GHSUG User Group

The Means Procedure in SAS Enterprise Guide (EG)... “Summary Statistics”

Sueheir Saddik

April 15th, 2010

Bell

Outline

- The Means Procedure – Overview and Usage
- The Means Procedure – Proc Means Syntax
- SAS Enterprise Guide – Summary Statistics – Screen Shot and options
- Data Used and Information / Analysis Needed
- SAS Enterprise Guide – Summary Statistics
  - Data & Drop Down
  - Interface, Variable Selection, Statistics, Plots, Results, Tittles, Code Viewing ... Etc
  - Past Due Amount Summary
  - Data / Code Checking
  - Make it Pretty & Add Distributions
  - Profiling (Key Variables), Output, Summary
- Questions

Bell Canada Restricted

The Means Procedure – Overview and Usage

- The Means procedure is one of the most powerful and useful procedures in SAS

- The Means procedure computes descriptive statistics for variables across the observations and within groups of observation with an option to store the statistics in a SAS dataset
  - Some of the computed statistics are:
    - Arithmetic Mean: $\overline{X} = \frac{\sum_{i=1}^{n} X_i}{n}$
    - Variance: $Var(X) = \frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n-1}$
    - Standard deviation: $SD(X) = \sqrt{Var(X)}$

- The Means Procedure can be used in; analytics, business intelligence, reporting, profiling, standard data checking for coded values created using exiting ones, checking for outliers / extreme values, missing values, data penetration, differences between population mean and certain group of observations (t-test) ... etc

Bell Canada Restricted

The Means Procedure – Proc Means Syntax

- Simplified ...

```
proc means  data = XXXX  mean  min  max  n  nmiss;
   var  variable(s) name;
run;
```

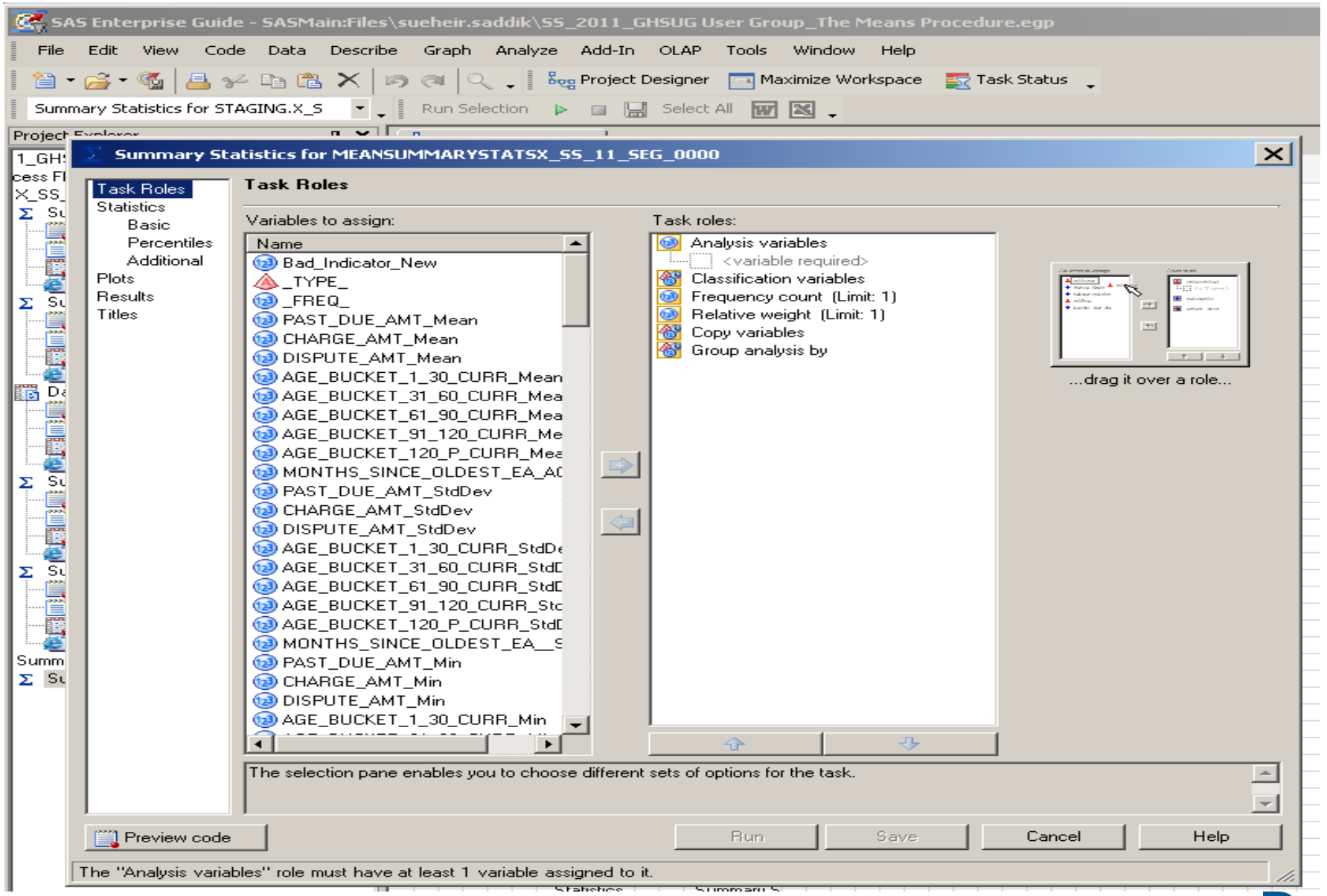
- Complicated .... SAS web site

```
PROC MEANS <option(s)> <statistic-keyword(s)>;
    BY <DESCENDING> variable-1 <... <DESCENDING> variable-n><NOTSORTED>;
    CLASS variable(s) </ option(s)>;
    FREQ variable;
    ID variable(s);
    OUTPUT <OUT=SAS-data-set> <output-statistic-specification(s)>  <id-group-specification(s)> <maximum-id-
    specification(s)>  <minimum-id-specification(s)> </ option(s)> ;
    TYPES request(s);
    VAR variable(s) < / WEIGHT=weight-variable>;
    WAYS list;
    WEIGHT variable;
     ... Etc
RUN;
```

