Producing Patient Profiles Using PROC DOCUMENT and ODS Layout
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ABSTRACT
This paper describes the production of patient profiles using PROC DOCUMENT and ODS Layout. Patient profiles are listings of data from a single patient on one or just a few pages. They are used in the pharmaceutical industry for regulatory submissions, writing patient narratives or case histories, and data clean up and audit activities. Typically, a complicated DATA _NULL_ is used which is difficult to write and even more difficult to modify. Using PROC DOCUMENT with the appropriate ODS Layout code, output from common SAS® procedures such as PRINT, FREQ and MEANS, which may already have been written for study listings, can be used for the profile. SAS/Graph output can also be included on the page. This process can have other applications including a laboratory summary by analyte or a stock market company report.

INTRODUCTION
Patient profiles, also known as individual case summaries or case report form tabulations, are listings of the data of a patient in a clinical trial on usually one or a few pages. Data from clinical trials are usually stored in several different data sets of different structures. Combining these data sets is often difficult. Using ODS Document, output from SAS procedures can be stored and then replayed into locations on a page defined using ODS LAYOUT. There are three steps involved in this process: the first is to write code using PROC PRINT, PROC REPORT or procedures (including SAS/GRAPH®) that will display the desired data. Next, ‘wrap’ this code with ODS Document NAME=name(WRITE) and ODS Document CLOSE to store the output. The last step is to define regions on the page using ODS LAYOUT and then replay the output into the region using PROC DOCUMENT. The first step is trivial and will not be discussed further. The second and third will be discussed in the next sections.

ODS DOCUMENT
ODS Document allows the output from procedures to be stored and then later replayed using PROC DOCUMENT. The syntax to start storing output is:

```
ODS Document NAME=name (WRITE);
```

The familiar `ODS Document CLOSE` will stop storing the output. Entries in the document are uniquely identified with sequence numbers. The entries in a document can be shown using the following code:

```
proc document name=name;
  list/levels=all;
run;
```

The output for two PROC PRINT outputs, a PROC GPLOT and a PROC FREQ would be:

<table>
<thead>
<tr>
<th>Obs</th>
<th>Path</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>\Print#1</td>
<td>Dir</td>
</tr>
<tr>
<td>2</td>
<td>\Print#1\Print#1</td>
<td>Report</td>
</tr>
<tr>
<td>3</td>
<td>\Print#2</td>
<td>Dir</td>
</tr>
<tr>
<td>4</td>
<td>\Print#2\Print#1</td>
<td>Report</td>
</tr>
<tr>
<td>3</td>
<td>\Gplot#1</td>
<td>Dir</td>
</tr>
<tr>
<td>4</td>
<td>\Gplot#1\Gplot#1</td>
<td>Graph</td>
</tr>
<tr>
<td>5</td>
<td>\Freq#1</td>
<td>Dir</td>
</tr>
<tr>
<td>6</td>
<td>\Freq#1\x_by_y#1</td>
<td>Dir</td>
</tr>
<tr>
<td>7</td>
<td>\Freq#1\x_by_y#1\CrossTabFreqs#1</td>
<td>Crosstab</td>
</tr>
</tbody>
</table>

The path will be used in the PROC DOCUMENT code to replay the correct output. To replay the Graph the following code would be used:

```
proc document name=name;
  dir \Gplot#1; run;
  replay Gplot#1;
quit;
```
ODS LAYOUT
First, note that ODS Layout is experimental in V9 and may change when it becomes production. ODS Layout statements define the page and place the output in the desired location. The code section begins with ODS LAYOUT START and ends with ODS LAYOUT END. There are two different ways of describing the locations of the output: absolute and relative. Absolute requires that x and y positions, relative to the upper left corner of the layout area, and the height and width of the area are specified. The units can be in PT, IN, CM, PX, %, MM, or WT. The following code defines the upper left quadrant of a page:

```ods region x=0% y=0% width=50% height=50%;```

The PROC DOCUMENT code above will then replay the output into that region. Likewise, the following code defines the bottom right quadrant of a page:

```ods region x=50% y=50% width=50% height=50%;```

When using relative referencing the output areas are defined like a table with rows and columns. The output is then placed in the appropriate location in the table. The ODS LAYOUT START statement must specify the number of columns and rows. Then the column and row are specified in the ODS Region statement and the output is replayed in that location:

```ods region row=1 column=1;```

The example provided allows output to span multiple columns using the column_span=2 option:

```ods region row=2 column=1 column_span=2;```

CODE AND EXAMPLES
An example of a Patient Profile is given. One note is that there are certain displays, for example adverse events and concomitant medications, which can be variable in length. In those cases, additional pages may be necessary. Code can be written that checks the number of observations of certain datasets and more pages can be conditionally called for those situations. A lab summary by test is also included. This uses the absolute referencing with the page divided into four quadrants.

