

## Using SAS® to Automatically Generate Reports in Any Special Formats

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## ABSTRACT

SAS can be used to calculate statistics and display the results in table format, specifically PROC TABULATE, PROC REPORT and DATA \_NULL\_ can be used to generate tables. However tables are not the final step in real life, they are used in report writing. When people write report, often they insert or copy/paste the tables into their reports. When inserting or pasting tables, they cannot keep the original layout and have to reformat the tables. Imagining to insert or copy/paste 50 or 100 tables in a report, the process is painful. Besides, the table formats that SAS can produce are limited, SAS can't generate special format tables, for example, tables with special logos, tables using different color, font type, font size and font style for different sections, ... , etc. This presentation will introduce a SAS macro that can generate tables in any special formats. Moreover, this paper will present an idea to automatically generate tables in the body of report. Report writers don't need to insert and reformat the tables in their reports anymore. Also, the table validation/QC becomes much easier.

## INTRODUCTION

When SAS programmers are asked to generate a table, they are often presented a table template. What they need to do is to pull the real data and generate a table similar to the table template. Ideally, the table format should be identical to the template. However, not all formats can be mimicked by SAS. The following is a table template in Word format. In this template, different font styles and font sizes are used for different sections; Superscripts are also used; It even includes some special logos and shadowed areas. It's hard to generate this format using SAS. This paper will introduce a new approach to handle this crazy format: using SAS to calculate all information (i.e. Mean, SD, n and %), and then replace the data spot XXX in the template with the calculated numbers; In this way, you use the template format, actually you never touch or change the format. Your final table format will be identical to the template format. Two macros %TOWORD and %TOREPORT will be introduced, they were developed based on this approach. Some preparations need to be done before calling the macros :

1. Use SAS to calculate the information that will be displayed in the table.
2. Create a SAS data set to include all the calculated values in one variable.
3. Sort the calculated values in the order that is consistent with the table data point order (from top left to bottom right).

After the preparation, input the final data into the macros, the macros will automatically open the Word template and replace the data points XXX with the real values.



Table 1. Subject Characteristics

Characteristics ↓	Dosage		Overall N=XXX
	Dose 1 N=XXX	Dose 2 N=XXX	
<b>Age, yr</b>			
Mean (SD)	XXX(XXX)	XXX(XXX)	XXX(XXX)
<b>Race, n (%)</b>			
White	XXX(XXX%)	XXX(XXX%)	XXX(XXX%)
Black	XXX(XXX%)	XXX(XXX%)	XXX(XXX%)
Hispanic	XXX(XXX%)	XXX(XXX%)	XXX(XXX%)
Other	XXX(XXX%)	XXX(XXX%)	XXX(XXX%)
<b>Smoking Status, n (%)</b>			
Never Smoked	XXX(XXX%)	XXX(XXX%)	XXX(XXX%)
Past Smoker	XXX(XXX%)	XXX(XXX%)	XXX(XXX%)
Current Smoker <sup>a</sup>	XXX(XXX%)	XXX(XXX%)	XXX(XXX%)
<i>Light</i>	XXX(XXX%)	XXX(XXX%)	XXX(XXX%)
<i>Moderate</i>	XXX(XXX%)	XXX(XXX%)	XXX(XXX%)
<i>Heavy</i>	XXX(XXX%)	XXX(XXX%)	XXX(XXX%)
<b>BMI, kg/m<sup>2</sup></b>			
Mean (SD)	XXX(XXX)	XXX(XXX)	XXX(XXX)

SD = Standard deviation.  
a Light = 1-10 cigarettes/day;  
Moderate = 11-20 cigarettes/day;  
Heavy = ≥ 21 cigarettes/day.



SSSSSSSS.SAS

MM/DD/YY HH:MM:SS

## GENERATE TABLES IN ANY FORMATS

## Example 1.

In this example, we'll generate a table in the format of the above template; the information has been calculated and saved in SAS data set FDATA:

TEXT	MERGEID	_NAME_	ORDER
230	0.1	TOT3	0
150	0.3	TOT1	0
150	0.5	TOT2	0
50.02	1.0	MEAN1	1
3.78	2.0	STD1	1
51.10	3.0	MEAN2	1
4.28	4.0	STD2	1
50.89	5.0	MEAN3	1
3.93	6.0	STD3	1
. . . . .			
(more data)			

Variable TEXT will be used to fill the table; MERGEID, NAME and ORDER are used for sort and description purpose. The Word template is saved as C:\MOCK.DOC. Submit the following SAS program TEST.SAS :

```
%TOWORD( INDATA =FDATA,
          TEMPLATE=C:\MOCK.DOC,
          SAVEAS =C:\WTMP.DOC );
```

It will automatically open the table template and populate the following table and also save it as C:\WTMP.DOC.



