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| **Steps for Creating a SAS Datasets** | | | **Scope** |
| 1 | **LIBNAME** libref ‘<Path>’; | Reference a SAS data library | Global |
| 2 | **FILENAME** fileref ‘<Path>’; | Reference (Temp) an external file | Global |
| 3 | **DATA** ‘SASDataSetName’; | Name a SAS data set |  |
| 4 | **INFILE** ‘filename/fileref’  ***OBS***=10;  **FIRSTOBS=2;**  **Dlm=’,’ DSD;** | Identify an external file using INFILE statement  **OBS** mention the ***range till which data needs to be read.*** Can be used in data and proc print. Used to ***verify Data*** reading without affecting RAM space much. ***FIRSTOBS*** will start to read data from row2 of raw dataset, ***DLM/DSD*** is Delimiter and Delimiter sensitive data. |  |
| 5 | **INPUT** <informats>; | Describe data |  |
| 6 | Sum\_var **+** var2; | + is called accumulator variable.  ***Defaults to zero initially*** and in case if values are ***missing***. Values get summed as dataset is read. ***+ will automatically retain*** its value |  |
| 7 | **Retain** <Sum\_var> <val>; | ***Used to initializes Accumulator variable*** which is otherwise 0 by default. |  |
| 8 | **IF** <condition> then Vari=Val; | Condition can use any conditional operator:  ***=/eq,~=/^=/ne, >=/ge, <=/le, >/gt, </lt, in, &, |***  Character ***values need to be of same case*** in condition statements, enclosed in ‘‘  Condition inside ***parenthesis is given high importance***. ***BODMAS*** rule apply here.  **0/. = False**, that is 0 or missing is false  **1 = True** |  |
| 9 | **LENGTH** Var1 $ 10 Var2 20; | By default, SAS ***allocates the space of first value*** it encounters. Numeric variables have ***default size 8***.  This ***should be declared before value is set*** |  |
| 10 | If <condition> then <stmt>;  **Else** if <condi2> then <stmt>;  Else <final condition>; | Used for code optimization  Better to arrange else-if operation in ***decreasing probability*** to increase performance. |  |
| 11 | If <condition> then **DELETE**; | This is used to ***delete an observation using condition***. Used mostly ***along with IF*** |  |
| 12 | **DROP** **=** Var1 / **KEEP** **=** Var1; | This ***can be used in Data Step as well SAS procedures***.  Doesn’t apply to all output dataset that are named in Data statement. |  |
| 13 | **DROP** Var1 / **Keep** Var1; | ***Cannot be used in proc steps***  ***Applies to all o/p data sets***  Based on the count of variables use Drop and Keep wisely. |  |
| 14 | **LABEL** Var=’Label Detail’;  **FORMAT** Var1 DOLLAR12; | Used to provide a ***permanent label/format*** to a variable. However, when ***used in Proc*** statement ***can override this behaviour***. |  |
| 15 | **SELECT** <Var>; **WHEN** (“Val”) stmt; **otherwise** <stmt>; **end**; | This is like a Switch-Case statement, this will use ***select – when – otherwise - end*** |  |
| 16 | **DO**; <SAS Statements>; **END**; | If loop or when can handle only one stmt, do can handle many statement in its block |  |

