CUSTOM REPORT WRITING USING SAS AND THE IBM 6670
LASER PRINTER

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ABSTRACT

Computer-generated reports need not be dull and difficult to read. The IBM 6670 laser printer has considerable flexibility, but is customarily used for text processing. With the use of some simple techniques SAS can be made to produce high-quality reports that appear to have been professionally typeset. For applications wherein SAS output would normally be retyped to produce final drafts of reports, it is usually possible to eliminate this step, thereby saving much time and completely eliminating transcription errors. Sample applications are presented below to demonstrate the use of the DATA step and the PUT statement to control the operation of the IBM 6670.

INTRODUCTION

The powerful report-writing capabilities of SAS continue to enjoy the appreciation of many users. In this era characterized by the fusion of data and word processing, however, managers increasingly wish to have computer-generated reports that have the polished appearance of those generated by word-processing systems. The physical inconvenience of binding and filing continuous forms fourteen-inch paper has further hindered the integration of text with number-oriented reports. One of the ways in which IBM (among other vendors) has responded has been the introduction of high-quality, plain-paper printers capable of communication with a host mainframe computer. When configured appropriately, such a device allows users to treat it as they would any line printer. The printed output, however, is far more appealing.

The 6670 permits formats to be stored internally in "arrangements." As many users have discovered, one of the possible arrangements correspond exactly to the format of usual line printer output: 132 columns across the longer side of a page, by (approximately) 60 lines down the shorter side. For many applications, this arrangement produces very appealing output. Especially convenient is the fact that programs need not be altered in order to accommodate this alternate destination, since the output page is identical in format -- although more convenient in size -- than that produced by a standard line printer.

There are two drawbacks to the use of the 6670 in this manner. First, it is not always desirable for output to be "rotated." For example, a table produced by PROC PRINT having 50 observations and two variables would probably be a good candidate for formatting in a non-rotated way. Second, the 6670 makes available only one typestyle when output is rotated. On the other hand, up to four typestyles are available (even on a single output line) when the output is not rotated.

The Louisiana State Department of Education maintains an elementary school testing program, and is required to generate and disseminate voluminous reports to each school district summarizing the test results. Public relations are significantly enhanced if these reports are highly readable and professional in appearance, and the availability of two 6670 printers presented an opportunity to explore their capabilities for printing data processing (as opposed to word processing) reports.

TECHNIQUES

The manner in which the 6670 formats an output page can be controlled by instructions transmitted from the host computer. These instructions are called Operator Command Language (OCL). OCL instructions allow the user to control, for example, the page length, line length, and typestyles available for use in a given document. In addition, changes in typestyles may be affected by first redefining, then transmitting whenever necessary, a control sequence associated with a given typestyle.

The most straightforward way to transmit initial OCL to the 6670 from within a SAS job is by means of a DATA step (Figure 1). Very simply, a NULL data step is executed in which OCL is directed to the print file as a series of character literals. The step is executed only once, of course. Part of the OCL defines "programmed stops" whose purpose is to define special characters that will signal the 6670 to make some change when those characters occur in the subsequent job stream. Most commonly, such characters are used to cause a change in typestyles for emphasis.

Once this DATA step has executed, the 6670 is ready to format the page as instructed, and to respond to programmed stops in the appropriate manner. In order to cause typestyle changes in a SAS report, all that is needed is to cause SAS to output the appropriate control characters whenever a change in typestyle is desired (Figure 2).
AUTOMATING THE PROCESS

With the advent of SAS 82, a powerful macro language is now available. A major improvement over the primitive macro capability supported under SAS 79 is the ability to pass parameters to a macro at invocation time. This seemed to present an excellent opportunity to automate the procedures described above. The user need only define and store a macro called "OCL" containing symbolic variables representing OCL instructions and codes. At invocation time, the SAS user specifies the OCL particulars as parameters, and the macro is expanded after symbolic substitution, to produce a DATA step like the one described above. Happily, SAS 82 allows one to specify parameter defaults, so the macro may be defined for the most common case. When no changes in OCL are desired, the SAS user need only invoke the macro with no parameters (Figure 4).

Figure 4
Use of a MACRO to Transmit Initial OCL to the IBM 6670 Laser Printer

```sas
%MACRO OCL(T1=86,T2=163,T3=160,MAR=12,FIR=4)
DATA NULL ; FILE PRINT;
PUT '|MOD'| /
'TYP &T1 &T2 &T3_&MAR_2' /
'&STOP' /
'&PRO' /
'&OUTPUT J63_2 OUTPUT J60_3 OUTPUT 86' /
'&END' ;
%MEND

%OCL
```

Since most custom report writing with SAS is done with PUT statements, the simplest way to send control sequences to the 6670 is to PUT them as character literals wherever desired. For the purpose of examining rough drafts, the user may direct the output to a line printer. Both the usual SAS output and the OCL and imbedded stops will be printed for inspection. This intermediate process is recommended where conservation of letter-quality paper is of concern.