Table 1. Subject Characteristics

Characteristics	Dosage		Overall N=230
	Dose 1 N=115	Dose 2 N=115	
<b>Age, yr</b>			
Mean (SD)	50.02(3.78)	51.10(4.28)	<b>50.89(3.93)</b>
<b>Race, n (%)</b>			
White	95(83%)	93( 81%)	<b>188( 82%)</b>
Black	9( 8%)	10( 9%)	<b>19( 8%)</b>
Hispanic	6( 5%)	6( 5%)	<b>12( 5%)</b>
Other	5( 4%)	6( 5%)	<b>11( 5%)</b>
<b>Smoking Status, n (%)</b>			
Never Smoked	57(50%)	62(54%)	<b>119(52%)</b>
Past Smoker	35(30%)	32(28%)	<b>67(29%)</b>
Current Smoker <sup>a</sup>	23(20%)	21(18%)	<b>44(19%)</b>
<i>Light</i>	8(35%)	7(33%)	<b>15( 7%)</b>
<i>Moderate</i>	11(48%)	11(52%)	<b>22(10%)</b>
<i>Heavy</i>	4(17%)	3(14%)	<b>7( 3%)</b>
<b>BMI, kg/m<sup>2</sup></b>			
Mean (SD)	26.22(3.59)	27.21(3.49)	<b>27.02(3.48)</b>

SD = Standard deviation.  
<sup>a</sup> Light = 1-10 cigarettes/day;  
 Moderate = 11-20 cigarettes/day;  
 Heavy = ≥ 21 cigarettes/day.



TEST.SAS

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**GENERATE TABLES IN THE BODY OF REPORT**

**Example 2.**

The following is a report shell in Word format. It includes texts and table templates :

This is an report example. Demographic information is summarized and the results are discussed in details.

Table 1 Subject Characteristics

Characteristics	Dosage		Overall N=XXX
	Dose 1 N=XXX	Dose 2 N=XXX	
<b>Age, yr</b>			
Mean (SD)	XXX(XXX)	XXX(XXX)	<b>XXX(XXX)</b>
<b>Race, n (%)</b>			
White	XXX(XXX%)	XXX(XXX%)	<b>XXX(XXX%)</b>
Black	XXX(XXX%)	XXX(XXX%)	<b>XXX(XXX%)</b>
Hispanic	XXX(XXX%)	XXX(XXX%)	<b>XXX(XXX%)</b>
Other	XXX(XXX%)	XXX(XXX%)	<b>XXX(XXX%)</b>

SD = Standard deviation.

Smoking status and BMI information are summarized in the following table and the results are discussed in details.

Table 2 Subject Smoking Status and BMI

Characteristics	Dosage		Overall N=XXX
	Dose 1 N=XXX	Dose 2 N=XXX	
<b>Smoking Status, n (%)</b>			
Never Smoked	XXX(XXX%)	XXX(XXX%)	<b>XXX(XXX%)</b>
Past Smoker	XXX(XXX%)	XXX(XXX%)	<b>XXX(XXX%)</b>
Current Smoker <sup>a</sup>	XXX(XXX%)	XXX(XXX%)	<b>XXX(XXX%)</b>
<i>Light</i>	XXX(XXX%)	XXX(XXX%)	<b>XXX(XXX%)</b>
<i>Moderate</i>	XXX(XXX%)	XXX(XXX%)	<b>XXX(XXX%)</b>
<i>Heavy</i>	XXX(XXX%)	XXX(XXX%)	<b>XXX(XXX%)</b>
<b>BMI, kg/m<sup>2</sup></b>			
Mean (SD)	XXX(XXX)	XXX(XXX)	<b>XXX(XXX)</b>

SD = Standard deviation.

<sup>a</sup> Light = 1-10 cigarettes/day;  
 Moderate = 11-20 cigarettes/day;  
 Heavy = ≥ 21 cigarettes/day.

The information need to be displayed in table1 and table 2 has been calculated and saved in SAS data sets FDATA1 and FDATA2 respectively.

Data FDATA1:

**TEXT**

230  
 150  
 150  
 50.02  
 3.78  
 51.10  
 4.28  
 50.89  
 3.93  
 ... ..

(more data)

Data FDATA2:

**TEXT**

230  
150  
150  
57  
50  
62  
54  
119  
52  
... ..

(more data)

Open the report shell, then submit the following SAS code:

```
%TOREPORT( INDATA=fdata1,
           START=Table 1 Subject Characteristics );
```

```
%TOREPORT( INDATA=fdata2,
           START=Table 2 Subject Smoking Status and BMI );
```

It will read the data from FDATA1 and FDATA2 to generate the following real report :

This is an report example. Demographic information is summarized and the results are discussed in details.

**Table 1 Subject Characteristics**

Characteristics	Dosage		Overall N=230
	Dose 1 N=115	Dose 2 N=115	
<b>Age, yr</b>			
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**Table 2 Subject Smoking Status and BMI**

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<i>Heavy</i>	4(17%)	3(14%)	<b>7( 3%)</b>
<b>BMI, kg/m<sup>2</sup></b>			
Mean (SD)	26.22(3.59)	27.21(3.49)	<b>27.02(3.48)</b>

SD = Standard deviation.