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| **Steps for Reading & Combining SAS Datasets** | | |
| ***DATA*** NEWSASDATASET (***DROP***=COL4 COL5); \* Col4-5 participate in any data manipulation but not available in the final datasets.  **SET** <Data Set Name> (**…**); \* Used to read SAS dataset;  (***DROP =*** COL1 COL2 COL3) \* COL1-3 will not participate in any data manipulations.  *Use* ***DROP/KEEP*** *complimentarily based on the number of variables involved*  ***POINT*** *– Used for direct access of an observation, should be used along with* ***STOP***  ***END = var -***  *Used to read only the last observation in a dataset. Do not use with POINT* | | |
| 1 | **If** (condition);  **If** (condition) **then** **delete**; | 1. IF statement is used to subset a data 2. IF – then – delete is used to drop unnecessary data based on a condition |
| 2 | **If** (condition) **then** Var1=’’;  **Else** var1 = ‘’; | IF – then – else can be used to create a new column in a SAS data file. Also, called as conditional execution. |
| 3 | **Length** var2 $ 5; | We cannot set length for already existing variable at this stage as they would be already defined. This is used when we need to create a new variable and set explicit length for it. |
| 4 | **Label** var1 = “Variable1”; | Label is used to set the label; this can be seem using proc print with label as its argument. |
| 5 | **Format** var1 COMMA6.; | Used to define the format of the variable |
| 6 | **By** COL1 COL2; | When By is used, data set ***must be sorted*** based on that BY variable before. Use ***PROC SORT DATA=<DS> out = <New DS>; BY Var;*** command for the same.  When BY is used, SAS produce ***FIRST.variable*** and ***LAST.variable*** *to keep track on sorted variables data.* Used to fetch first and last observations in Subgroups.  ***BY*** ***can carry more than one variable***; but again, both needs to be sorted before accordingly. |
| 7 | Varname = 5;  **SET** <DS> **POINT**=<Var***name***>;  **OUTPUT;**  **STOP**; | This is used to read an observation using direct access and not sequentially using point and observation number accordingly.  Remember***, POINT cannot carry a numeric constant, it can only carry a variable name.*** So, define a variable with an observation number and then use it in POINT. More complex way of using it is in merging the dataset.  Because there is no EoF (end of file) just using POINT will create an infinite loop. So, it ***needs to be used with STOP statement***.  Again, this will only write data to PDV, to write the observation to a target dataset, we ***need to explicitly OUTPUT the data obtained as part of POINT***. |
| 8 | DATA ***<DS1> <DS2>***;  SET <DS>; | We can create one or more dataset like this. Data in <DS> is written to both <DS1> and <DS2>. |
| 9 | **END** = <Variable Name> | Variable name will carry 1 or zero for the last observation. Variable contains the EoF marker. |
| 10 | SET, RETAIN, SUM, \_TEMPORARY\_ | Will retain its values in PDV for each iteration. Other variables are set to missing values accordingly in each iteration.  Difference in reading the data from SAS is that ***for each iteration variables are not assigned to missing*** but values are retained with respective older values. |
| 11 | **\_N\_, \_ERROR\_** | \_N\_ = Initial value is 1 and increment as observations are read  \_ERROR\_ = Initial value is 0 and is set to 1 if error found |
| **Steps for Combining SAS Datasets** | | |
| ***DATA*** NEWSASDATASET (***DROP***=COL4 COL5); \* Col4-5 participate in any data manipulation but not available in the final datasets.  **SET/MERGE** <Data Set Name> (**…**); \* Used to read SAS dataset;  (***DROP =*** COL1 COL2 COL3) \* COL1-3 will not participate in any data manipulations.  *Use* ***DROP/KEEP*** *complimentarily based on the number of variables involved* | | |
| 1 | **SET** A;  **SET** B; | 1. **One to One Mapping** 2. ***Multiple SET statement – No Missing Values – Values skipped*** 3. Number of observation in new dataset is equal to the number of observation in the smallest original dataset; |
| 2 | **SET** A B C; | 1. **Concatenation** 2. ***Single SET statement - Missing Values - No Values skipped*** 3. Like a sanwidge, one data set sit below the other in a stacked fashion 4. Type of common variables should be the same, else SAS throw error 5. If no explicit mention of Type, Label, format or informats are made, SAS will automatically derive them from first occurring dataset |
| 3 | **SET** A B C;  **BY** ID; | 1. **Interleaving** 2. ***Single SET + BY statement - No Missing Value - No Values Skipped;*** 3. Multiple matching observation for a single observation in BY statement 4. Data read based on the order of By Variables defined |
| 4 | **MERGE** A B; | 1. **One to One Match merging** 2. ***Single MERGE statement – Missing Values - Values skipped*** 3. Diff between Concatenation and Simple Merge: Doesn’t stops its iteration with the smaller dataset, loop extends to the maximum observations |
| 5 | **MERGE**  A (**in**=inA **RENAME**=(VarA=VariableA)) B(**in**=inB **RENAME**=(VarA=VariableB)**;**  **BY DESCENDING** ID;  If inA = 1 and inB=1; | 1. Simple Match Merging 2. ***Single MERGE + BY statement - Missing Values - No Values skipped*** 3. PDV will retain its value until the value for all BY variables changes; 4. Order of Sorting can be changed to descending by mentioning **DECENDING** after BY Statement; 5. It must ***also be done in all PROC SORT steps*** and as well in merge statement accordingly; 6. In case any two datasets has same column name, SAS will overwrite the data with the latest data it encounters, to prevent this we can rename the matching variables using **RENAME**. 7. **IN** is a temporary variable, used to select only the observations that appear in both dataset 8. **DROP/KEEP** in ***DATA statement*** ***means*** drop those variable as part of DROP in target dataset 9. **DROP/KEEP** in ***merge statement means*** don’t even consider while merging, drop them even before PDV is completely formed |