- SAS EG is user friendly, with drag and drop interface. There is no need to remember or memorize the above code ... ☺
  - More efficient
  - Less time consuming
  - Keeping it simple

Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Screen Shot



Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics

- Task Roles
  - Analysis variables :
    - numeric variables on which you want the statistics generated
  - Classification variables:
    - no data sorting required
  - Frequency count:
  - Relative weight:
  - Copy variables
  - Group analysis by:
    - requires that the data set must be sorted ... The variables that you assign to this role are used to compute separate statistics for each distinct value or combination of values of the Group analysis by variables. The data is automatically sorted by the variables in this role before the statistics are computed.
- Statistics
  - Basic
  - Percentiles
  - Additional
- Plots
  - Histogram
  - Box and Wisker
- Results
  - Save statistics to data set
  - Show statistics
- Titles
  - Default
  - specify

Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics ... Cont'd

Statistics

- **Basic statistics available:**
  - Mean: is the arithmetic average, calculated by adding the values of a sample variable and dividing this sum by the number of observations.
  - Std Dev = Standard deviation: is a statistical measure of the variability of a group of data values. This measure, which is the most widely used measure of the dispersion of a frequency distribution, is equal to the positive square root of the variance.
  - Standard error: is the standard deviation of the sample mean. The standard error is defined as the ratio of the sample standard deviation to the square root of the sample size.
  - Variance: is a statistical measure of dispersion of data values. This measure is an average of the total squared dispersion between each observation and the sample mean.
  - Minimum: is the lowest value for an observation.
  - Maximum: is the largest value for an observation.
  - Range: is the difference between the largest and the smallest values in the data.
  - Sum: is the sum of all observations.
  - N = Number of observations :is the total number of observations that do not have a missing value.
  - N Miss = Number of missing observations: is the number of observations for which no value is entered.

  - You can specify the maximum number of decimal places here
    - By default, a statistic is displayed by using the best fit, which is usually 7 decimal places.

  - Missing values are not included in the calculations produced by the means procedure

Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics ...Cont'd

Statistics

- **Percentiles** … **By default, no percentiles are selected.**
  - 1st Pctl = 1st percentile
  - 5th Pctl = 5th percentile
  - 10th Pctl = 10th percentile
  - Lower Quartile = 1st quartile = 25th percentile
  - Median = 50th percentile
  - Upper Quartile = 3rd quartile = 75th percentile
  - 90th Pctl = 90th percentile
  - 95th Pctl = 95th percentile
  - 99th Pctl = 99th percentile

- **Additional**
  - Confidence limits of the mean
  - T – statistics and prob > I t I
  - Coefficient of variation
  - Corrected sum of squares
  - Un corrected sum of squares

Bell Canada Restricted

Data Used and Information / Analysis Needed

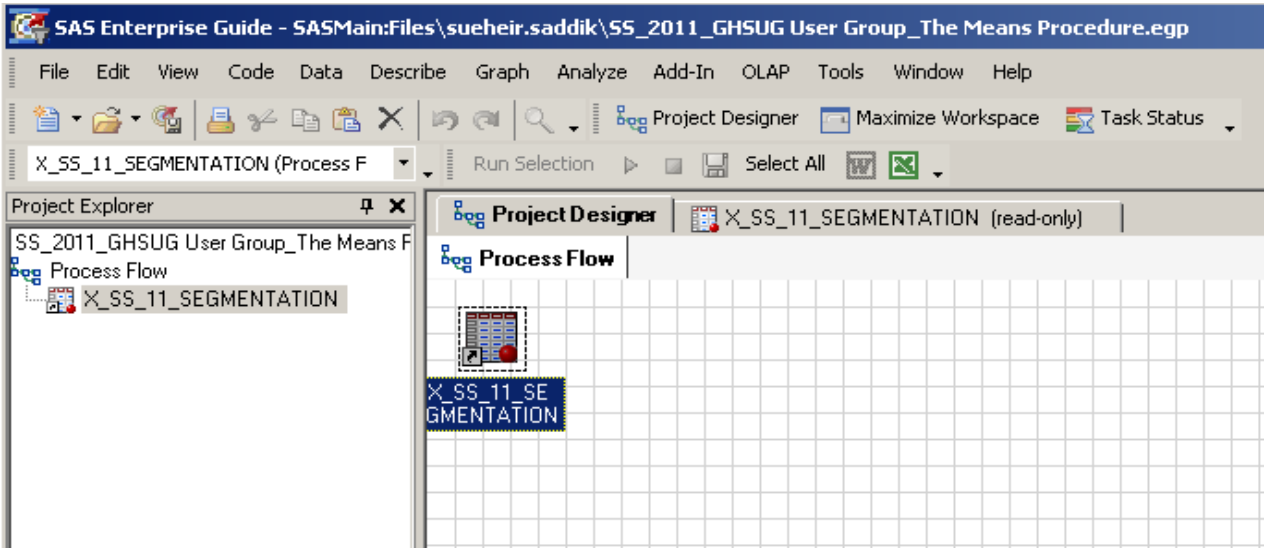
- Bell Canada data was used in the example presented in this presentation
  - Collection data with 604,009 distinct observations
  - 74 variables ... Variables used
    - Past Due Amount: amount owing by customers
    - Bad_Ind_New: an indicator with these values
      - 0 = good
      - 1 = bad
    - Aging buckets
    - Time spent in collection in days
    - Tenure in months

- Information needed - questions to answer ....
  - Data quality, missing values, penetration, extreme values, transformations created ... ?
  - What is the overall average past due amount?
  - How does the past due amount differ with respect to the bad / good groups?
  - What is the profile of bad customers?

