A SAS ROUTINE FOR MODIFYING THE OUTPUT OF PROC CHART TO MEET SPECIAL REPORT REQUIREMENTS

William Taylor, Biometric Research Institute, Inc.

1. Abstract

A large medical device clinical trial requires reports to the Food and Drug Administration (FDA) concerning the safety and efficacy of the device under study. These reports are frequent and must be clearly documented and titled to be easily reviewed by the staff. PROC CHART can display information both in tables and graphs. This feature lends itself well to satisfying medical device trial reporting needs. The output from PROC CHART contains all necessary numeric information, although a different format was desired and more labels were necessary. The output from the procedure was directed to a file using PROC PRINTTO. A SAS program then read this file and modified the print lines, adding vertical labels, page numbers, blanking cumulative percents and frequencies and repeats of group variable values, and adding a percentage scale at the top of the bar chart. The modified output was printed using a Xerox 9700 laser printer creating an acceptable format that could be directly entered into the report.

The modification of the output into an acceptable report format saved time and reduced errors that would have likely occurred if the same report had been manually prepared. This paper describes the program used to modify the PROC CHART output.

2. Introduction

To determine the safety and efficacy of medical devices, the Federal Investigational Device Exemption Regulations require a clinical trial investigation. FDA examines the results of these clinical trials to approve the device for general public use. Pending this approval, all patients who receive a medical device must be followed and reported on periodically as part of a clinical study. To expedite the approval process, the presentation of data and analyses to FDA must be clear, concise, and complete.

Having for many years submitted study results using hand generated tables and graphs, frequency distributions, and plots, we were pleased to have the variety of new display formats available in PROC CHART. The HBAR option not only generates horizontal bar charts but frequency statistics as well. Most data displays for this project required percentage HBAR charts. Percentage charts that also display the frequency count were necessary to show relative magnitude of different groups.

With a few modifications, the HBAR option can generate all desired data and in a format suitable for publication.

Original plans included generating the bar charts using PROC CHART and the HBAR option then typing in additional labeling and other information to produce a self-documenting chart. To simplify the chart, cumulative frequency and percentage tables would be omitted. This approach seemed reasonable until we established the need for 1500-2000 charts per report and about 20 reports. Thus, a solution that allowed the computer to do most or all of the work was felt to be advantageous, not only in time saved but also in reducing errors.

3. A Solution

The following statements were used to generate the PROC CHART output:

```sas
//FT2OFO01 DD DSN = ....;
PROC PRINTTO UNIT = 20 NEW;
PROC CHART DATA = ....;
FORMAT ....;
LABEL ....;
HBAR variable/DISCRETE TYPE = PCT AXIS = 100 SYMBOL = 'XO';
TITLE ....;
```

All charts generated were HBAR percentage charts. The axis = 100 option creates uniform axes for all charts. The G100 option used with the group variable forced the bars and statistics to add to 100% for each group. Two symbols were overprinted to create a solid bar and the PROC PRINTTO statement caused the output to be directed to a file. It was this file that was then processed to generate the final charts. It was desirable to generate charts that showed a variable grouped on more than one group variable. Only one group variable is allowed by PROC CHART; however, the procedure will
accept character variables. By creating a character string by concatenating the character values of more than one variable, it is possible to create a "multiple group variable". Some examples of this:

\[ \text{SURGPR} = \text{SURG} \times \text{INTERVAL} \times \text{L} \]

```
IF SURG = 1 Then _SURGPRB = 'PROBLEMS';
Else _SURGPRB = 'No PROBLEM';
```

A character variable is created that will have various values depending upon the values of multiple variables. Since PROC CHART handles the change in a character string as a different level of the variable, the statistics are computed for each level. Since the SAS release trimmed trailing blanks a 082 punch was placed at the end of a character string before the concatenation.

This non-printable character proved useful in locating the position of the variable value when blanking repetitive values. The program to process the PROC CHART OUTPUT is shown in Figure 1. Four subroutines perform the various tasks. A character string is input as well as the carriage control character. If this is the beginning of a page, the START routine is called. This routine initializes variables, page counters, etc. The bottom of the page was selected for page numbers since the report was to be found on the top. The variable L represents the line counter. The detection of the beginning of a page would generate blank output lines until the bottom of the page was reached, then the page number and confidential statement was placed in variable X. The character variable X is read in, modified, then output. Blank lines may be output to generate the page bottom.

The FINDVAR routine locates the group variable if present. If the label for the variable has not been looked-up, the LOOKUP subroutine is called. Here the variable label (max of 40 characters) is retained. Up to 90 labels may be used here.

The BLANK subroutine blanks out the cumulative statistics, as well as repeats of the first part of the group variable value. The table is easier to read if the entire group variable does not print each time, but only when the first part changes or when the variable first appears on the page. An additional scale is placed on the top of the chart to aid in interpreting the bars. The vertical labels are then created down the left side.

4. Performance and Limitations

The routine uses relatively little CPU time. Only percentage HBAR charts have been processed by us in this way; however, other charts could be similarly processed. Although not necessary to prevent trimming on concatenation in newer releases of SAS, the 082 punch does serve as a pointer to the various levels of the group variable.

5. Conclusions

The output of the program was written to a computer tape, which was processed directly on a Xerox 9700 laser printer generating the output pictured in Table 1.