**Column Style:** **[Standard Data + *Well Ordered in Column]***

1--------10---------20---------30--------40---------50---------60---------70---------80--------90

124 61 Mod Male Pradeep United States

123 76 Ded Female Sruthi India

142 89 Reg Male Sathyamurthy United Kingdom

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| **PROC PRINT DATA=DATASETNAME**  **NOOBS \*used to avoid printing observation column while printing;**  **DOUBLE \*print double spacing in SAS Output and not in SAS Report;**  **(OBS=3) \* Print only the first 3 observation of the dataset in print;** | | **Scope** |
| **Sum** <Col Name>; | Calculate the sum of the column | Local |
| **VAR** <Col Name>; | Mention the variable and its ***order*** of printing | Local |
| **Label** <Col Name>=’’; | Define label name for a column  Can mention up to ***256 char***  ***Can be defined in single or multiple lines*** | **Local** |
| **Where** <Col/col condi>  **CONTAINS** ‘str’;  **?** ‘str’;  **IN**(‘str1’,’str2’); | Defines the column condition  ***=, ^=, >, <, >=, <=***  ***CONTAINS*** *is string comparison*  ***AND, OR*** *operator used along with col name each time*  ***IN*** *operator is used as SQL style in comparison.* | Local |
| **ID** <Col Names>; | Act as a primary key, ***replace OBS*** column without explicitly mention of NOOBS.  ID used along with ***Var*** will ***display*** a ***column twice***. | Local |
| **SUM** <Col Name>; | Will provide the total of the column specified. | Local |
| **BY** <Col Name>; | Col Name should be ***same as one that is sorted before*** using this. ***Subset results***. | Local |
| **BY** <Col Name1>;  **ID** <Col Name1>; | When ID used along with BY it will:   1. ***Supress OBS*** column 2. ID/BY variable name is printed in left col 3. Each ***ID/BY value is printed only once*** at the start of each by group and on the line, that has group sub-total. | Local |
| **By** <Col Name1>;  **PAGEBY**<Col Name1>; | Mostly used along with sum-by-id.  ***Column used in PAGEBY should be same as one used in BY***.  Used to ***print each sub-total on a separate page***. | Local |
| **FORMAT** <Col Name>; | When defined ***inside PROC it scopes within it***. To make it ***permanent FORMAT or Labels*** need ***to be defined in DATA step*** | Local/Global |
| **TITLE** ‘str1’; | Generally, ***need to be defined outside a PROC step***.  However, it can be used inside PROC too  ***TITLE is global.*** Once defined will stay forever until title statement is modified, cancelled or end SAS session.  ***Cancel of title*** is done by ***title;*** | Global |
| **FOOTNOTE** ‘str2’; | Used to print note below a table/graph  It is same as TITLE function, up to ***10 footnotes can be defined*** in SAS.  ***Cancel of footnote*** is done by:  ***Footnote;*** | Global |

