USING SAS WITH THE IBM 3800 AND 6670

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ABSTRACT

SAS users who have access to an IBM 3800 laser printer or an IBM 6670 Information Distributor (Word Processor) can make use of many of the inherent features of these devices. Very few changes to their existing programming methods are required. This paper examines some of the features of these devices and demonstrates how these capabilities can be incorporated in SAS programs.

I. THE IBM 3800

Many special features are standard in the IBM 3800 laser printer. This printer uses a modulated laser beam to produce an image of a page to be printed on a rotating drum. It can be printed at about 200 pages per minute at a constant speed. SAS applications programs require no changes to make use of the 3800 when changing from a 3211 or 1403 impact printer. There are many other features that an imaginative user can make use of. These include:

1. Selection of character size and interline spacing.
2. Generation of multiple copies, with each copy an original.
3. Copy modification without program modification.
4. Forms overlay, allowing picture imposition upon output.
5. Inclusion of special graphics characters for plotting/charting.
6. User-defined symbols, allowing corporate logos to be imposed on the output.
7. Output may be rotated 90 degrees on a page with an optional IUP (purchased program).
8. Upper and lower case output.
9. A choice of format characters, allowing the user to "box" in his outputs.

However, the conversion from an impact printer is not totally transparent to the SAS user. The limitations include:

1. The overprint capability of the impact printer no longer exists, since the printer uses a laser beam of a single diameter to print. Thus, the SAS OPTIONS statement must be modified for OPTIONS NOOVERPRINT; otherwise, multiple lines are printed when the user attempts to darken a line as with SAS error messages.

2. The 3800 reserves the top and bottom 1/2 inch for accelerating and decelerating paper; programs that are designed to make use of this area must be modified. The LINESIZE option has to be reset for the paper size in the printer.

USING 3800 FEATURES

3800 Character Sets

The SAS user can make use of the IBM-defined character sets available with the 3800. Northeast Utilities Service Company (NUSCO) utilizes the following character sets:

Table 1. Character Set Definitions at NUSCO

Character Set Name	Pitch	NUSCO SYSOUT Class	Description
GF15	15	A	All upper case Standard character set
GF12	12	E	12 pitch upper case
GF10	10	D	10 pitch upper case
GFC	15	C	Condensed 15 pitch 12 lines/inch
T11	10	G	Upper and lower case text
ET89	10	9	Rotated output upper and lower case
SPEC	15	A	Installation defined special characters, logo, and upper case text

The standard paper size used at NUSCO is 8-1/2 by 12 inches. This paper permits the user to cut off the top and bottom perforations and end up with an 8-1/2 by 11 sheet of paper. The character set most often used is GF15, as lower case prints as upper case; interline spacing is 8 lines per inch. In converting from a 3211 impact printer to the 3800, 60 lines per page are still printed with this choice (8.5 inches - 1 inch border)*8 lines per inch = 60). The GFC character set is a condensed print; it allows an interline spacing of 12 lines per inch, and thus 90 lines per page. With 14-1/2 by 11 inch paper, 120 lines per page could be printed, thus resulting in a paper savings of 50% for SAS outputs.

Character Set and Interline Spacing Selection

In order to make use of the nonstandard 3800 character sets, the SAS batch execution procedure must be modified. This is done in several ways.

The SAS procedure can have additional parameters added to indicate character set and number of lines per inch to print. For example:

```
//STEP1 EXEC SAS,CHARSET=GF15,LPI=8
```

specifies the NUSCO default character tables and interline spacing.

```
//STEP2 EXEC SAS,CHARSET=T11,LPI=6
```

changes to upper and lower case print spaced at 6 lines per inch.

Changes to the installation SAS procedure itself are:

```
//SAS PROC CHARSET=GF15,LPI=8,WORK=10
//SAS EXEC PGM=SAS
 .
 .
//FT11F001 DD SYSOUT=A,
//  CHARS=&CHARSET,FCB=LP&LPI
//FT12F001 DD SYSOUT=A,
//  CHARS=&CHARSET,FCB=LP&LPI
 .
 .
```

In this example, the CHARSET= parameter is one of the character set names described in Table 1. The FCB= parameter is a forms control parameter which is created by the installation. It describes the number of lines per inch and number of lines per page. The FCB is dependent on the size of the paper in the printer. Figure 1 shows some standard FCB definitions created with the 3800 utility program IEBIMAGE.