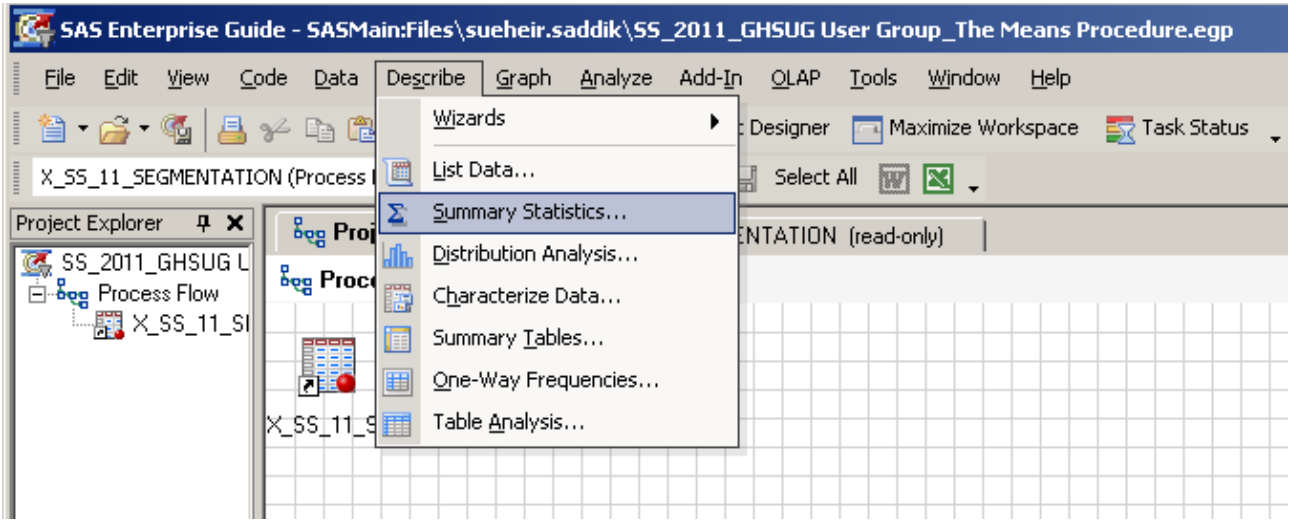
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Data & Drop Down