<sup>a</sup> Light = 1-10 cigarettes/day;

Moderate = 11-20 cigarettes/day;

Heavy = ≥ 21 cigarettes/day.

## DISCUSSION

Using those macros to generate tables not only makes it possible to generate complicated tables but also simplifies the validation process. Instead of physically comparing the validation data against the data in the tables, the validators can put the validation data into one variable in a SAS data set and use PROC COMPARE to compare the validation data with the data used in the macros. No format validation is needed.

Macros %TOWORD and %TOREPORT are designed to generate tables with fixed length. They cannot handle tables with non-fixed length: table length changes according to the available data. Further development needs to be done for those macros to handle tables with non-fixed length, and it is feasible.

## TRADEMARKS

SAS is registered trademark of SAS Institute Inc. in the USA and other countries. ® indicates USA registration. Other brand and product names are registered trademark or trademarks of their respective companies.

## REFERENCES

SAS Institute Inc. (1990), *SAS Language: Reference, Version 6, First Edition*, Cary, NC: SAS Institute Inc.

SAS Institute Inc. (1999), *SAS Macro Language: Reference, Version 8*, Cary, NC: SAS Institute Inc.

## APPENDIX

### Code for macro %TOWORD :

```
%MACRO TOWORD( INDATA=, TEMPLATE=, TEXT=TEXT,
               SAVEAS=_WTMP.DOC, SLEEP=5, DATASPOT=XXX,
               SOURCE=SSSSSSSS.SAS );
```

```
Data _NULL_;
  RDATE=DATE();
  RTIME=TIME();
  call symput('RUNDATE', PUT(RDATE, DATE9.));
  call symput('RUNTIME', PUT(RTIME, TIME8.));
RUN;
```

```
Proc sql noprint ;
  create table PROGNAME as
  select fileref, xpath
  from dictionary.exfiles ;
Quit;
```

```
Data _NULL_ ;
  SET PROGNAME ;
  WHERE ( index(COMPRESS(UPCASE(XPATH)), '.SAS') ) ;
  XPATH=TRIM(LEFT(COMPRESS(UPCASE(XPATH)))) ;
  If _N_=1 then
  Do;
    CALL SYMPUT('PROGNAME' , REVERSE( SCAN(reverse(XPATH),1,'') ) ;
  End;
RUN ;
```

```
X &TEMPLATE ;
```

```

FILENAME FTOWORD DDE 'WINWORD|SYSTEM';

DATA _NULL_;
X=SLEEP(&SLEEP);
RUN;

DATA _NULL_;
FILE FTOWORD ;
SET &INDATA END=EOF ;
LEN=LENGTH(TEXT) ;

IF _N_=1 THEN
DO;
  PUT '[StartOfDocument]';
  PUT '[EditReplace.Find="MM/DD/YY",.Replace="
    "&RUNDATE" " " ,.Direction=0,.ReplaceAll,.Format=1]';

  PUT '[StartOfDocument]';
  PUT '[EditReplace.Find="HH:MM:SS",.Replace="
    "&RUNTIME" " " ,.Direction=0,.ReplaceAll,.Format=1]';

  PUT '[StartOfDocument]';
  PUT '[EditReplace.Find=" "&SOURCE" " " ,.Replace="
    "&PROGNAME" " " ,.Direction=0,.ReplaceAll,.Format=0]';

  PUT '[StartOfDocument]';
END;

PUT '[EditReplace.Find=" "&DATASPOT" " " ,.Replace="
  &TEXT $VARYING200. LEN " " ,.Direction=0,.ReplaceOne,.Format=1]';

IF EOF THEN
DO;
  PUT '[FileSaveAs.Name=" "&SAVEAS" " " ,.Format=0]';
  PUT '[FileExit(2)]';
END;
RETURN;

RUN;

DATA _NULL_;
  PUT "NOTE: Output was saved to file &SAVEAS";
RUN;

%MEND ;

```

### Code for macro %TOREPORT :

```

%MACRO TOREPORT( INDATA=, TEXT=TEXT, SLEEP=5,
  DATASPOT=XXX, START= );

FILENAME FTOWORD DDE 'WINWORD|SYSTEM';

DATA _NULL_;
X=SLEEP(&SLEEP);
RUN;

DATA _NULL_;
FILE FTOWORD ;
SET &INDATA END=EOF ;
LEN=LENGTH(&TEXT) ;

IF _N_=1 THEN
DO;
  PUT '[EndOfDocument]';
  PUT '[EditFind .Find = " "&START" " " ,.Direction = 1,
    .WholeWord =0, .MatchCase = 0, .Format =0]';
  PUT '[EndOfLine]';
END;

PUT '[EditReplace.Find=" "&DATASPOT" " " ,.Replace="
  &TEXT $VARYING200. LEN " " ,.Direction=0,.ReplaceOne,.Format=0]';

RETURN;

RUN;

%MEND ;

```

### CONTACT INFORMATION

Your comments and questions are valued and encouraged.  
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