NON-STANDARD IDVAR (&NAME) IS
BEING USED.;
%PUT WARNING: EXECUTION CONTINUES, RESULT IS
UNPREDICTABLE;
%STR(&NAME)
%END;
%MEND VERIFID;

```

Table Modules

TABLE MODULES contain an array of lines-printed by each of the table display macros, arrays used to access table variables and compute statistics, table display macros to present tables and an "alltabs" macro to invoke all of the display macros in the module. The 1990 Public Law 94-171 file is small, but it has a sufficient number of tables to be illustrative of table modules in general. The PL94-171 table module follows:

```

%MACRO _ARRAYS;
ARRAY DEPTH { T } DEPTH1-DEPTH6;
RETAIN DEPTH1 2 DEPTH2 9 DEPTH3 9

```

```

DEPTH4 12 DEPTH5 12 DEPTH6 2;
ARRAY PCT (1) PC1-PC20;
ARRAY P1 (1) P11;
ARRAY P2 (1) P21-P215;
ARRAY P3 (1) P31-P315;
ARRAY P4 (1) P41-P416;
ARRAY P5 (1) P51-P516;
ARRAY H1 (1) H11;
ARRAY TABLE (T) P1-P5 H1;
%MEND;
%MACRO _P1;
  T = 1; *--INDEX TO DEPTH FIELD--*;
  LINK SETLINE; *--A COMMON MACRO USED TO
  DETERMINE
  WHETHER TO ADVANCE TO TOP OF A NEW
  COLUMN/PAGE--*;
  PUT @C 'P1: TOTAL PERSONS.....' P11 COMMA9./;
%MEND;
%MACRO _P2;
  T = 2;
  LINK SETLINE;
  IF P11>0 THEN PCTFACTOR=100/P11;
  ELSE PCTFACTOR=.;
  PB=1; PE=5; LINK PCT DO;
  PUT @C 'P2: PERSONS BY RACE'/
  @C 'WHITE.....' P21 COMMA9. +1 PC1 5.1 '%'/
  @C 'BLACK.....' P212 COMMA9. +1 PC2 5.1 '%'/
  @C 'AMERICAN INDIAN, ESKIMO,/'
  @C 'OR ALEUT.....' P213 COMMA9. +1 PC3 5.1 '%'/
  @C 'ASIAN OR PACIFIC/'
  @C 'ISLANDER.....' P214 COMMA9. +1 PC4 5.1 '%'/
  @C 'OTHER RACE.....' P215 COMMA9. +1 PC5 5.1
  '%'/;
%MEND;
%MACRO _P3;
  T = 3;
  LINK SETLINE;
  IF SUM(OF P31-P315)>0 THEN PCTFACTOR=100/SUM(OF
  P31-P315);
  ELSE PCTFACTOR=.;
  PB=1; PE=5; LINK PCT DO;
  PUT @C 'P3: RACE'/
  @C 'UNIVERSE: PERSONS 18 YEARS AND OVER'/
  @C 'WHITE.....' P31 COMMA9. +1 PC1 5.1 '%'/
  @C 'BLACK.....' P312 COMMA9. +1 PC2 5.1 '%'/
  @C 'AMERICAN INDIAN, ESKIMO,/'
  @C 'OR ALEUT.....' P313 COMMA9. +1 PC3 5.1 '%'/
  @C 'ASIAN OR PACIFIC/'
  @C 'ISLANDER.....' P314 COMMA9. +1 PC4 5.1 '%'/
  @C 'OTHER RACE.....' P315 COMMA9. +1 PC5 5.1
  '%'/;
%MEND;
%MACRO _P4;
  T = 4;
  LINK SETLINE;
  IF P11>0 THEN PCTFACTOR=100/P11;
  ELSE PCTFACTOR=.;
  PB=1; PE=6; LINK PCT DO;
  PUT @C 'P4: HISPANIC ORIGIN BY RACE'/
  @C 'UNIVERSE: PERSONS/'
  @C 'HISPANIC ORIGIN.....' P411 COMMA9. +1 PC1 5.1
  '%'/
  @C 'NOT OF HISPANIC ORIGIN:/'
  @C 'WHITE.....' P412 COMMA9. +1 PC2 5.1 '%'/
  @C 'BLACK.....' P413 COMMA9. +1 PC3 5.1 '%'/
  @C 'AMERICAN INDIAN, ESKIMO,/'

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```

  @C 'OR ALEUT.....' P414 COMMA9. +1 PC4 5.1 '%'/
  @C 'ASIAN PACIFIC/'
  @C 'ISLANDER.....' P415 COMMA9. +1 PC5 5.1 '%'/
  @C 'OTHER RACE.....' P416 COMMA9. +1 PC6 5.1
  '%'/;
%MEND;
%MACRO _P5;
  T = 5;
  LINK SETLINE;
  IF SUM(OF P51-P516)>0 THEN PCTFACTOR=100/SUM(OF
  P51-P516);
  ELSE PCTFACTOR=.;
  PB=1; PE=6; LINK PCT DO;
  PUT @C 'P5: HISPANIC ORIGIN BY RACE'/
  @C 'UNIVERSE: PERSONS 18 YEARS AND OVER/'
  @C 'HISPANIC ORIGIN.....' P511 COMMA9. +1 PC1 5.1
  '%'/
  @C 'NOT OF HISPANIC ORIGIN:/'
  @C 'WHITE.....' P512 COMMA9. +1 PC2 5.1 '%'/
  @C 'BLACK.....' P513 COMMA9. +1 PC3 5.1 '%'/
  @C 'AMERICAN INDIAN, ESKIMO,/'
  @C 'OR ALEUT.....' P514 COMMA9. +1 PC4 5.1 '%'/
  @C 'ASIAN PACIFIC/'
  @C 'ISLANDER.....' P515 COMMA9. +1 PC5 5.1 '%'/
  @C 'OTHER RACE.....' P516 COMMA9. +1 PC6 5.1
  '%'/;
%MEND;
%MACRO _H1;
  T = 6;
  LINK SETLINE;
  PUT @C 'H1: HOUSING UNITS.....' H11 COMMA9./;
%MEND;
%MACRO _PL94ALL;
  %_P1 %_P2 %_P3 %_P4 %_P5 %_H1;
%MEND;

```

Future Enhancements

The TABRGEN system has seen only limited use because it is expensive to run and we have a more efficient alternate means of producing dumps of 1990 STF1 in the State Data Center Association compiled data step profile reports. The first enhancement to TABRGEN must be employing the compiled macro facility to increase the efficiency of the system. Other possible enhancements would include a SAS/AF* front end for invoking the macro and/or generating report job setups and a SAS/AF front end for generating table macros. Of course, additional TABLE and DESCRIPTOR modules will be developed.

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