The user is not strictly limited to PUT statements to output programmed stops. If a report is produced using PROC PRINT, the options are perhaps not as flexible, but a number of them exist. To cause a TITLE to appear in an alternate typestyle, one need only begin and end the title with the appropriate stop codes. If column headers are desired in alternate typestyles, variable labels can begin and end with stop codes, and PROC PRINT can be used with the LABEL or SPLIT option (Figure 3).
When changes are desired, parameters are easily coded (Figure 5).

Figure 6 contains an excerpt from a SAS-generated report in which some of the techniques discussed above were employed.

Figure 3
Use of Symbolic Substitution to Alter Default OCL Parameters Stored in a MACRO

%MACRO OCL(T1=86,T2=163,T3=160,MAR=12,FIR=4)
DATA _NULL_; FILE PRINT;
PUT 'MOD' /
"TYP &T1 &T2 &T3 &MAR,2' /
"END" ;
%MEND

%OCL(T1=162,FIR=10)
DATA ONE;

Figure 6

LOUISIANA BASIC SKILLS TESTING PROGRAM
GRADE TWO 1981-1982
Number and Percent of Students Attaining and Not Attaining Performance Standard

MATHEMATICS

<table>
<thead>
<tr>
<th>Parish or City</th>
<th>Regular Education</th>
<th>Special Education</th>
<th>Limited or Non-English Proficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE TOTALS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STUDENT TESTED</td>
<td>312,564</td>
<td>50,991 (16%)</td>
<td>2,398 (74%)</td>
</tr>
<tr>
<td>NUMBER ATTAINING</td>
<td>294,722 (95%)</td>
<td>2,272 (95%)</td>
<td>1,124 (92%)</td>
</tr>
<tr>
<td>NUMBER NOT ATTAINING</td>
<td>17,842 (5%)</td>
<td>226 (2%)</td>
<td>124 (9%)</td>
</tr>
<tr>
<td>ACADIA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STUDENT TESTED</td>
<td>162</td>
<td>14 (9%)</td>
<td>98 (61%)</td>
</tr>
<tr>
<td>NUMBER ATTAINING</td>
<td>122 (76%)</td>
<td>2 (2%)</td>
<td></td>
</tr>
<tr>
<td>NUMBER NOT ATTAINING</td>
<td>40 (24%)</td>
<td>96 (62%)</td>
<td></td>
</tr>
<tr>
<td>ALEX</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STUDENT TESTED</td>
<td>452</td>
<td>30 (66%)</td>
<td>16 (34%)</td>
</tr>
<tr>
<td>NUMBER ATTAINING</td>
<td>332 (74%)</td>
<td>12 (2%)</td>
<td></td>
</tr>
<tr>
<td>NUMBER NOT ATTAINING</td>
<td>120 (26%)</td>
<td>144 (78%)</td>
<td></td>
</tr>
<tr>
<td>ASCENSION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STUDENT TESTED</td>
<td>790</td>
<td>60 (7%)</td>
<td>730 (93%)</td>
</tr>
<tr>
<td>NUMBER ATTAINING</td>
<td>584 (74%)</td>
<td>144 (19%)</td>
<td></td>
</tr>
<tr>
<td>NUMBER NOT ATTAINING</td>
<td>206 (26%)</td>
<td>586 (81%)</td>
<td></td>
</tr>
<tr>
<td>ASSUMPTION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STUDENT TESTED</td>
<td>381</td>
<td>21 (5%)</td>
<td>360 (85%)</td>
</tr>
<tr>
<td>NUMBER ATTAINING</td>
<td>304 (79%)</td>
<td>36 (10%)</td>
<td></td>
</tr>
<tr>
<td>NUMBER NOT ATTAINING</td>
<td>77 (21%)</td>
<td>224 (60%)</td>
<td></td>
</tr>
</tbody>
</table>

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* Regular Education includes all regular education students and special education students classified as "gifted/talented," "hospital/homebound," or "speech impaired," except those whose home language is other than English and who are judged by their teachers as having limited or no proficiency in English.

** Special Education includes all special education students (regardless of proficiency in English) whose primary handicapping conditions are within categories 4-15 (see attached list).

*** Students in this category are regular education students whose home language is other than English and who are judged by their teachers as having limited or no proficiency in English.