CONCLUSION
Using ODS Layout and PROC DOCUMENT is a powerful way to place data from different datasets easily on the same page. Common SAS procedures such as PROC PRINT and PROC REPORT can be used instead of a complicated DATA _NULL_. Moreover, code that may have already been written for study listings possibly can be used. The code is compartmentalized so that changes in one window do not affect other windows. In conclusion, code for individual case summaries can be developed with higher quality and in shorter time with the use of this macro.

CONTACT INFORMATION
Your comments and questions are valued and encouraged. Contact the author at:

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REFERENCES


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<table>
<thead>
<tr>
<th>Obs</th>
<th>Patient Number:</th>
<th>1001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Initials:</td>
<td>SAS</td>
<td></td>
</tr>
<tr>
<td>Gender:</td>
<td>Male</td>
<td></td>
</tr>
<tr>
<td>Race:</td>
<td>Caucasian</td>
<td></td>
</tr>
<tr>
<td>Age:</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Height (in):</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Weight (lbs):</td>
<td>190</td>
<td></td>
</tr>
<tr>
<td>Treatment:</td>
<td>Placebo</td>
<td></td>
</tr>
<tr>
<td>First Dose Date:</td>
<td>01APR2001</td>
<td></td>
</tr>
<tr>
<td>Last Dose Date:</td>
<td>21APR2001</td>
<td></td>
</tr>
<tr>
<td>Completed Study?</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Withdrawal Reason:</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Body System</th>
<th>Screening</th>
<th>End_Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARDIOVASCULAR</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>ENDOCRINE</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>GASTROINTESTINAL</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>GENITOURINARY</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>HEENT</td>
<td>ABNORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>LYMPHATIC</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>MUSCULOSKELETAL</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>NEUROLOGICAL</td>
<td>ABNORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>OTHER</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>RESPIRATORY</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
<tr>
<td>SKIN</td>
<td>NORMAL</td>
<td>NORMAL</td>
</tr>
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<table>
<thead>
<tr>
<th>Obs</th>
<th>Start Date</th>
<th>Stop Date</th>
<th>Adverse Event</th>
<th>Causality</th>
<th>Severity</th>
<th>Serious</th>
<th>Action Taken</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>04APR2004</td>
<td>04APR2004</td>
<td>HEADACHE</td>
<td>RELATED</td>
<td>MILD</td>
<td>NO</td>
<td>CON MED</td>
<td>RECOVERED</td>
</tr>
<tr>
<td>2</td>
<td>04APR2004</td>
<td>04APR2004</td>
<td>FEVER</td>
<td>RELATED</td>
<td>MILD</td>
<td>NO</td>
<td>CON MED</td>
<td>RECOVERED</td>
</tr>
<tr>
<td>3</td>
<td>04APR2004</td>
<td>04APR2004</td>
<td>FATIGUE</td>
<td>RELATED</td>
<td>MILD</td>
<td>NO</td>
<td>NONE</td>
<td>RECOVERED</td>
</tr>
<tr>
<td>4</td>
<td>04APR2004</td>
<td>04APR2004</td>
<td>NAUSEA</td>
<td>RELATED</td>
<td>MODERATE</td>
<td>NO</td>
<td>CON MED</td>
<td>RECOVERED</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Obs</th>
<th>Date</th>
<th>Visit</th>
<th>Heart Rate</th>
<th>Blood Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15MAR2004</td>
<td>VISIT 1</td>
<td>64</td>
<td>114/70</td>
</tr>
<tr>
<td>2</td>
<td>01APR2004</td>
<td>VISIT 2</td>
<td>78</td>
<td>118/70</td>
</tr>
<tr>
<td>3</td>
<td>08APR2004</td>
<td>VISIT 3</td>
<td>82</td>
<td>116/70</td>
</tr>
<tr>
<td>4</td>
<td>15APR2004</td>
<td>VISIT 4</td>
<td>76</td>
<td>122/80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Obs</th>
<th>Date</th>
<th>Visit</th>
<th>Score 1</th>
<th>Score 2</th>
<th>Score 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15MAR2004</td>
<td>VISIT 1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>01APR2004</td>
<td>VISIT 2</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>08APR2004</td>
<td>VISIT 3</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>15APR2004</td>
<td>VISIT 4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Obs</th>
<th>Start Date</th>
<th>Stop Date</th>
<th>Concomitant Medication</th>
<th>Continue</th>
<th>Dose/Units/Frequency/Route</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>04APR2004</td>
<td>04APR2004</td>
<td>TYLENOL PM</td>
<td>NO</td>
<td>500 MG QID PO</td>
<td>HEADACHE/FEVER</td>
</tr>
<tr>
<td>2</td>
<td>04APR2004</td>
<td>04APR2004</td>
<td>ZANTAC</td>
<td>NO</td>
<td>75 MG PRN PO</td>
<td>NAUSEA</td>
</tr>
<tr>
<td>3</td>
<td>10APR2004</td>
<td>20APR2004</td>
<td>BENADRYL</td>
<td>NO</td>
<td>CREAM PRN TOPICALLY</td>
<td>RASH</td>
</tr>
</tbody>
</table>
* This program creates a patient profile using PROC DOCUMENT and ODS Layout