A second way of specifying the character set and interline spacing is with procedure overrides. This is a useful method if a user does not want to modify the standard installation procedure. With this method, the job control language for the FT11F001 and FT12F001 DD cards is explicitly specified. Example:

```
//STEP1 EXEC SAS
//FT11F001 DD SYSOUT=A,CHARS=T11,
//  FCB=LP10
//FT12F001 DD SYSOUT=A,CHARS=T11,
//  FCB=LP10
//SYSIN DD *
 .
 .
SAS PROGRAM
 .
 .
/*
```

This method is useful in that the user can choose particular print styles for particular files. The order of the JCL cards is very important. They must be in the same order as in the installation procedures. The SAS program listing may be in the standard print and have the SAS outputs in the test character set. Additionally, multiple DD cards can be added with different character sets and use PROC PRINTTO to select the character set for a particular report.

These two methods of character set selection only function with batch runs of SAS.

In order to address the problem of SAS use of different character sets under TSO, NUSCO has SYSOUT classes for each of the character sets. The TSO user chooses his character set at the time that he issues the SAS command. Example: SAS SYSOUT(D). The CLIST is modified: ALLOC FILE (FT12F001) SYSOUT (&SYSOUT). The computer operator waits until a group of

outputs are collected in an output class and then changes the printer FCB and CHARS with a set of JES2 printer control commands.

A sample of these operator commands is: $PPRT1; $TPRT1,C=LPB,Q=D,T=GF10; $SPRT1.   This interface allows the SAS TSO user easy access to the extended 3800 character sets.

Upper and Lower Case Characters

TSO and VSPC users of SAS can make use of the lower case capabilities of their keyboards when using a terminal with this feature. In TSO, a set of SAS program statements is edited as follows:

```
EDIT program name DATA ASIS
```

The ASIS option allows both upper and lower case letters. In VSPC, the user should issue the TRANSLATE OFF command before attempting to user lowercase letters.

Use of lowercase is helpful in TITLE statements; input data, as in the case of names; or when creating your own report formats with PUT statements. One example:

```
DATA; INPUT FIRST & LAST &;
     FILE PRINT; PUT 'The name is' FIRST
         LAST;
     CARDS;
     SAS Institute
      .
      .
     TITLE Sample of Upper and Lower Case
         Use;
```

Note that all SAS keywords must be in upper case. You must use the T11 character set on the 3800 to see the results in both cases. Example: The default //FT12F001 DD SYSOUT=A, CHARS=T11 character set GF15 "folds" lower case into capitals.

Additional Copies

The 3800 allows multiple copies to be printed with each copy of original. Users of batch SAS can incorporate this quite easily either through a SAS execution procedure change or through a procedure override. The parameter to be added is a "COPIES=" on each SYSOUT file.

A.   Changes to Execution Procedure

```
//SAS PROC LOGCOPY=1,PRTCOPY=1,
//  WORK=10,...
 .
 .
//FT11F001 DD SYSOUT=&SYSOUT,
//  COPIES=&LOGCOPY
//FT12F001 DD SYSOUT=&SYSOUT,
//  COPIES=&PRTCOPY
```

B.   Specifying Number of Copies

```
//STEP EXEC SAS,LOGCOPY=2,PRTCOPY=9
```

This yields two copies of the SAS log and nine copies of the print output.

C. Direct Overrides

```
//STEP EXEC SAS
//FT11F001 DD SYSOUT=A,COPIES=2
//FT12F001 DD SYSOUT=A,COPIES=9
```

This would yield the same results as in (B).

The use of the COPIES parameter can save valuable processor time often used to rerun a SAS program to obtain additional copies of the output.

Special Characters

One of the most useful features of the 3800 is the capability of each installation to create new characters such as the Greek letter " ", change existing characters, such as the zero to "0". New character sets can be created. For example, the many special characters for the language APL can be made into a 3800 character set; and foreign languages, boldface print, composite characters, etc., can all be made into printable 3800 character sets.

Letters from different character sets can be printed on the same page. PROC CHART mentions using special hex characters with the "SYMBOL=" parameter in PROC CHART, described in "SAS User's Guide 1979 Edition." The character mentioned in this document is not a standard character. Each installation must define it themselves. NUSCO chose to add this and several other special characters for use with SAS.

New character definition is done with the 3800 utility program IEBIMAGE. Once a character is defined, it can be added to different character sets. Definition of character sets is rather complex. Figure 2 contains a sample of the basic job to define several special characters. You can implement these without going through the gyrations of comprehension of 3800 WCGM generation, character definition, etc.

The special characters so defined are used in PROC PLOT, PROC CHART, and with PUT statements. The box character is most often used with the PROC CHART; the circle character with PROC PLOT. Samples of use of these characters are shown in Figures 3 and 4.

Format Characters

The 3800 printer has a group of standard format characters. Characters are useful in reporting writing as they allow columns to be boxed in without any gaps as is evident in such procedures as PROC FREQ. The normal way of using the 3800 format characters is awkward, forcing one to use a form of overprinting and multiple character sets. The amount of SAS program statements is increased and the JCL becomes more difficult to use. In order to resolve this problem, the FM15 format character set can be copied into a new or existing character set. The new hexadecimal features of SAS79 enable one to quickly and easily specify each of these characters. Figure 5 contains part of the 3800 utility program used to create the format character set at NUSCO. Table 2 was created using this format group and illustrates use of the "box" capability within a SAS program.