Data
Variables = columns
Observations = rows

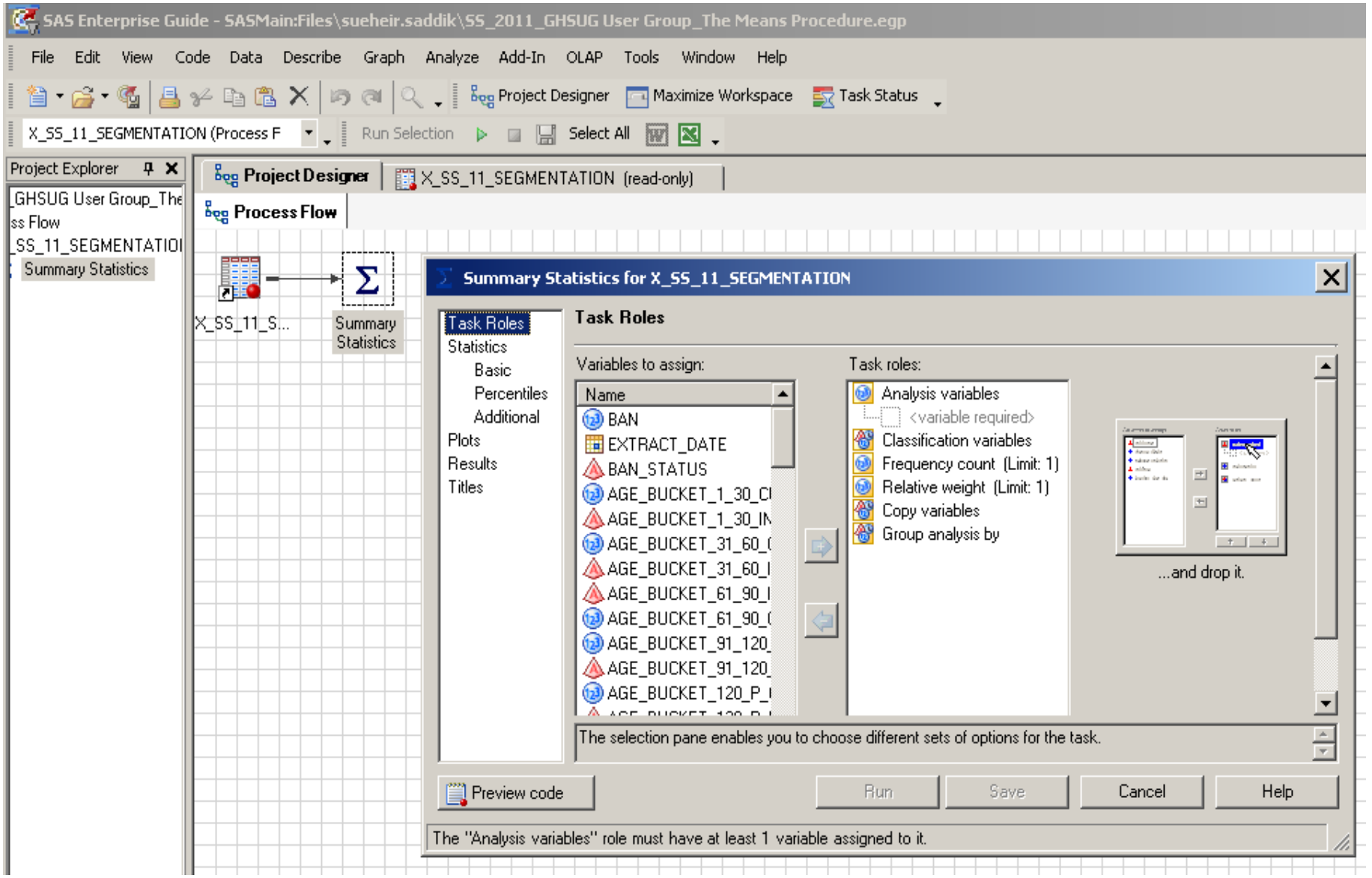


Describe –
Summary Statistics



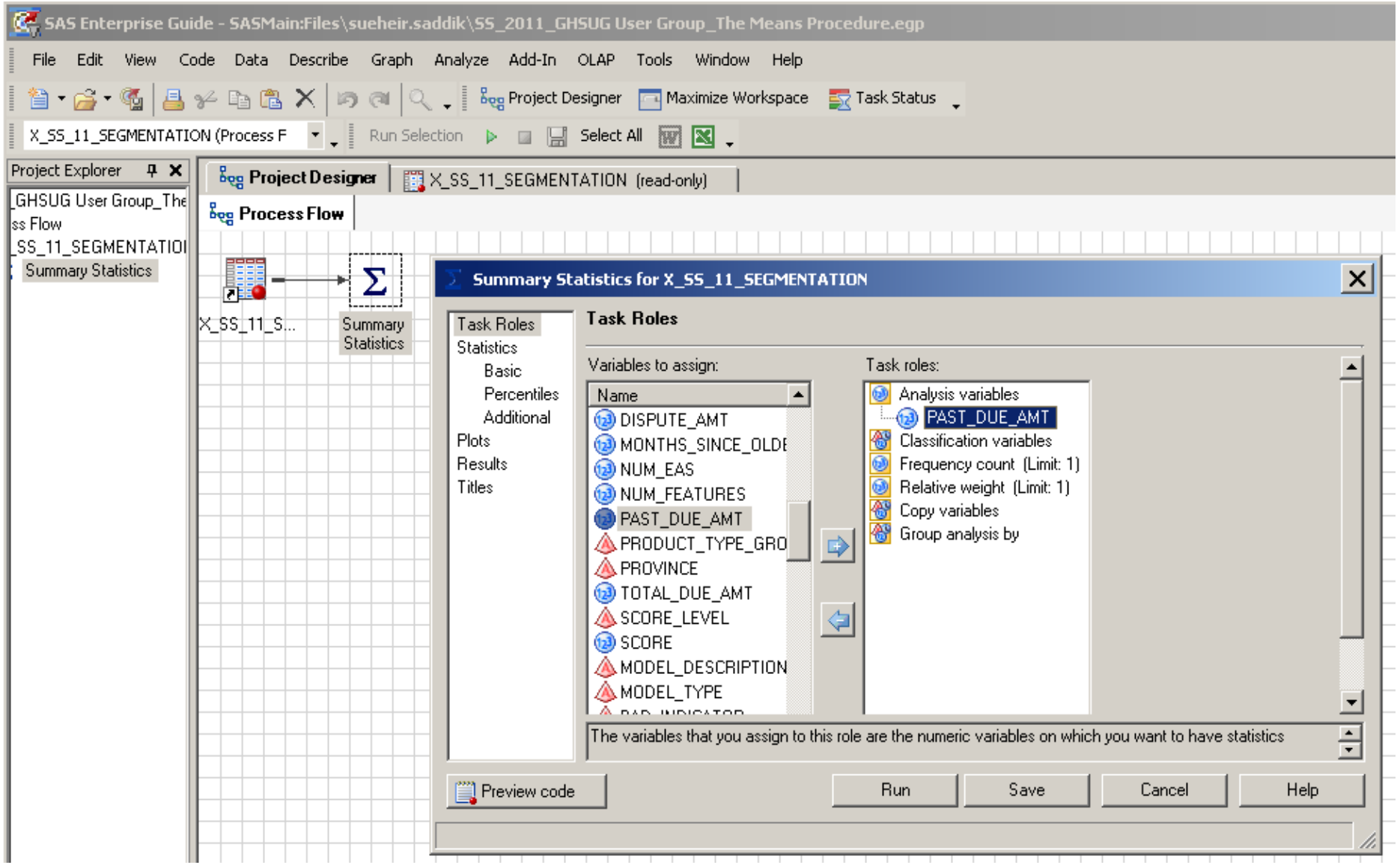
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Interface