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| **PROC SORT** **DATA=DATASETNAME**  **OUT=DATASETNAME \*o/p SAS dataset** | |  |
| **by** <Col Name>;  **by descending** <col1> | Sorted by the column mentioned, sort takes place from right to left columns mentioned.  If used with descending it will apply to ***column which is immediately after it***, rest of the other columns will be sorted in ascending order. | Local |
| **NOTSORTED**; | To explicitly mention not to sort if the ***values are equal*** based on by condition. | Local |
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| **PROC FORMAT LIB=library**  **LIBRARY/LIB \*Defines the SAS library that needs to be referred;**  **FMTLIB \*print all the user defined format present in the Library mentioned;** | | | **Scope** |
| 1 | **LIBNAME** ***library*** ‘<Path>’; | Reference a SAS data library | Permanent |
| 2 | **PROC FORMAT LIB**=library  **FMTLIB**; | Library can be the SAS library referred above or it can be a catalog like ***library.catalog.***  ***FMTLIB*** will list all the user defined format present in the library. ***formats.sas7bcat*** file is created in the path mentioned in library. | Permanent |
| 3 | **Value** <format-name> | Format name must begin with ***$ for Char*** var  Cannot be > 8 char in length  Cannot be the name of existing SAS format  Cannot end with a number  Does not end with a period when defined | Permanent |
|  | Range1=’label1’ | Range1= Actual Column Data  Label1= Description of Range1  Numeric => 102=’Manager’  Character => ‘A’=’Good Performance’  Range => low-<12=’Not Teen Age’ | Permanent |
|  | Range2=’label2’; | Always the last Range must be ended with; which implies SAS that PROC FORMAT statement ends. | Permanent |
| 4 | **PROC FORMAT;** | This format will be created in the ***work directory*** which ***means temporary***. | Temporary |
|  | Value <format-name> | Scope within that SAS session only | Temporary |
|  | Range1=’label1’ | Scope within that SAS session only | Temporary |
|  | Range2=’label2’; | Scope within that SAS session only | Temporary |
| 5 | **PROC CATALOG;** | You can delete the user defined format | Permanent |

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| **PROC REPORT DATA=<DATASETNAME>**  **WD/NOWD \*Decides should the o/p be printed in a dedicated report window;**  **DOUBLE \*print double spacing in SAS Output and not in SAS Report;**  **SPLIT=’<symbol>’ \* Symbol can be \*, # $ etc., Used to define the label split in reporting;** | | | **Scope** |
| 1 | **COLUMN** <Col Names> | Used ***to subset the column*** that is needed to be displayed in the report. | Local |
| 2 | **WHERE** <Col Condi/Name>  **In** (‘value1’,’value2’) | Used to ***filter out the data*** required  In ***used along with where to filter the data*** based on values provided, SQL style usage. | Local |
| 3 | **DEFINE** <Col1>/<***usage***>  DEFINE <Col2>/<***attribute***>  DEFINE <Col3>/<***options***>  DEFINE <Col4>/<**Justify**>  DEFINE <Col5>/<***Col*** Heading>    \* Column definition;  **PROC** **REPORT** DATA=CARS\_SAMPLE NOWD SPLIT='\*' HEADLINE HEADSKIP;  define Make/format=$CHAR8. width=**3** spacing=**10**;  define Type/'Car\*Type';  define Model/center;  define Cylinders/order DESCENDING;  define Cylinders/group;  **RUN**;  \* Column definition - usage of group definition;  **PROC** **REPORT** DATA=CARS\_SAMPLE NOWD SPLIT='\*' HEADLINE HEADSKIP;  column cylinders MSRP;  define cylinders/group;  **RUN**;  \* Specifying statistics;  **PROC** **REPORT** DATA=CARS\_SAMPLE NOWD SPLIT='\*' HEADLINE HEADSKIP;  column cylinders MSRP;  define cylinders/group;  define MSRP/mean 'Average of MSRP';  **RUN**;  \* Column definition - usage of across definition;  **PROC** **REPORT** DATA=CARS\_SAMPLE NOWD SPLIT='\*' HEADLINE HEADSKIP;  column cylinders type MSRP;  define cylinders/across;  define type/across;  **RUN**; | Used to ***build column definitions*** in report like column space and width, etc.,  Let to ***define more than one column attribute*** at a time.  Column can be defined ***in any order*** and list ***options within it in any order as well***.  ***Usage*** specifies ***how to use the variables***:  By ***default***, **Char** Variable defined as ***Display***  And ***Numeric*** variables defined as ***Analysis***   1. **Across** – Displays variable ***horizontally*** rather vertically 2. **Analysis** - Default ***SUM*** analysis. 3. **Computed** – ***position*** of compute variable is ***very important. Use compute*** *and* ***endcomp*** *and* ***derive the value*** with some formula 4. ***Display*** – This is for ***Char*** variables 5. ***Group*** – to create ***summary report***. To get a proper result, display/character variables need to be grouped properly. 6. **Order** – This is like Grouping and Order, by ***default it is ordered in ascending***, if needed we need explicit mention of value ***DESCENDING***.   ***Attributes*** specifies the ***look*** of each column:  Width and spacing has its ***effect only in o/p window*** and doesn’t affect HTML window.   1. **Format** – define SAS/user format, default is ***its variable type*** 2. **Width** – width of col, default is ***Max*** 3. **Spacing** – No of blank char, default is ***2***   ***Options*** specifies the ***further formatting*** option:   1. **DESCENDING** 2. **NOPRINT** 3. **NOZERO** 4. **PAGE**   ***Justification*** specifies ***arrangements*** of column:   1. **Center** – Justify the char in centre 2. **Left** – ***default for*** ***chars*** n left justify 3. **Right** – ***default for*** ***num*** n right justify | Local |
| ***Column Heading*** is the ***label definition***. ***Split*** in report definition is used to ***split the column label*** as needed. (e.g. ***SPLIT=’\*’;***) define col/c\*t; | | | |