The creation of this special character set can easily be modified by any installation that uses 12 or 10 pitch characters as its default. The 3800 Programmer's Guide specifies the EBCDIC codes for each of the character pitches.

Logo Definitions

Most companies have some type of a corporate logo. With the 3800, it is possible to define a group of special characters that, when put together on a page in the proper order, create the company logo. The Northeast Utilities logo consists of a large "NU". To create the logo, we drew a large logo and then divided it down into 33 unique pieces - eleven characters wide and three characters down. Each character was then defined and added to our special character arrangement table, SPEC. Figure 6 contains a sample of this definition.

How is the logo used with SAS? There are two methods of doing this. First, when using PUT statements, the characters making up the logo are specified:

```
PUT

@10'0102030405060708090A0B'X/
@10'0C0D0E0F10111213141516'X/
@10'1718181A1B1C1D1E1F2021'X/;
```

Each hex character corresponds to one piece of the logo. This method is limited only to user-written reports. SAS PROCS cannot use this method. It also leaves room for error if the user incorrectly specifies one of the hexadecimal character strings.

The second method makes use of the 3800 capability to modify copies. This permits every page of the SAS report to have the logo on it. The only restriction to the user is that he cannot make use of the part of the page where the logo appears. The NU logo appears in lines 1-3, columns 1-10 since this area is left unused by SAS.

A copy is modified using the IEBIMAGE utility. Individual copies can be modified or lines changed. For instance, the title "STATISTICAL ANALYSIS SYSTEM" could be replaced with your company name with the modify capability. Figure 7 contains the COPYMOD statements to display the NU logo in columns 1-11, lines 1-3 of every page.