These reports are bound and submitted directly to FDA. No manual clerical effort is involved in generating frequency numbers, page numbers, bar charts, or titles. PROC CHART and PROC PRINTTO have allowed for processing of the output into a format that has been well received by a government regulatory agency.
DATA ONE.OKE (KEEP= X ); * SAVE DATA SET CREATED;

* INITIAL INPUT:

READ X BITCHARS.

CC $ 1.

* X = A LINK OF OUTPUT FROM PROC CHART;
* CC = CARRAGE CONTROL CHARACTER;
* LOCATE BEGINNING OF NEW PAGE;

IF CC = ' ' THEN LINE START;

LINE FINDPAR; * LOCATE VARIABLE ON THIS PAGE;

LINE BLANK; * BLANK OUT INFO NOT DESIRED;

RETURN;

DEFINE:

SCAF: = LENGTH LABEL $ 40 ;
LENGTH STRING $ 40 ;
LENGTH PAGE $ 5 GROUP $ 11 BINARY $ 11 ;
"SETUP FOR ADDING PAGE NUMBERS AT BOTTOM OF PAGE;

DETERM L 0 PAGE " -1 ; * SET INITIAL VALUES;

RECEIVE BINARY ;

PAGE = PAGE " 1 ;

SAVE R X ; * SAVE LINE;

DO L = 0 TO 66 ; * LOCATE BOTTOM OF PAGE FOR PAGINATION;

X = " 1 ;

SUBSTR(X,55,46) = "PAGE X " [ 1 PAGE ] " CONFIDENTIAL " [ L = 67 ] ;

RETURN;

DEFINE:

SUBSTR(X,2,35) = "VAR "," GROUP " ;
VAR _ VIPOT (SOBSR(X,2,35),$-35, 1 r 11 LOO)( FOR VARIABLE 5UM - "CUM " ;
POS1 = INDBX(X,CUM) - 2 / "LOCATE 2ND CUM TITLE " ;
POS2 = INDBX(X,CUM) - 2 / "LOCATE 2ND CUM TITLE " ;

RETURN: 4 PRINT LABEL ETC,

END:

DATA ONE.OKE (KEEP= X ) ; * SAVE DATA SET CREATED;

* INITIAL INPUT:

READ X BITCHARS.

CC $ 1.

* X = A LINK OF OUTPUT FROM PROC CHART;
* CC = CARRAGE CONTROL CHARACTER;
* LOCATE BEGINNING OF NEW PAGE;

IF CC = ' ' THEN LINE START;

LINE FINDPAR; * LOCATE VARIABLE ON THIS PAGE;

LINE BLANK; * BLANK OUT INFO NOT DESIRED;

RETURN;

DEFINE:

SCAF: = LENGTH LABEL $ 40 ;
LENGTH STRING $ 40 ;
LENGTH PAGE $ 5 GROUP $ 11 BINARY $ 11 ;
"SETUP FOR ADDING PAGE NUMBERS AT BOTTOM OF PAGE;

DETERM L 0 PAGE " -1 ; * SET INITIAL VALUES;

RECEIVE BINARY ;

PAGE = PAGE " 1 ;

SAVE R X ; * SAVE LINE;

DO L = 0 TO 66 ; * LOCATE BOTTOM OF PAGE FOR PAGINATION;

X = " 1 ;

SUBSTR(X,55,46) = "PAGE X " [ 1 PAGE ] " CONFIDENTIAL " [ L = 67 ] ;

RETURN;

DEFINE:

SUBSTR(X,2,35) = "VAR "," GROUP " ;
VAR _ VIPOT (SOBSR(X,2,35),$-35, 1 r 11 LOO)( FOR VARIABLE 5UM - "CUM " ;
POS1 = INDBX(X,CUM) - 2 / "LOCATE 2ND CUM TITLE " ;
POS2 = INDBX(X,CUM) - 2 / "LOCATE 2ND CUM TITLE " ;

RETURN: 4 PRINT LABEL ETC,

END:
# Table 4.2.6

<table>
<thead>
<tr>
<th>SURGPRE</th>
<th>TENSION</th>
<th>FOLLOW UP TENSION</th>
<th>FREQ</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10-20</td>
<td>20-30</td>
<td>30-40</td>
<td>40-50</td>
</tr>
<tr>
<td>S PROBLEMS INT</td>
<td>6</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>10-14</td>
<td>15-19</td>
<td>20-24</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>15-19</td>
<td>20-24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N PROBLEM INT</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>10-14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>15-19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>20-24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>25-29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>30+</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Table 1

<table>
<thead>
<tr>
<th>FREQ</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>2.00</td>
</tr>
<tr>
<td>20</td>
<td>4.00</td>
</tr>
<tr>
<td>30</td>
<td>6.00</td>
</tr>
<tr>
<td>40</td>
<td>8.00</td>
</tr>
<tr>
<td>50</td>
<td>10.00</td>
</tr>
<tr>
<td>60</td>
<td>12.00</td>
</tr>
<tr>
<td>70</td>
<td>14.00</td>
</tr>
<tr>
<td>80</td>
<td>16.00</td>
</tr>
<tr>
<td>90</td>
<td>18.00</td>
</tr>
<tr>
<td>100</td>
<td>20.00</td>
</tr>
</tbody>
</table>

---

Confidential & Proprietary