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Converting Thousands of Variables from Character to Numeric: The One-Hour Fix

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ABSTRACT

At the conclusion of many survey-based data collecting projects, recoding the hundreds and thousands of character variables to 'reserved scale' specified numeric variables is a uncomplicated but cumbersome task for SAS® programmers. If you are a person who likes to avoid a large amount of typing as much as I do, this paper will give you an idea of how to maintain high quality for this recoding task with minimal typing. This paper also answers the following questions: How can you create a powerful SAS® MACRO that will write the IF-ELSE-THEN Statement for you? How can you avoid any human errors such as typos? And how do you use MS Excel to speed up your work?

INTRODUCTION

As a programmer, I am often in situations in which very vast quantities of survey data need to be recoded into corresponding numeric values in a very short time. The recoding process is not necessarily a difficult one, but it has the potential to be very time-consuming and frustrating.

If we ignore the matter of program efficiency for a moment, there are so many words to type, between using IF-ELSE-THEN statements, SELECT-WHEN statements or PROC FORMAT tricks; the mere fact that there is so much to type means that there is a great risk of making small typos, such as omitting a semicolon or misspelling a variable name, both of which are errors that would require time and energy to de-bug. Even if you consider yourself to be the most detail-orientated person in the world, human error almost seems inevitable. Do you ever dream of using powerful SAS® MACRO to do all of the tedious typing for you? This paper will use a real example drawn from a specific project to demonstrate the quick tricks to do just that. With a basic knowledge of SAS® MACRO, you can make this dream a reality.

TAKE FULL ADVANTAGE OF WHAT WE HAVE

For all of our examples we are using data that is in two different files. First, we have a raw data file (see Figure 1a), which contains several records with answers to questions starting with variable Q1a (4001) in column H. Second, we have a Names and Labels spreadsheet (see Figure 1b), which contains labels for each question in the raw data.

While the files we have may not seem to be hard to handle, they are actually quite messy; there is some character raw data in Excel format, a separate Excel spreadsheet that contains the names and labels information for the new numeric variables and a detailed Questionnaire description, and finally instructions for us to recode the data. So how can we integrate these three files? Normally, we could write IF-ELSE-THEN codes that follow the logic reference provided by the Questionnaire description and then apply these codes to the raw data. The variable names and labels spreadsheet will be used to generate the SAS® labels. Unfortunately, this method still requires a great deal of effort. Instead, let us take another look at the raw data and Labels files.

	C	D	E	F	G	H	I	J
1	Access Code	Level Reference ID	Module ID	Module Reviewed	Module Submitted	Q1a (4001)	Q1b (4002)	Q1c (4003)
2	G5FAD	0315	07	No	Yes	YES	YES	NO
3	P4830	1055	07	Yes	Yes	NO	NO	NO
4	K7953	0592	07	No	Yes	YES	YES	YES
5	BF31	0506	07	Yes	Yes	NO	NO	NO
6	E7K3M	1058	07	No	Yes	YES	YES	YES
7	J585E	1077	07	No	No	NOT DISPLAYED	NOT DISPLAYED	NOT DISPLAYED
8	R2EF3	1036	07	No	Yes	YES	YES	NO
9	LF433	0568	07	No	Yes	YES	NO	NO
10	VBBDA	0706	07	No	Yes	YES	YES	YES
11	G1A3E	0926	07	No	Yes	YES	NO	NO
12	F79C4	0149	07	No	Yes	YES	YES	YES
13	V20BF	0895	07	Yes	Yes	YES	NO	NO
14	D4B9D	0720	07	No	Yes	NO	NO	NO
15	FFA3C	0486	07	Yes	Yes	YES	YES	NO
16	B2064	0351	07	No	Yes	NO	NO	NO
17	FA4E2	0917	07	No	Yes	YES	YES	YES
18	XD455	0491	07	No	Yes	YES	YES	YES
19	D1737	0017	07	No	Yes	YES	NO	YES
20	L7DDC	1125	07	No	Yes	YES	NO	YES
21	R25EB	0765	07	No	Yes	YES	YES	NO
22	KBECE	0954	07	No	Yes	NO	NO	NO

Figure 1a. Snapshot of the raw data

Question Variable	Question Variable Label
END142	END142 - Dist person oversee/coord school hlth/safety pol/activ
END143	END143 - R is person
END144a	END144a - Coordinator - Develop hlth/safety pol
END144b	END144b - Coordinator - Securing funding
END144c	END144c - Coordinator - Communic priorities
END144d	END144d - Coordinator - Linking cmty-based hlth-related resources
END144e	END144e - Coordinator - Facilitating collaboration
END144f	END144f - Coordinator - Liaison between dist office/overseers
END144g	END144g - Coordinator - Convening meetings
END144h	END144h - Coordinator - Coordinating prof dev
END145	END145 - Years responsible for coordinating
END146	END146 - R has undergrad degree
END147_1	END147_1 - R major - HE

Figure 1b. Snapshot of the Names and Labels Spreadsheet

The column heading “Q1a(4001)” in Figure 1a represents the first question of the survey, and it corresponds to the first variable name in Figure 1b, END142, which also represents the first question in the survey . Traditionally, we could write codes such as: ’IF Q1a(4001)=’YES’ THEN END142=1;’. However we should take advantage of the fact that we already know how the contents of these two files correspond to each other.