Rotated Output

An IBM Installed User Program (IUP), 5796-ARE, is available for printing output sideways on a page. This program is very useful for printing in 8-1/2 by 11 format for documantation and storage purposes. Removing the perforations and three-hole punching the paper creates an excellent report medium for storage in standard binders. The free-format capabilities of SAS prove to be very useful in this environment. Our printer paper alignment permits 100 lines per page and 90 columns across. Use of the OPTIONS LINESIZE=90 PAGESIZE=100, correctly formats the output on a "rotated" page.

```
//*
//*    FIGURE 1. FCB DEFINITION AND SAMPLE OF USE
//*
//01003586 JOB (VSP,008),
//         CARD          CLASS=F,MSGLEVEL=1,TIME=1,MSGCLASS=R
//LIST3800 EXEC PGM=IEBIMAGE
//SYSPRINT  DD  SYSOUT=A,FCB=LP8
//SYSUT1    DD  DSN=SYS1.IMAGELIB,DISP=SHR
//SYSIN     DD  *
       FCB       LPI=(6,45),SIZE=85,CH1=1,CH2=4,CH3=8,CH4=12,        XXXXX
                 CH5=16,CH6=20,CH7=25,CH8=28,                        XXXXX
                 CH9=32,CH10=36,CH11=40,CH12=45
       NAME      LP6(R)
       FCB       LPI=(8,60),SIZE=85,CH1=1,CH2=4,CH3=8,CH4=12,        XXXXX
                 CH5=16,CH6=20,CH7=25,CH8=28,                        XXXXX
                 CH9=32,CH10=36,CH11=40,CH12=60
       NAME      LP8(R)
       FCB       LPI=(12,90),SIZE=85,CH1=1,CH2=4,CH3=8,CH4=12,       XXXX
                 CH5=16,CH6=20,CH7=25,CH8=28,                        XXXXX
                 CH9=32,CH10=36,CH11=40,CH12=90
       NAME      LP12(R)
```

```
//*
//*   FIGURE 2. CREATION OF SOME SPECIAL CHARACTERS
//*
// JOBCARD    OLEKSIW,CLASS=F,MSGLEVEL=1,TIME=1,MSGCLASS=R
//LIST3800 EXEC PGM=IEBIMAGE
//SYSPRINT  DD  SYSOUT=*,CHARS=SPEC
//SYSUT1    DD  DSN=SYS1.IMAGELIB,DISP=SHR
//SYSIN     DD  *
    GRAPHIC  ASSIGN=(23,15)
    XXXXXXXXXXXX              SEQ=05
    XXXXXXXXXXXX              SEQ=06
    XXXXXXXXXXXX              SEQ=07
    XXXXXXXXXXXX              SEQ=08
    XXXXXXXXXXXX              SEQ=09
    XXXXXXXXXXXX              SEQ=10
    XXXXXXXXXXXX              SEQ=11
    XXXXXXXXXXXX              SEQ=12
    XXXXXXXXXXXX              SEQ=13
    XXXXXXXXXXXX              SEQ=14
    XXXXXXXXXXXX              SEQ=15
    XXXXXXXXXXXX              SEQ=16
    XXXXXXXXXXXX              SEQ=17
    XXXXXXXXXXXX              SEQ=18
    XXXXXXXXXXXX              SEQ=19
    XXXXXXXXXXXX              SEQ=20
    XXXXXXXXXXXX              SEQ=21
    XXXXXXXXXXXX              SEQ=22
    GRAPHIC  ASSIGN=(25,15)
    XXX         X            SEQ=05
    XXX                      SEQ=06
     XXX                     SEQ=07
     XXXX                    SEQ=08
      XXX                    SEQ=09
      XXXX                   SEQ=10
       XXX                   SEQ=11
       XXX                   SEQ=12
       XXXX                  SEQ=13
        XXX                  SEQ=14
        XXX                  SEQ=15
        XXXX                 SEQ=16
         XXX                 SEQ=17
         XXX                 SEQ=18
         XXX                 SEQ=19
         XXX                 SEQ=20
         XXX                 SEQ=21
    X        XX              SEQ=22
    GRAPHIC  ASSIGN=(28,15)
      XX                     SEQ=10
    XXXXXXXX                 SEQ=11
    XXXXXXXXXX               SEQ=12
    XXXXXXXXXXXX             SEQ=13
    XXXXXXXXXXXX             SEQ=14
    XXXXXXXXXXXX             SEQ=15
    XXXXXXXXXX               SEQ=16
    XXXXXXXX                 SEQ=17
      XX                     SEQ=18
    GRAPHIC  ASSIGN=(2A,15)
      XX                     SEQ=08
     XXXX                    SEQ=09
    XXXXXX                   SEQ=10
    XXXXXXXX                 SEQ=11
    XXXXXXXXXX               SEQ=12
    XXXXXXXXXXXX             SEQ=13
    XXXXXXXXXX               SEQ=14
    XXXXXXXX                 SEQ=15
    XXXXXX                   SEQ=16
     XXXX                    SEQ=17
      XX                     SEQ=18
    NAME SPEC(R)
SPEC   TABLE GCMLIST=SPEC,CGMID=(86,FF),
           LOC=((00,23,1),(01,25,1),(02,28,1),(03,2A,1))
    NAME SPEC(R)
```

```
//*   FIGURE 3 - SAS PROGRAM TO USE SPECIAL 3800 SYMBOLS ;
//*
//01003589 JOB (VSP,008),
//         ' JIM OLEKSIW ',CLASS=Q,
//   MSGLEVEL=1,MSGCLASS=A,TIME=(,15)
//ST EXEC SAS79,OPTIONS='LINESIZE=72,PAGESIZE=35,NODATE' ;
//FT11F001  DD  SYSOUT=*,CHARS=SPEC
//FT12F001  DD  SYSOUT=*,CHARS=SPEC,MODIFY=LOGO
//SYSIN DD  *
TITLE BIORYTHM CYCLES;
DATA SAMP ; DO X =1 TO 15 ; Z=SIN(X-5); Y = COS(X) ; OUTPUT ; END ;
TITLE FIGURE 4. SAMPLES OF 3800 SPECIAL CHARACTERS WITH SAS ;
PROC CHART ; VBAR X / SYMBOL='23'X  SUMVAR=Y MIDPOINTS=0 TO 16 BY 2 ;
PROC PLOT ; PLOT Y*X='2A'X  Z*X='28'X /OVERLAY HREF=5 HREFCHAR='81'X
 VREF=0 VREFCHAR='92'X ;
```

4. SAMPLES OF 3800 SPECIAL CHARACTERS WITH SAS   2

```
PLOT OF Y*X    SYMBOL USED IS ♦
PLOT OF Z*X    SYMBOL USED IS ♣
```

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TABLE 2. 3800 FORMAT CHARACTERS AND THEIR CODES
IN CHARACTER SET "SPEC"