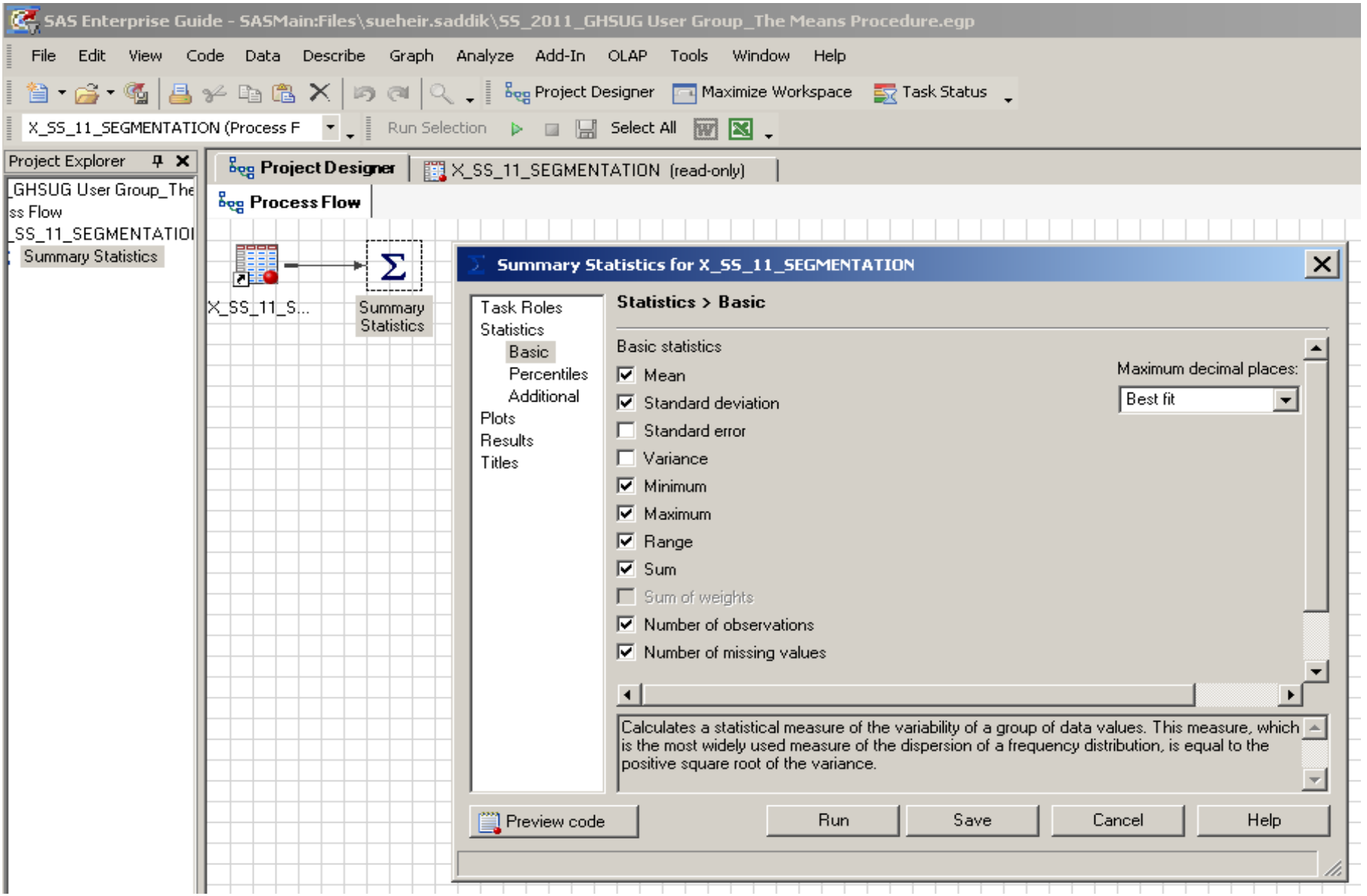
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Variable Selection



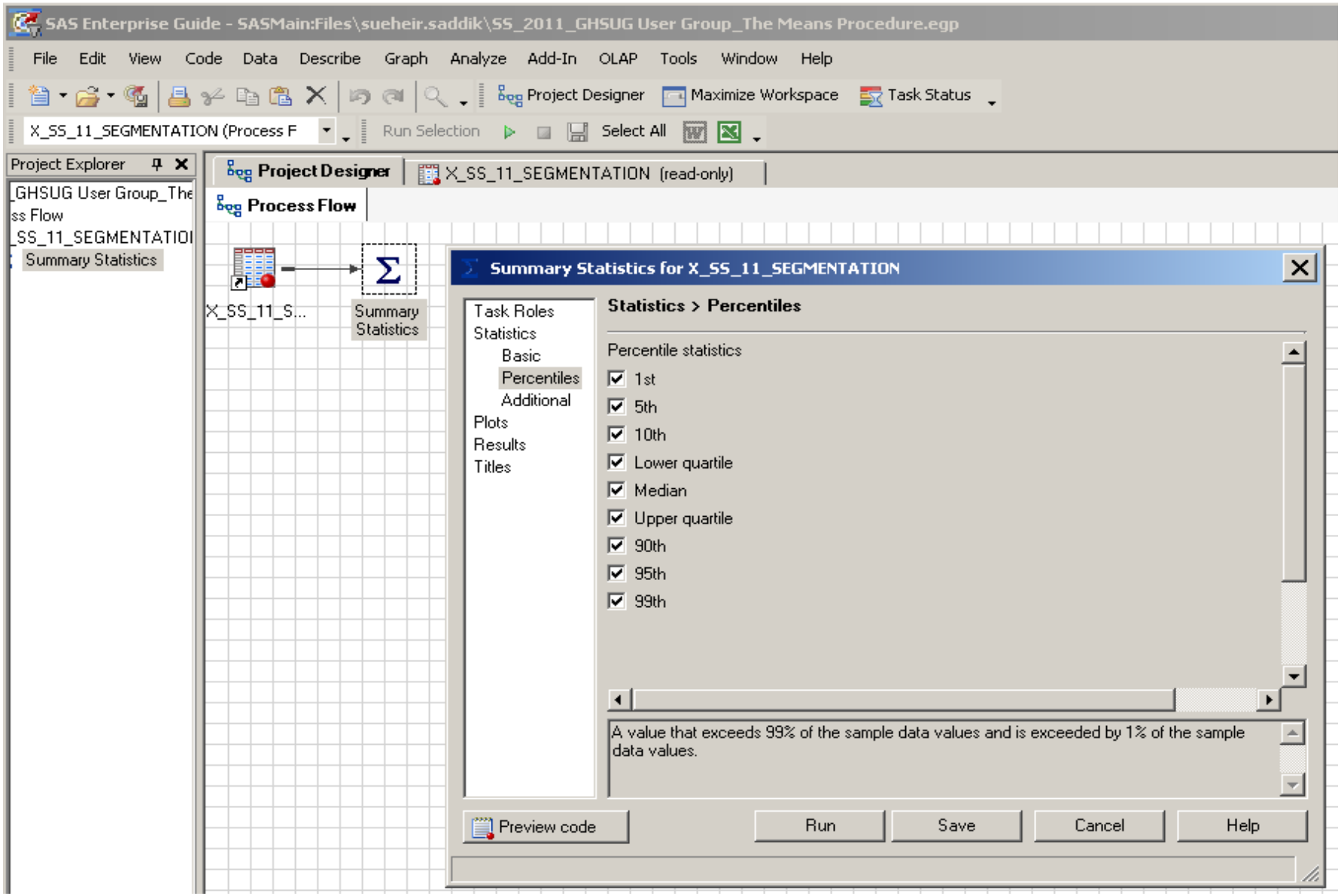
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Statistics – Basic Statistics



