



Defensive Programming, Avoiding the Big Mistakes

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Introduction

- Planning
- Writing the Programs
- Testing and Validating

Planning

- General programming guidance and/or SOPs
- Study Protocol
- Study SAP
- Study Output Shells, e.g. table shells
- CRF (would be nice if this was annotated)

A Useful Piece of Code

```
proc sql noprint;
  select memname into :dslist separated by ' '
  from sashelp.vmember where libname in('RAWDATA');
quit;
title1 "Datasets in RAWDATA Directory";
proc contents data=rawdata._all_ directory nodetails; run;
%let i=1;
%do %while(%scan(&dslist,&i) ne );
  title1 "Dataset: %scan(&dslist,&i)";
  proc contents data=rawdata.%scan(&dslist,&i) varnum; run;
  proc print data=rawdata.%scan(&dslist,&i) obs=5; run;
  run;
  %let i=%eval(&i+1);
%end
```

Consider Macros

- only one set of code needs to be written
- change is the difference in one or more parameter values
- only one set of code needs to be maintained
- only one set of code needs to be QC'ed

Writing the Programs

- NO HARDCODES
 - if patid='001001' then height=178; *Obvious;
 - if stop_y>year("&sysdate9"d) then
stop_y=year("&sysdate9"d); *Less Obvious;
 - if pt='001001' and date()<="31OCT2007"d
then birthdt='25MAY1970'd; *Time limited;

Writing the Programs

- Better use of a Hardcode
 - if pt='001001' then do;
 - if birthdt='25MAY2007'd then do;
 - birthdt='25MAY1970'd;
 - put 'WAR' 'NING: Hardcode for patient 001001 to '
 'correct birth date issue.';
 - end;
 - else put 'WAR' 'NING: Hardcode for patient 001001 '
 'should be reviewed as DOB value has changed';
 - end;

Writing the Programs

- Program to the CRF
- Assume duplicate and invalid data
- Dates
- Avoid Overwriting DB variables
- Initialize variables
- Use Comments
- Use Program Headers
- Don't be afraid to seek help

Testing and Validating

- Check the LOG!
'ERROR:', 'WARNING:', 'uninitialized', 'not exist',
'extraneous', 'repeats', 'not resolved', 'converted to
numeric', 'converted to char', 'is already on the
library', 'sas set option obs=0', 'stopped due to
looping', 'sas went', 'unknown', 'replaced', 'Missing
values', 'invalid', 'At least one W.D format was too
small', 'outside the axis range', 'truncate',
'Unreferenced label', 'Truncation may result',
'overwritten by data set'

Testing and Validating

- Always review the output!

Testing and Validating

```
data _alllogs0;
```

```
  attrib _txt length=$256 informat=$char256. format=$char256.
```

```
    _fn length=$256 _myinfile length=$256 _ln length=8;
```

```
  infile "C:\TUIAI\LISTINGS\L*.log" (recl=256 filename=_myinfile length=len;
```

```
  input _txt $varying256. len;
```

```
  _fn=scan(strip(_myinfile),-1,'\'); _ln=_n_; run;
```

```
proc sort data=_alllogs0; by _fn _ln; run;
```

```
title1 "QC of SAS LOG(s)";
```

```
data _null_;
```

```
  retain _k 0; file PRINT; set _alllogs0 end=eof; by _fn _ln;
```

```
  if first._fn then do; put // @1 '***** LOG FILE: ' _fn /; _k=0; end;
```

```
  if index(_txt,'ERROR:') or index(_txt,'WARNING:') then do;
```

```
    _k+1; put _txt; end;
```

```
  if last._fn and _k=0 then put @1 '*** NO ISSUES FOUND ***';
```

```
  if eof then put /'/*EOF*/'; run;
```

Conclusion

Pharma

SUG

SAN DIEGO

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