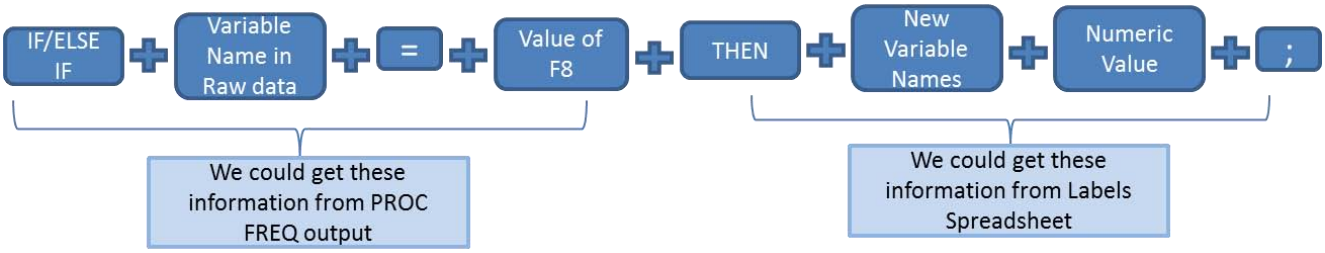
PROC FREQ—IT’S NOT JUST ABOUT THE FREQUENCIES

It might seem like a very strange idea to use the PROC FREQ procedure to begin recoding data. But in fact this procedure works perfectly.

	F8	Frequency Count	Percent of Total Frequency
1	DISPLAYED	1	0.1449275362
2	NO	110	15.942028986
3	NOT ANSWERED	14	2.0289855072
4	NOT DISPLAYED	48	6.9565217391
5	YES	517	74.927536232

Figure 2. Output of Proc Freq.

Take a close look at Figure 2 and you will notice that the values in the column for the variable labeled “F8” are all of the possible values this variable can have in the raw data. The output shown in Figure 2 almost follows the structure of a complete IF-THEN-ELSE statement. Although it is missing a few components of the IF-THEN-ELSE format, we can use this information to write the entire statement quite easily. The following diagram illustrates how to do this.



We must start with either the phrase "IF" or "ELSE IF", then reference the name of the variable in question (which we will retrieve by using a SAS® MACRO), an equal sign, and the value of the F8 variable (which was already generated, see Fig. 2). Next, we add the phrase "THEN" and then follow a similar format: the new variable names that we can retrieve from the Labels spreadsheet (Figure 1b), an equal sign, and the appropriate numeric value. Finally, we add a semicolon to indicate the end of the statement.

You may be wondering what the F8 variable stands for. Since the raw data is in Excel format, we can use the GET-NAMES function in our PROC IMPORT code. In this example, GETNAMES=NO is recommended. We can use this to easily assign sequential orders to the character variable names, which will be beneficial for the following steps.

DYNAMIC SAS® MACROS—MACROS THAT WILL DO ALL OF THE WORK FOR YOU

In the last step, we created the general frame of our codes. What we need to do now is to find an effective way to create a functional S SAS®AS MACRO that contains one MACRO variable to retrieve the value of F8, one to retrieve the variable names from the raw data and another to retrieve the new variable names from the Labels spreadsheet (Figure1b) and combine those MACRO variables together.

```
%macro freq;
%do i=8 %to 68;
proc freq data=hea noprint;
table F&i/out=q%eval(&i-7) (rename=(F&i=fvalue));
run;
data q%eval(&i-7);
set q%eval(&i-7);
length Raw $15;
Raw="F&i";
%end;
%mend;
%freq;
```

	F8	Frequency Count	Percent of Total Frequency	Raw
1	DISPLAYED	1	0.1449275362	F8
2	NO	110	15.942028986	F8
3	NOT ANSWERED	14	2.0289855072	F8
4	NOT DISPLAYED	48	6.9565217391	F8
5	YES	517	74.927536232	F8

Figure 2 Partial output of MACRO %freq

The code above will generate PROC FREQ output for every character variable which needs to be recoded. We developed a new variable, "Raw", to store the variable names in the raw data. You may notice we use **%eval(&i-7)** here, since the variables need to be recoded starting from F8, and doing this will give us a better one to one correspondent relationship between variables in the raw data and the new variable names. That is, it passes variables F1 through F7 and begins with variable F8 as the first variable to recode.

There are a few tricks that are worth noticing.

First, we use a CALL SYMPUT DATA step to define MACRO variables. The advantages of this method include not only assigning a sequential number to each variable or each data set, but also providing a convenient way to store the com-pound character values. In the following code, the order of observation _N_ is used to assign a sequential number to each variable name. The total number of variables is also retained in &nvar.

For each data set, we set up a variable order equal to _N_, which determines values of V1; in other words, it determines if we should use “IF” or “ELSE IF” at the beginning of the statement.