OPTIONS ORIENTATION=PORTRAIT TOPMARGIN=0.5 BOTTOMMARGIN=0.5 LEFTMARGIN=0.5 RIGHTMARGIN=0.5;

ods document name=profile(write);

****************************************
* This creates a block of demog info. *
****************************************

data demog;
  patient=1001;   initials='SAS';      ht=75; wt=190;    race='Caucasian';        gender='Male';
  age=34;         treatmnt='Placebo';  firstdos='01Apr2001'd;   lastdose='21Apr2001'd;   complete='Yes';
  withdraw='N/A';
format firstdos lastdose date9.;
length text $50 resp $50;
text='Patient Number:      '; resp=Patient; output;
text='Patient Initials:    '; resp=Initials; output;
text='Gender:              '; resp=gender; output;
text='Race:                '; resp=race; output;
text='Age:                 '; resp=age; output;
text='Height (in):         '; resp=ht; output;
text='Weight (lbs):        '; resp=wt; output;
text='Treatment:           '; resp=Treatmnt; output;
text='First Dose Date:     '; resp=put( firstdos, date9.); output;
text='Last Dose Date:      '; resp=put( lastdose, date9.); output;
text='Completed Study?     '; resp=complete; output;
text='Withdrawal Reason:   '; resp=withdraw; output;
labeled text='00'x resp='00'x;
keep text resp;
run;
title;
proc print data=demog noobs label;  var text resp;  run;

***********************************************
* This creates a block of physical exam info. *
***********************************************

data ph_exam;
  body='CARDIOVASCULAR            '; screen='NORMAL  '; final='NORMAL  '; OUTPUT;
  body='ENDOCRINE                 '; screen='NORMAL  '; final='NORMAL  '; OUTPUT;
  body='GASTROINTESTINAL          '; screen='NORMAL  '; final='NORMAL  '; OUTPUT;
  body='GENITOURINARY             '; screen='NORMAL  '; final='NORMAL  '; OUTPUT;
  body='HEENT                     '; screen='ABNORMAL'; final='NORMAL  '; OUTPUT;
  body='LYMPHATIC                 '; screen='NORMAL  '; final='NORMAL  '; OUTPUT;
  body='MUSCULOSKELETAL           '; screen='NORMAL  '; final='NORMAL  '; OUTPUT;
  body='NEUROLOGICAL              '; screen='ABNORMAL'; final='NORMAL  '; OUTPUT;
  body='OTHER                     '; screen='NORMAL  '; final='NORMAL  '; OUTPUT;
  body='RESPIRATORY              '; screen='NORMAL  '; final='NORMAL  '; OUTPUT;
  body='SKIN                      '; screen='NORMAL  '; final='NORMAL  '; OUTPUT;
  label body='Body System' SCREEN='Screening' final='End_Study';
run;
proc print data=ph_exam noobs label;  var body screen final;  run;