CHARACTER	HEX CODE	LOWERCASE EBCDIC EQUIVALENT
┃	81	A
┎	82	B
┐	83	C
┘	84	D
┗	85	E
┣	86	F
┫	87	G
┳	88	H
┻	89	I
╋	91	J
━	92	K

```
//*  FIGURE 5.B.
//*     SAS PROGRAM TO PRINT OUT THE TABLE OF FORMAT
//*     CHARACTERS MODIFIED FOR EASIER USE
//*
//  JOBCARD
//ST EXEC SAS79
//FT11F001  DD  SYSOUT=9  (3800 90 DEGREE PRINT)
//FT12F001  DD  SYSOUT=A,CHARS=SPEC,COPIES=2,MODIFY=LOGO
//SYSIN DD  *
DATA _NULL_ ;
      FILE PRINT PRINT ;
      PUT //a35 ' TABLE 2.   3800 FORMAT CHARACTERS AND THEIR
         a35 '              IN CHARACTER SET "SPEC"
  'bkkkkkkkkkkkkkkkhkkkkkkkkkkkkkhkkkkkkkkkkkkkkkc'/a30
  'a                     a              a     LOWERCASE  a'/a30
  'a   CHARACTER         a   HEX CODE   a      EBCDIC    a'/a30
  'a                     a              a    EQUIVALENT a'/a30
  'fkkkkkkkkkkkkkkkjkkkkkkkkkkkkkjkkkkkkkkkkkkkkkg'/a30
  'a       a             a    81       a        A       a'/a30
  'a       b             a    82       a        B       a'/a30
  'a       c             a    83       a        C       a'/a30
  'a       d             a    84       a        D       a'/a30
  'a       e             a    85       a        E       a'/a30
  'a       f             a    86       a        F       a'/a30
  'a       g             a    87       a        G       a'/a30
  'a       h             a    88       a        H       a'/a30
  'a       i             a    89       a        I       a'/a30
  'a       j             a    91       a        J       a'/a30
  'a       k             a    92       a        K       a'/a30
  'ekkkkkkkkkkkkkkkikkkkkkkkkkkkkikkkkkkkkkkkkkkkd'/
```

```
//*
//*   FIGURE 6.  PIECES OF SPECIAL CHARACTERS USED
//*     TO GENERATE A LOGO (TOTAL 33 CHARACTERS GENERATED)
//*
// JOBCARD     OLEKSIW,CLASS=F,MSGLEVEL=1,TIME=1,MSGCLASS=R
//LIST3800 EXEC PGM=IEBIMAGE
//SYSPRINT  DD  SYSOUT=*
//SYSUT1    DD  DSN=SYS1.IMAGELIB,DISP=SHR
//SYSIN     DD  *
   GRAPHIC    ASSIGN=(22,10)
XXXXXXXXXXXXXXXXXXX        SEQ=05
  XXXXXXXXXXXX            SEQ=06
  XXXXXXXXXXXX            SEQ=07
  XXXXXXXXXXXX            SEQ=08
  XXXXXXXXXXXX            SEQ=09
  XXXXXXXXXXXX            SEQ=10
  XXXXXXXXXXXX            SEQ=11
  XXX XXXXXXXX            SEQ=12
  XXX  XXXXXXX            SEQ=13
  XXX    XXXXXX           SEQ=14
  XXX     XXXXX           SEQ=15
  XXX      XXXX           SEQ=16
  XXX       XXX           SEQ=17
  XXX        XX           SEQ=18
  XXX                     SEQ=19
  XXX                     SEQ=20
  XXX                     SEQ=21
  XXX                     SEQ=22
   GRAPHIC    ASSIGN=(0E,15)
  XXX                     SEQ=05
  XXXXXX                  SEQ=06
  XXXXXXX                 SEQ=07
  XXXXXXXX                SEQ=08
  XXXXXXXXX               SEQ=09
  XXXXXXXXXX              SEQ=10
  XXXXXXXXXXX             SEQ=11
  XXXXXXXXXXXX            SEQ=12
  XXXXXXXXXXXX            SEQ=13
  XXXXXXXXXXXX            SEQ=14
  XXXXXXXXXXXX            SEQ=15
  XXXXXXXXXXXX            SEQ=16
  XXXXXXXXXXXX            SEQ=17
  XXXXXXXXXXXX            SEQ=18
  XXXXXXXXXXXX            SEQ=19
  XXXXXXXXXXXX            SEQ=20
  XXXXXXXXXXXX            SEQ=21
  XXXXXXXXXXXX            SEQ=22
   GRAPHIC    ASSIGN=(04,15)
XXXXXXXXXXXX              SEQ=05
  XXXX                   SEQ=06
  XXXX                   SEQ=07
  XXXX                   SEQ=08
  XXXX                   SEQ=09
  XXXX                   SEQ=10
  XXXX                   SEQ=11
  XXXX                   SEQ=12
X  XXXX                  SEQ=13