We can apply this basic logic in the codes. According to the questionnaire description, we know that 90% percent of the variables use the same logic to define how to convert “YES”,”NO”,”SKIPPED” and “NOT ANSWERED”. I was unwilling to incorporate every possible situation in the codes, such as “NO DISTRICT-LEVEL STAFF IN THIS AREA”, which are all values that are long and can easily prompt human errors. Keep in mind that we are trying to avoid a large amount of typing.

```
%macro combine;
data _null_;
set name;
call symput(compress("varname"||_N_),trim(F1));
call symput(compress("nvar"),compress(_N_));
run;
%do i=1 %to &nvar;
data a&i;
length name $50 ffvalue $150;
set q&i;
name="&&varname&i";
ffvalue=fvalue;
order=_N_;
run;
     data b&i(keep=v1 v2 v3 v4 v5 v6 v7 v8 v9);
set a&i;
length v1 v2 v3 v4 v5 v6 v7 v8 v9 $150;
if order=1 then v1="if";
else v1="else if";
v2=Raw;
v3="=";
v4='"'||Trim(ffvalue)||'"';
v5="then";
v6=name;
v7="’”||”=";
if upcase(ffvalue)="YES" THEN v8="1";
else if  upcase(ffvalue)="NO" THEN v8="2";
else if ffvalue in ("SKIPPED","SK")  THEN v8=".A";
else if ffvalue in ("NOT ANSWERED"," ","NA" ,"DISPLAYED", "NOT DISPLAYED") THEN
v8=".C";
else if ffvalue in ("NOT APPLICABLE") THEN v8=".N";
ELSE v8=" "; V9=”;”;
run; %end;%mend;%combine;
```

	v1	v2	v3	v5	v6	v7	v8	v9	v4
1	if	F8	'=	then	HED1	'=	.C	;	"DISPLAYED"
2	else if	F8	'=	then	HED1	'=	2	;	"NO"
3	else if	F8	'=	then	HED1	'=	.C	;	"NOT ANSWERED"
4	else if	F8	'=	then	HED1	'=	.C	;	"NOT DISPLAYED"
5	else if	F8	'=	then	HED1	'=	1	;	"YES"

Figure 3. Partial output of MACRO %combine

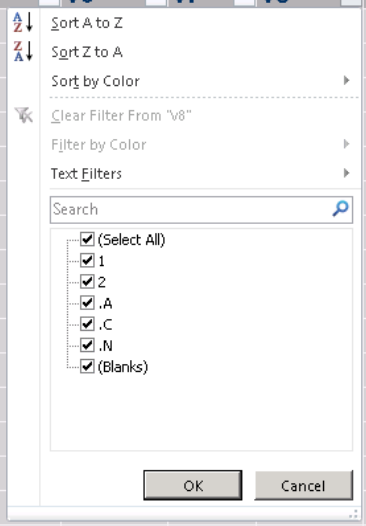
As Figure 4 shows, we now have every element we need for the IF-ELSE-THEN statement.

OUTPUT THE RESULT IN AUTO FILTER EXCEL FORMAT

Although the output in Figure 4 contains all of the information we need, we need to realize that we cannot do anything to the data sets unless we transfer the output into a particular format. First I tried to use a text file since we can simply CALL the recodes file using an %INCLUDE statement. However I soon discovered the drawbacks of this method. Remember, in the previous step we only coded the common values, and ignored the longer values to avoid human error. So now, for those long values we will have blank values in column V8. If we output the data in a text file format, it won’t be easy to find those blanks. That is a risk we do not want to take.

The benefit of outputting data into auto filter excel format is that it makes finding values that are not recoded an easy job; also, you can easily fill in the blanks. Furthermore, we can use this output as double check. For example, if you find any blank values which are not associated with some long words, you'd better check your program again. After all of the blanks in V8 column are filled in, the recodes are done. Although this paper refers to this as a one hour fix, it's actually even shorter than one hour. If we compare this to manually coding everything, the time you save with automation and the human error you avoid are valuable not only to you but to your clients also.

v1	v2	v3	v4	v5	v6	v7	v8	v9
if	F8	=	"DISPLAYED"	then				;
else if	F8	=	"NO"	then				;
else if	F8	=	"NOT ANSWERED"	then				;
else if	F8	=	"NOT DISPLAYED"	then				;
else if	F8	=	"YES"	then				;
if	F9	=	"NO"	then				;
else if	F9	=	"NOT ANSWERED"	then				;
else if	F9	=	"NOT DISPLAYED"	then				;
else if	F9	=	"SKIPPED"	then				;
else if	F9	=	"YES"	then				;
if	F10	=	"NO"	then				;
else if	F10	=	"NOT ANSWERED"	then				;
else if	F10	=	"NOT DISPLAYED"	then				;
else if	F10	=	"SKIPPED"	then				;
else if	F10	=	"YES"	then				;
if	F11	=	"NO"	then	HED36	=	2	;



CONCLUSION

This paper serves as an introduction to creating a lot of recodes with minimal typing. The programs and method presented in this paper can be easily modified to fit the needs of different users. I hope to have provided sufficient explanation for even a beginner level SAS® programmer to learn how to handle such tasks. Although my methods are basic, they are extremely useful even in an advanced user's day-to-day programming.

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