****************************************
* This creates a block of ae info.     *
****************************************

data adverse;
  format start stop date9.;
  ae='HEADACHE    ';  start='04APR2004'D; stop='04APR2004'D; cause='RELATED  '; severit='MILD    '; serious='NO   '; action='CON MED'; outcome='RECOVERED'; OUTPUT;
  ae='FEVER       ';  start='04APR2004'D; stop='04APR2004'D; cause='RELATED  '; severit='MILD    '; serious='NO   '; action='CON MED'; outcome='RECOVERED'; OUTPUT;
  ae='FATIGUE     ';  start='04APR2004'D; stop='04APR2004'D; cause='RELATED  '; severit='MILD    '; serious='NO   '; action='NONE      '; outcome='RECOVERED'; OUTPUT;
  ae='NAUSEA      ';  start='04APR2004'D; stop='04APR2004'D; cause='RELATED  '; severit='MODERATE'; serious='NO   '; action='CON MED'; outcome='RECOVERED'; OUTPUT;
  label ae='Adverse Event' start='Start Date' stop='Stop Date' severity='Severity' cause='Causality' action='Action Taken' outcome='Outcome' serious='Serious';
run;
proc print data=adverse label noobs;  var ae start stop severit cause action outcome;  run;

****************************************
* This creates a block of vitals info. *
****************************************

data vitals;
  format date date9.;
  visit='VISIT 1';  date='15MAR2004'D; hr='114'; bp='114/ 70'; output;
VISIT='VISIT 2'; DATE='01APR2004'D; HR='78'; BP='118/70'; OUTPUT;
VISIT='VISIT 3'; DATE='08APR2004'D; HR='82'; BP='116/70'; OUTPUT;
VISIT='VISIT 4'; DATE='15APR2004'D; HR='76'; BP='122/80'; OUTPUT;
LABEL VISIT='Visit' BP='Blood Pressure' HR='Heart Rate' DATE='Date';
RUN;
PROCPRTN DATA=VITALS NOOBS LABEL SPLIT='|'; VAR VISIT HR BP; RUN;

******************************************************************************
* This creates a block of efficacy info. *
******************************************************************************;

DATA EFFICACY;
  FORMAT DATE DATE9.;
  VISIT='VISIT 1'; DATE='15MAR2004'D;
    SCORE1=PUT(INT(RANUNI(DATE)*4)+1,2.);
    SCORE2=PUT(INT(RANUNI(DATE)*4)+1,2.);
    SCORE3=PUT(INT(RANUNI(DATE)*4)+1,2.);
    TOTAL=PUT(SCORE1+SCORE2+SCORE3,2.);
    OUTPUT;
  VISIT='VISIT 2'; DATE='01APR2004'D;
    SCORE1=PUT(INT(RANUNI(DATE)*4)+1,2.);
    SCORE2=PUT(INT(RANUNI(DATE)*4)+1,2.);
    SCORE3=PUT(INT(RANUNI(DATE)*4)+1,2.);
    TOTAL=PUT(SCORE1+SCORE2+SCORE3,2.);
    OUTPUT;
  VISIT='VISIT 3'; DATE='08APR2004'D;
    SCORE1=PUT(INT(RANUNI(DATE)*4)+1,2.);
    SCORE2=PUT(INT(RANUNI(DATE)*4)+1,2.);
    SCORE3=PUT(INT(RANUNI(DATE)*4)+1,2.);
    TOTAL=PUT(SCORE1+SCORE2+SCORE3,2.);
    OUTPUT;
  VISIT='VISIT 4'; DATE='15APR2004'D;
    SCORE1=PUT(INT(RANUNI(DATE)*4)+1,2.);
    SCORE2=PUT(INT(RANUNI(DATE)*4)+1,2.);
    SCORE3=PUT(INT(RANUNI(DATE)*4)+1,2.);
    TOTAL=PUT(SCORE1+SCORE2+SCORE3,2.);
    OUTPUT;
LABEL VISIT='Visit' DATE='Date' SCORE1='Score 1' SCORE2='Score 2' SCORE3='Score 3' TOTAL='Total';
RUN;
PROCPRTN DATA=EFFICACY LABEL NOOBS; VAR VISIT DATE SCORE1 SCORE2 SCORE3 TOTAL; RUN;