XX XXXX                  SEQ=14
XXXXXXX                  SEQ=15
XXXXXXX                  SEQ=16
XXXXXXXXXXXX             SEQ=17
XXXXXXXXXXXX             SEQ=18
XXXXXXXXXXXX             SEQ=19
XXXXXXXXXXXX             SEQ=20
XXXXXXXXXXXX             SEQ=21
XXXXXXXXXXXX             SEQ=22
SPEC    TABLE GCMLIST=SPEC,CGMID=(86,FF),
              LOC=((00,00,1),(01,01,1),(02,02,1),(03,03,1),
              (04,04,1),(05,05,1),(06,06,1),(07,07,1),
              (08,08,1),(09,09,1),(0A,0A,1),(0B,0B,1),
              (0C,0C,1),(0D,0D,1),(0E,0E,1),(0F,0F,1),
              (10,10,1),(11,11,1),(12,12,1),(13,13,1),
              (14,14,1),(15,15,1),(16,16,1),(17,17,1),
              (18,18,1),(19,19,1),(1A,1A,1),(1B,1B,1),
              (1C,1C,1),(1D,1D,1),(1E,1E,1),(1F,1F,1),
              (20,20,1),(21,21,1),(22,22,1),(23,23,1),
              (24,24,1),(25,25,1),(26,26,1),(27,27,1),
              (28,28,1),(29,29,1),(2A,2A,1),(2B,2B,1),
              (81,2C,1),(82,2D,1),(83,2E,1),(84,2F,1),
              (85,30,1),(86,31,1),(87,32,1),(88,33,1),
              (89,34,1),(91,35,1),(92,36,1),
              (2C,37,1),(2D,38,1),(2E,39,1),(2F,3A,1))
         NAME SPEC(R)
```
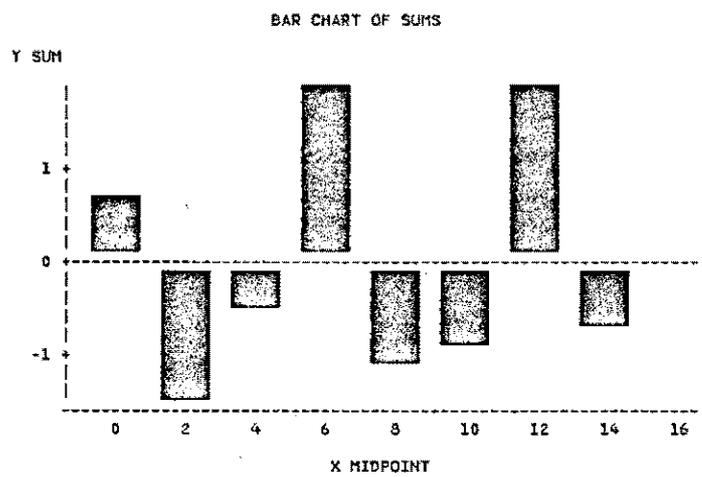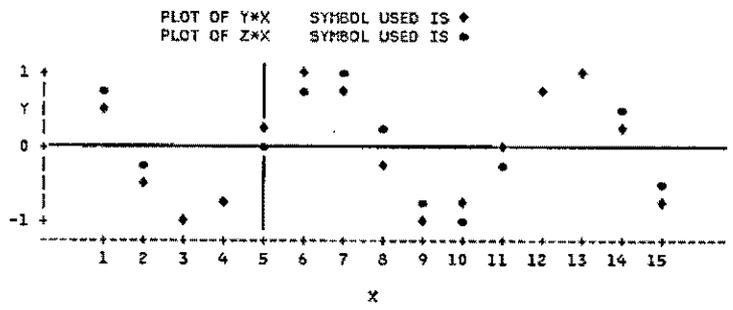
```
//*
//*   FIGURE 5.A.  SAMPLE OF SPECIAL
//*      FORMAT CHARACTER CREATION
//*
//  JOBCARD    OLEKSIW,CLASS=F
//LIST3800 EXEC PGM=IEBIMAGE
//SYSPRINT  DD  SYSOUT=*
//SYSUT1    DD  DSN=SYS1.IMAGELIB,DISP=SHR
//SYSIN     DD  *
   GRAPHIC    ASSIGN=(83,15)
   XXXXXXXX              SEQ=12
   XXXXXXXX              SEQ=13
   XXXXXXXX              SEQ=14
      XXXX               SEQ=15
      XXXX               SEQ=16
      XXXX               SEQ=17
      XXXX               SEQ=18
      XXXX               SEQ=19
      XXXX               SEQ=20
      XXXX               SEQ=21
      XXXX               SEQ=22
   GRAPHIC    ASSIGN=(84,15)
      XXXX               SEQ=05
      XXXX               SEQ=06
      XXXX               SEQ=07
      XXXX               SEQ=08
      XXXX               SEQ=09
      XXXX               SEQ=10
      XXXX               SEQ=11
   XXXXXXXX              SEQ=12
   XXXXXXXX              SEQ=13
   XXXXXXXX              SEQ=14
   GRAPHIC    ASSIGN=(85,15)
      XXXX               SEQ=05
      XXXX               SEQ=06
      XXXX               SEQ=07
      XXXX               SEQ=08
      XXXX               SEQ=09
      XXXX               SEQ=10
      XXXX               SEQ=11
   XXXXXXXX              SEQ=12
   XXXXXXXX              SEQ=13
   XXXXXXXX              SEQ=14
   GRAPHIC    ASSIGN=(86,15)
      XXXX               SEQ=05
      XXXX               SEQ=06
      XXXX               SEQ=07
      XXXX               SEQ=08
      XXXX               SEQ=09
      XXXX               SEQ=10
      XXXX               SEQ=11
   XXXXXXXX              SEQ=12
   XXXXXXXX              SEQ=13
   XXXXXXXX              SEQ=14
      XXXX               SEQ=15
      XXXX               SEQ=16
      XXXX               SEQ=17
      XXXX               SEQ=18
      XXXX               SEQ=19
      XXXX               SEQ=20
      XXXX               SEQ=21
      XXXX               SEQ=22
   NAME SPEC(R)
   INCLUDE GS15
SPEC    TABLE GCMLIST=SPEC,CGMID=(86,FF),
              LOC=((00,00,1),(01,01,1),
              (85,30,1),(86,31,1),(87,32,1),
              (89,34,1),(91,35,1),(92,36,1),
              (2C,37,1),(2D,38,1),(2E,39,1),
         NAME SPEC(R)
```