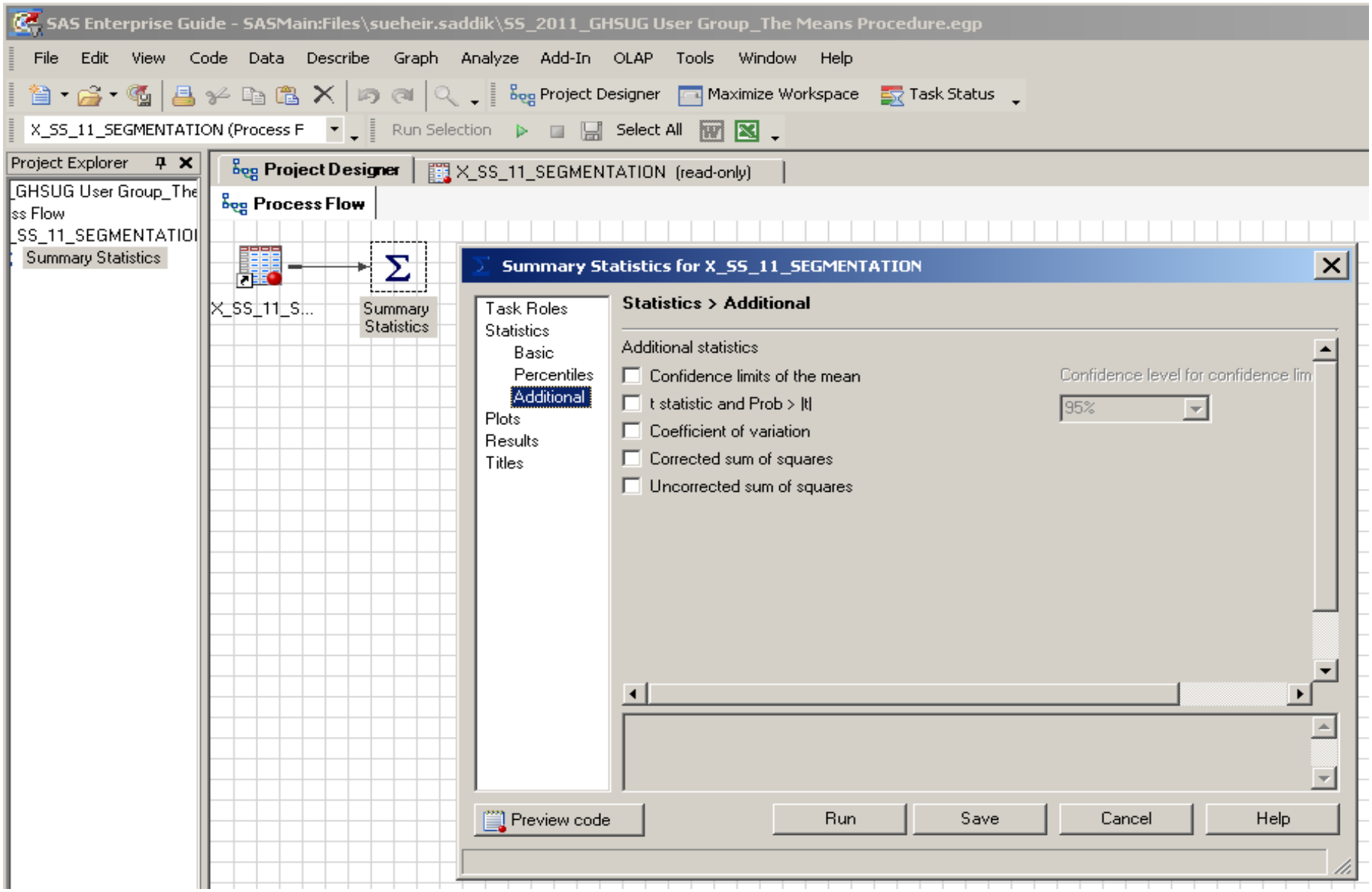
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Statistics – Percentiles