******************************************************************************
* This creates a block of con meds info. *
******************************************************************************;

data conmed;
  FORMAT START STOP DATE9.;
  conmed='TYLENOL PM '; START='04APR2004'D; STOP='04APR2004'D; CONT='NO'; DOSE='500 MG QID PO ';
    INDICAT='HEADACHE/FEVER     '; OUTPUT;
  conmed='ZANTAC      '; START='04APR2004'D; STOP='04APR2004'D; CONT='NO'; DOSE='75 MG PRN PO       ';
    INDICAT='NAUSEA             '; OUTPUT;
  conmed='BENADRYL    '; START='10APR2004'D; STOP='20APR2004'D; CONT='NO'; DOSE='CREAM PRN TOPICALLY';
    INDICAT='RASH               '; OUTPUT;
LABEL CONMED='Concomitant Medication' START='Start Date' STOP='Stop Date' CONT='Continue' DOSE='Dose/Units/ Frequency/Route' INDICAT='Indication';
run;
PROCPRTN DATA=CONMED LABEL NOOBS SPLIT='|'; VAR CONMED START STOP CONT DOSE INDICAT; RUN;
ods document close;
proc document name=profile; run;
  list/levels=all;
run; quit;
ods pdf file="C:\profile.pdf";
ods layout start rows=4 columns=2;
proc document name=profile;
  dir \\Print#1; run;
  ods region row=1 column=1;
    replay Print#1;
  dir \\Print#2; run;
  ods region row=1 column=2;
    replay Print#1;
  dir \\Print#3; run;
  ods region row=2 column=1 column_span=2;
    replay Print#1;
  dir \\Print#4; run;
  ods region row=3 column=1;
    replay Print#1;
  dir \\Print#5; run;
  ods region row=3 column=2;
    replay Print#1;
  dir \\Print#6; run;
  ods region row=4 column=1 column_span=2;
    replay Print#1;
quit;
ods layout end;
ods pdf close;
### The MEANS Procedure

<table>
<thead>
<tr>
<th>treatmnt</th>
<th>visit</th>
<th>N</th>
<th>Obs</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Minimum</th>
<th>Maximum</th>
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<tbody>
<tr>
<td>ACTIVE</td>
<td>Baseline</td>
<td>238</td>
<td>238</td>
<td>6.41</td>
<td>1.52</td>
<td>2.56</td>
<td>11.57</td>
<td></td>
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<tr>
<td></td>
<td>Final</td>
<td>238</td>
<td>238</td>
<td>6.48</td>
<td>1.55</td>
<td>1.92</td>
<td>10.89</td>
<td></td>
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<tr>
<td>PLACEBO</td>
<td>Baseline</td>
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<td>262</td>
<td>6.52</td>
<td>1.38</td>
<td>2.24</td>
<td>10.52</td>
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<tr>
<td></td>
<td>Final</td>
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<td>262</td>
<td>6.45</td>
<td>1.58</td>
<td>1.28</td>
<td>10.77</td>
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### The FREQ Procedure

**Table of baseline by final**

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<tr>
<th>baseline</th>
<th></th>
<th>final</th>
<th>Low</th>
<th>Normal</th>
<th>High</th>
<th>Total</th>
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<td>0</td>
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<td></td>
<td>Normal</td>
<td>2</td>
<td>226</td>
<td>5</td>
<td>233</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
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<tr>
<td></td>
<td></td>
<td>Total</td>
<td>2</td>
<td>231</td>
<td>5</td>
<td>238</td>
</tr>
</tbody>
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### The FREQ Procedure

**Table of baseline by final**

<table>
<thead>
<tr>
<th>baseline</th>
<th></th>
<th>final</th>
<th>Low</th>
<th>Normal</th>
<th>High</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td>Low</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Normal</td>
<td>7</td>
<td>246</td>
<td>3</td>
<td>256</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>7</td>
<td>252</td>
<td>3</td>
<td>262</td>
</tr>
</tbody>
</table>
OPTIONS ORIENTATION=LANDSCAPE TOPMARGIN=0.75 BOTTOMMARGIN=0.75 LEFTMARGIN=0.75 RIGHTMARGIN=0.75;
opts nonumber nodate nocenter;
ods document name=lab(write);

data lab;
  seed=40832209;
  test='Leukocyte Count (WBC)';
  units='10^9/L';
  do i=1 to 1000;
    result=normal(seed)*1.5+6.5;  output;
  end;
run;