Rotated output requires two adjustments to the SAS execution procedure job control language. NUSCO has a special procedure called SAS90 to provide this extra JCL. The first step of the procedure, the SAS execution, writes out the output files to temporary disk storage. The second step reads these files and reorders them for proper placement on the page. The output data is then written to the 3800 using a special character set. This character set supports both upper and lower case letters. Users of the 90 degree print program have choices of 3 character set sizes; however, only the 10-pitch character set is large enough to be easily read.

The standard 90 Degree Print Program does not provide an easy vehicle for TSO users to rotate their print output. There are several solutions to this problem. In the first method, the TSO user would write all his printed output to a dataset. Upon finishing his execution of SAS, the user would then run another CLIST which would then submit a batch job which would process the TSO dataset through the 90 Degree Print Program and print it.

NUSCO chose to implement another method for allowing TSO users to print output rotated on the 3800. A special SYSOUT class "9" has been allocated to rotated output. The TSO user simply enters the SAS command with the SYSOUT parameter: SAS SYSOUT(9). The clist itself can be modified as follows:

```
SAS PROC WORK(10) ... SYSOUT()
.
.
.
IF &SYSOUT= THEN ALLOC FILE (FT12F001)
    DA(*)    ELSE    ALLOCATE    FILE
    (FT12F001) SYSOUT(&SYSOUT)
.
.
.
CALL 'SAS.LIBRARY(SAS)'
FREE FILE (FT12F001)
END
```

As in the previous method, the computer operator waits until multiple outputs appear in this SYSOUT class. Rather than issue JES2 printer control commands, he then starts an output writer for class 9. This writer routes the output to the rotate program, which then writes the output rotated. The SAS TSO user at NUSCO thus has the same 3800 output capabilities as that batch job user.

II. THE IBM 6670

The IBM 6670 Information Distributor is another output device accessible to SAS users at NUSCO. The 6670 has several features that the 3800 printer lacks. While both devices use a laser to fuse ink dots to paper, the 6670 uses a higher density of dots to produce superior quality of output. Several type styles are available, and the user can rotate his output. Each page is standard 8-1/2 x 11 typewriter paper. The user can choose to have his SAS output on either standard white, memo paper, or on the corporate letterhead. The 6670 is limited by its communicating speed and its primary use is as a copier and word processing printer. The SAS user cannot have a substantial volume of output printed on it as it limits the primary uses of the 6670 during the first shift. Large print volumes (thirty pages or more) are done at off-peak hours due to the low baud rate (speed) of the communication line at NUSCO.

The 6670 is interfaced to the mainframe as a JES2 remote job entry (RJE) work station. Implementation of the 6670 as an RJE printer involves the following steps:

IBM 370 System

1. In the MVS SYSGEN, define an RJE line.

2. Connect a 270X line controller to the MVS address or define an RJE line in the 3705 emulation program.

3. Connect a dial-in or leased line modem to this controller address.

4. Add in an RJE definition to the JES2 startup parameters.

5. Route some output to the work station.

6670 WP System

6. Define default communications interface features via mag card.

7. Create a JES2 /*SIGNON mag card.

8. Read the mag cards into the 6670, create the line connection, and start printing.

As NUSCO already had extensive RJE capabilities, only steps 4 through 9 were required.