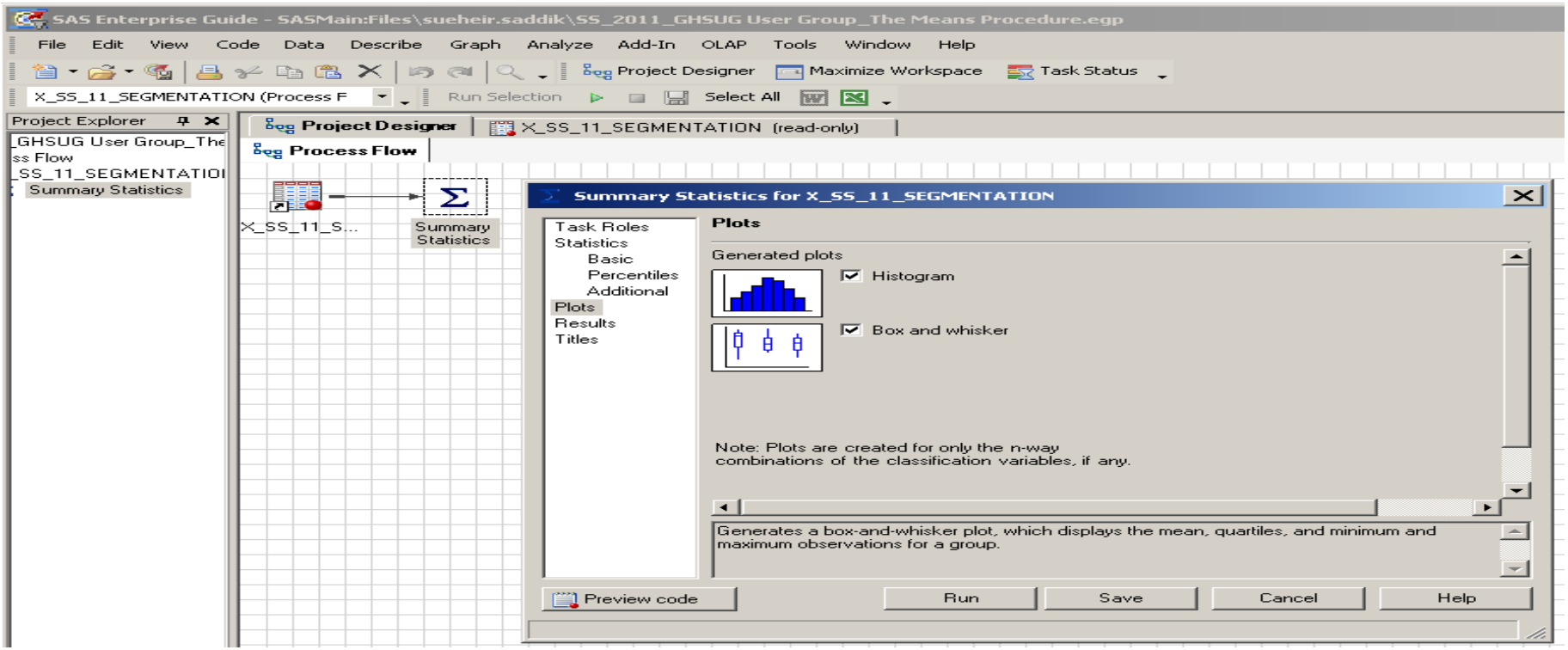
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Statistics – Additional



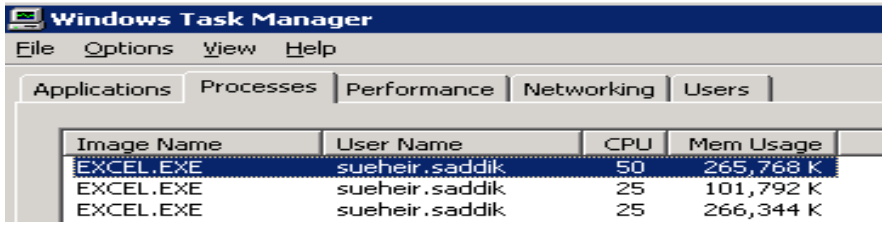
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Plots



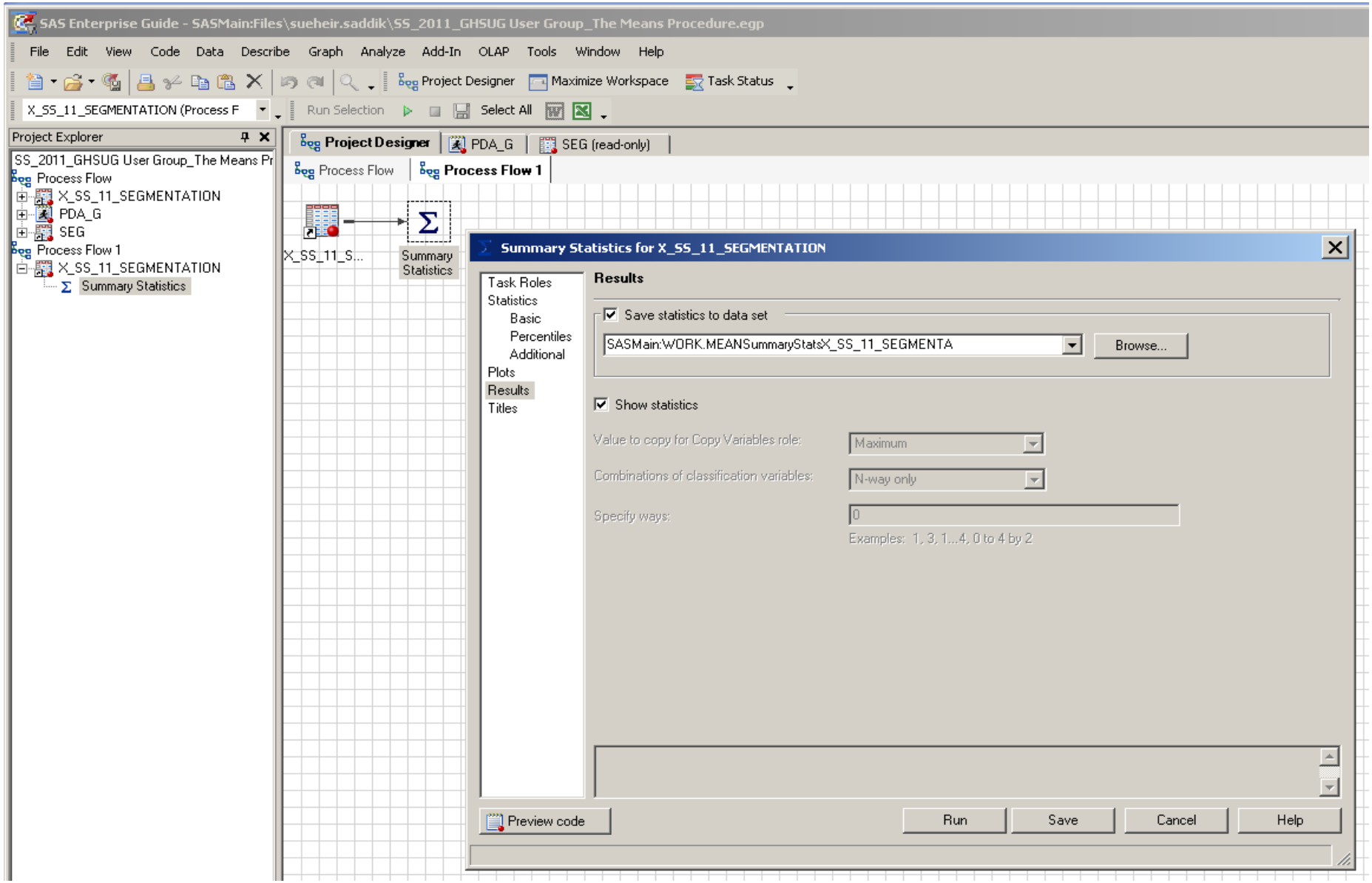
- No plots will be shown today ... My advice, avoid the plots option unless you have super CPU ... The process consumes lots and lots of CPU and brings the system down to it's knees ...