data lab;
  set lab;
  if mod(_n_,2)=1 then visit='Baseline';
  else visit='Final   ';
  patient=put(int((_n_-1)/2)+1,z4.);
  *** normal range 3.2 to 9.8 ***;
  if result<3.2 then flag='L';
  if result>9.8 then flag='H';
  resultc=put(result,4.1)||' '||flag;
run;
proc sort; by patient; run;
data patient(keep=patient treatmnt invest);
  length treatmnt $7;
  set lab;
  by patient;
  if first.patient;
    invest=put(int(_n_/100)+1,z4.);
    if ranuni(seed)>.5 then treatmnt='PLACEBO';
    else treatmnt='ACTIVE';
  run;

proc sort; by patient; run;
data lab;
  merge lab patient;
  by patient;
run;
title;
proc means data=lab maxdec=2 fw=7;
  class treatmnt visit;
  var result;
run;

* This code creates a plot of baseline values vs end study values using proc gplot *
data baseline(rename=(result=baseline flag=baseline_)) final(rename=(result=final flag=final_f));
set lab;
by patient;
if visit='Baseline' then output baseline;
else output final;
baseline=result;
keep patient result treatmnt flag;
run;
data forgraph;
  merge baseline final;
  by patient;
run;

symbol1 h=1 v=dot c=black;
symbol2 h=1 v=circle c=black;

proc gplot;
  plot final*baseline=treatmnt;
run;

remain data shift;
set forgraph(drop=baseline final);
if baseline_f=' ' then baseline=2;
else if baseline_f='L' then baseline=1;
else baseline=3;
if final_f=' ' then final=2;
else if final_f='L' then final=1;
else final=3;
run;

proc format;
  value shift 3='High' 1='Low' 2='Normal';
run;

proc freq data=shift order=internal;
  where treatmnt='ACTIVE';
  format baseline final shift.;
  tables baseline*final / norow nocol nopercent sparse;
run;

proc freq data=shift order=internal;
  where treatmnt='PLACEBO';
  format baseline final shift.;
  tables baseline*final / norow nocol nopercent sparse;
run;

ods document close;
proc document name=lab;
  list/levels=all;
run;
quit;

ods printer postscript file="C:\lab.ps";

remain data shift;
set forgraph(drop=baseline final);
if baseline_f=' ' then baseline=2;
else if baseline_f='L' then baseline=1;
else baseline=3;
if final_f=' ' then final=2;
else if final_f='L' then final=1;
else final=3;
run;

proc format;
  value shift 3='High' 1='Low' 2='Normal';
run;

proc freq data=shift order=internal;
  where treatmnt='ACTIVE';
  format baseline final shift.;
  tables baseline*final / norow nocol nopercent sparse;
run;

proc freq data=shift order=internal;
  where treatmnt='PLACEBO';
  format baseline final shift.;
  tables baseline*final / norow nocol nopercent sparse;
run;

ods document close;
proc document name=lab;
  list/levels=all;
run;
quit;

ods printer postscript file="C:\lab.ps";

** This code creates a shift table using two proc freqs. **
*******************************************************************************

remain data shift;
set forgraph(drop=baseline final);
if baseline_f=' ' then baseline=2;
else if baseline_f='L' then baseline=1;
else baseline=3;
if final_f=' ' then final=2;
else if final_f='L' then final=1;
else final=3;
run;

proc format;
  value shift 3='High' 1='Low' 2='Normal';
run;

proc freq data=shift order=internal;
  where treatmnt='ACTIVE';
  format baseline final shift.;
  tables baseline*final / norow nocol nopercent sparse;
run;

proc freq data=shift order=internal;
  where treatmnt='PLACEBO';
  format baseline final shift.;
  tables baseline*final / norow nocol nopercent sparse;
run;

ods document close;
proc document name=lab;
  list/levels=all;
run;
quit;

ods printer postscript file="C:\lab.ps";

*******************************************************************************
** This Uses ODS Layout with absolute referencing **
*******************************************************************************

ods layout start;
proc document name=lab;
  dir \\Means#1; run;
ods region x=0% y=0% width=50% height=50%;
  replay Summary#1; run;
  dir \\Gplot#1; run;
ods region x=0% y=0% width=50% height=50%;
  replay Gplot#1; run;
  dir \\Freq#1\Table1*1; run;
ods region x=0% y=50% width=50% height=50%;
  replay CrossTabFreqs#1; run;
  dir \\Freq#2\Table1*1; run;
ods region x=50% y=50% width=50% height=50%;
  replay CrossTabFreqs#1; run;
quit;
ods layout end;
ods printer close;