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| SI.NO | Statistics | Definition |
| 1 | **CSS** | Corrected sum of squares |
| 2 | **USS** | Uncorrected sum of squares |
| 3 | **CV** | Coefficient of variation |
| 4 | **MAX** | Maximum value |
| 5 | **MEAN** | Average |
| 6 | **MIN** | Minimum Value |
| 7 | **N** | Number of observations with non-missing values |
| 8 | **NMISS** | Number of observations with missing values |
| 9 | **RANGE** | Range |
| 10 | **STD** | Standard deviation |
| 11 | **STDERR** | Standard error of the mean |
| 12 | **SUM** | Sum |
| 13 | **SUMWGT** | Sum of the Weight variable values |
| 14 | **PCTN** | Percentage of a cell or row frequency to a total frequency |
| 15 | **PCTSUM** | Percentage of a cell or row sum to a total sum |
| 16 | **VAR** | Variance |
| 17 | **T** | Student's *t* for testing the hypothesis that the population mean is 0 |
| 18 | **PRT** | Probability of a greater absolute value of student's *t* |

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| ***Computing Statistics for Numeric Variable*** | | | |
| **PROC MEAN DATA=<DATASETNAME>**  **\*By default gives descriptive statistics, with n-count of all non-missing values;**  **<STATS KEYWORDS> \*To suppress default o/p and choose what stats is required for o/p;**  **MAXDEC=2 \*To set the decimal point;**  **NOPRINT \*Supress the result being printed;** | | | **Scope** |
| 1 | **VAR** <Col Names>; | Used to display the ***variables for which the statistics are required*** | Local |
| 2 | **CLASS** <Col Names>; | Specifies categorical variables which needed ***group processing*** | Local |
| 3 | **OUTPUT**  <***STATS***>=<Col Names>  ***OUT*** = <O/p dataset> | ***Output*** is used to ***structure the final output of the PORC MEAN*** above the segregation done based on a class variable.  <***STATS***> can be any ***statistic key-word*** and col name specifies on which columns it needs to be applied.  If <STATS> keywords are ***not mentioned***, then ***SAS will produce*** whole statistics and add ***\_STAT\_ variable along with \_TYPE\_ and \_FREQ\_***  ***\_TYPE\_*** is a ***simple binary pattern*** ***to summarise the CLASS variable***.    ***\_FREQ\_*** is the count of class variable occurrence  ***OUT*** specifies the ***output dataset*** in which the final ***statistic result needs to be stored***. | Local |

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| ***Computing Statistics for Numeric Variable*** | | | |
| **PROC SUMMARY DATA=<DATASETNAME> PRINT;** | | | **Scope** |
| 1 | **VAR** <Col Names>; | Used to display the ***variables for which the statistics are required*** |  |
| 2 | **CLASS** <Col Names>; | Specifies categorical variables which needed ***group processing*** |  |
| 3 | **OUTPUT**  <***STATS***>=<Col Names>  ***OUT*** = <O/p dataset> | ***Output*** is used to ***structure the final output of the PORC MEAN*** above the segregation done based on a class variable. |  |