The SAS to 6670 interface is quite simple for both batch and TSO. In the batch, the user adds a "/*ROUTE PRINT RMTn" card following the job card (where "n" is the RJE station number), or uses procedure overrides to specify the print destination. For example:

```
//SAS EXEC SAS
//FT12F001 DD SYSOUT=A,DEST=RMTn
//SAS.SYSIN DD *
```

Under TSO, a parameter can be added to the SAS CLIST to describe the printer destination as well as the SYSOUT class.

```
SAS      PROC    WORK(10)    SYSOUT()
         DEST(LOCAL)
.
.
.
IF &SYSOUT NE THEN .
ALLOC FILE(FT12F001) SYSOUT(&SYSOUT)-
    DEST(&DEST)
CALL 'SAS.LIBRARY(SAS)'
.
.
.
FREE FILE(FT12F001)
END
```

The default print location is the local 3800 printer. To run SAS to the 6670, the user specifies %SAS DEST(RMTn) SYSOUT(A). These interfaces allow the user to very easily route his print to the remote 6670 printer.

As with the 3800, this simple methodology does not allow one to use all the features of the 6670. The print produced is always that specified by the default communications interface and does not permit one to use alternate type styles, printing on both sides of a page, and rotated print. With these considerations in mind, a simple PL/1 program was written to pass an option string to a SYSOUT file. The 6670 reads the option string and modifies its print characteristics accordingly.

```
PGM: PROC(TEXT) OPTIONS(MAIN);
DCL TEXT CHAR(100) VAR,
SYSOUT FILE OUTPUT SEQUENTIAL;
IF TEXT r=" THEN DO;
WRITE FILE(SYSOUT) FROM(TEXT);
CLOSE FILE(SYSOUT);
END;
      ELSE;
END PGM;
```

Before each SAS execution, this program is called and any options desired are thus passed to the 6670.

The batch user then adds the following procedure call before his SAS JCL:

```
//STEP1 EXEC OPT6670,DEST=RMTn,
// OPTIONS=',PRINT 100_TYPE 86_,END'
//STEP2 EXEC SAS
//FT12F001 DD SYSOUT=A,DEST=RMTn
//SYSIN DD *
      PROC PRINT
```

Under TSO, a user would enter a clist before his SAS execution.

```
%OPT6670 DEST(RMTn)
PARM (',PRINT 100_TYPE 86_, END')
%SAS DEST(RMTn) SYSOUT(A)
```

The batch procedure is:

```
//OPT6670 PROC OPTION=,DEST=RMTn
//*PROCEDURE TO SPECIFY PRINTING
//*OPTIONS FOR THE 6670
//OPTIONS EXEC PGM=OPT6670,
// PARM='/&OPTIONS'
//SYSOUT DD SYSOUT=A,DEST=&DEST
```

The TSO CLIST is:

```
PROC 0 OPTIONS() DEST(RMTn)
ALLOC  FILE(SYSOUT)  SYSOUT(A)
    DEST(&DEST)
CALL 'USER.LINKLIB (OPT6670)'
FREE F(SYSOUT)
END
```

These procedures for batch and TSO thus give the SAS user the capability to use all the features of the 6670. This output cannot be distinguished from a typewritten page. Such high quality output is often desirable for the management reports produced with SAS.

SUMMARY

The IBM 3800 laser printer and 6670 word processor are both are high quality output devices each serving different purposes. Full use of the features and capabilities of these devices is not often achieved unless the user has an easy method of accessing these features. The various programs and procedures thus described provide this vehicle and should be useful in any installation with one or both of these devices.

REFERENCES

IBM: 3800 90 Degree Print Program IUP SH-20-2061-1, December 1979.

IBM: Programming the IBM 3800 Printing Subsystem, Independent Study Program, January 1979.

IBM: 3800 Printing Subsystem Programmer's Guide, GC26-3846-3, January 1980.

IBM: Programmer's Guide for Communicating with the IBM 6670 Information Distributor, Binary Synchronous Communications (BSC) Environment, G544-1007-1, November 1979.

```
//*
//* FIGURE 7. EXAMPLE OF COPYMODS
//* STATEMENT USED FOR LOGO OVERLAYING
//*
// JOBCARD   OLEKSIW,CLASS=F,MSGLEVEL=1,TIME=1,MSGCLASS=R
//LIST3800 EXEC PGM=IEBIMAGE
//*    NOTE: MODIFY=LOGO GENERATES THE LOGO
//SYSPRINT  DD  SYSOUT=*,MODIFY=LOGO,CHARS=SPEC
//SYSUT1    DD  DSN=SYS1.IMAGELIB,DISP=SHR
//SYSIN     DD  *
NU1  COPYMOD COPIES=(1,9),LINES=1,POS=5,                        X
              TEXT=(X,'010203040506070809090A0B')
NU2       COPYMOD COPIES=(1,9),LINES=2,POS=5,                   X
              TEXT=(X,'0C0D0E0F101112131415161')
NU3       COPYMOD COPIES=(1,9),LINES=3,POS=5,                   X
              TEXT=(X,'1718191A1B1C1D1E1F2021')
   NAME LOGO(R)
```