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| Descriptive Statistics | | | |
| SI.NO | **Keywords** | **Definition** |
| 1 | **CLM** | Two-sided confidence limit for the mean |
| 2 | **CSS** | Corrected sum of squares |
| 3 | **CV** | Coefficient of variation |
| 4 | **KURTOSIS / KURT** | Kurtosis |
| 5 | **LCLM** | One-sided confidence limit below the mean |
| 6 | **MAX** | Maximum value |
| 7 | **MEAN** | Average |
| 8 | **MIN** | Minimum value |
| 9 | **N** | Number of observations with non-missing values |
| 10 | **NMISS** | Number of observations with missing values |
| 11 | **RANGE** | Range |
| 12 | **SKEWNESS / SKEW** | Skewness |
| 13 | **STDDEV / STD** | Standard deviation |
| 14 | **STDERR / STDMEAN** | Standard error of the mean |
| 15 | **SUM** | Sum |
| 16 | **SUMWGT** | Sum of the Weight variable values |
| 17 | **UCLM** | One-sided confidence limit above the mean |
| 18 | **USS** | Uncorrected sum of squares |
| 19 | **VAR** | Variance |

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| Quantile Statistics | | | |
| SI.NO | **Keywords** | **Definition** |
| 1 | **MEDIAN / P50** | Median or 50th percentile |
| 2 | **P1** | 1st percentile |
| 3 | **P5** | 5th percentile |
| 4 | **P10** | 10th percentile |
| 5 | **Q1 / P25** | Lower quartile or 25th percentile |
| 6 | **Q3 / P75** | Upper quartile or 75th percentile |
| 7 | **P90** | 90th percentile |
| 8 | **P95** | 95th percentile |
| 9 | **P99** | 99th percentile |
| 10 | **QRANGE** | Difference between upper and lower quartiles: Q3-Q1 |

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| Hypothesis Testing | | | |
| SI.NO | **Keywords** | **Definition** |
| 1 | **PROBT** | Probability of a greater absolute value for the *t* value |
| 2 | **T** | Student's *t* for testing the hypothesis that the population mean is 0 |

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| ***Computing Statistics for Categorical Variable*** | | | |
| **PROC FREQ DATA=<DATASETNAME>**  **WD/NOWD \*Decides should the o/p be printed in a dedicated report window;** | | | **Scope** |
| 1 | **TABLE** <Col Names>  / **NOCUM**; | Used to ***mention the column names based on which a frequency table*** needs to be constructed.  ***One column name*** in TABLE will construct a ***simple frequency table with frequency and cumulative frequency and percentage***, totally 4 outputs.  ***NOCUM*** will ***supress the display of cumulative frequency and percentage*** from the output. | Local |
| 2 | **TABLE** <COL1> - <COL5> | This will again create simple frequency table for columns-1 to column-5 | Local |
| 3 | PROC FORMAT;  Value <frmt\_name> range1 ‘label-1’  Range2 ‘label-2’  Range3 ‘label-3’  RUN;  **PORC FREQ** data=<datasetnames>;  **Tables** <cat\_col\_name>;  ***Format weight <frmt\_name>.***; |  |  |
| 4 | **TABLE** <COL1> \* <COL2>; | This will ***create two-way table***. This will ***cross tabulate*** 2 different categorical variables. | Local |
| 5 | **TABLE** <COL1> \* <COL2> \* <COL3>; | This will ***create N-way table***. This will ***cross tabulate*** N different categorical variables. | Local |
| 6 | **TABLE** <COL1> \* <COL2>  / ***CROSSLIST***; | ***CROSSLIST*** will ***display cross tabulation in a ODS format***. This ***ODS output can be customized using*** the ***TEMPLATE*** procedure. | Local |
| 7 | **TABLE** <COL1> \* <COL2>  / ***LIST***; | Produce list output for crosstabulation. Puts frequency table in a simple and short table. | Local |
|  | **TABLE** <COL1> \* <COL2>  / ***nofreq nopercent norow nocol***; | ***Nofreq*** will ***supress the cell frequency***  ***Nopercent*** will supress the ***cell percentage***  ***Norow*** will supress ***row percentages***  ***Nocol*** will supress ***column percentage*** | Local |