Email received ... Oops ... subject "Fw: SAS_Critical_Alert - Server Conso SAS VGRCM1 CPU Util ..."



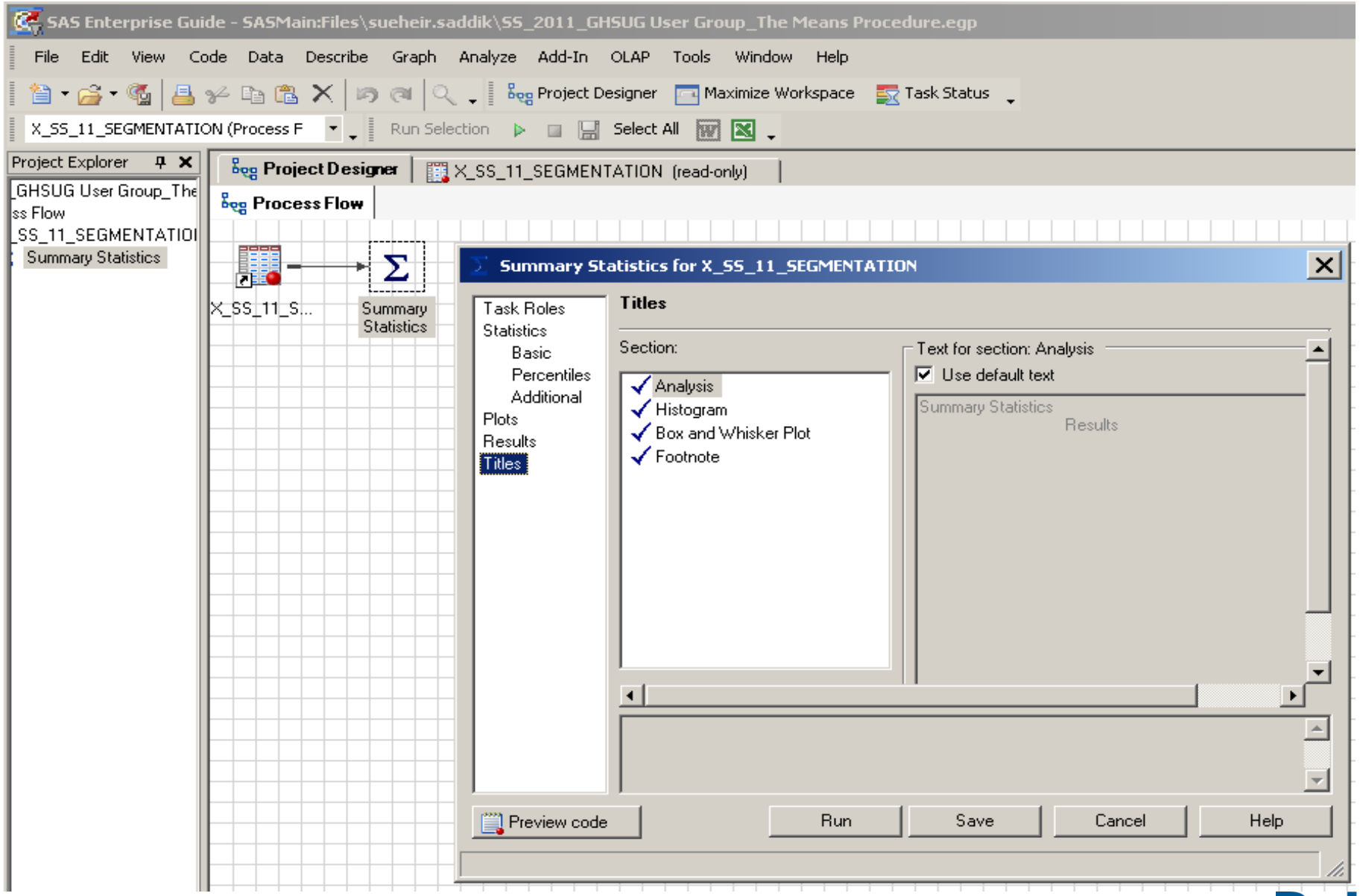
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Results



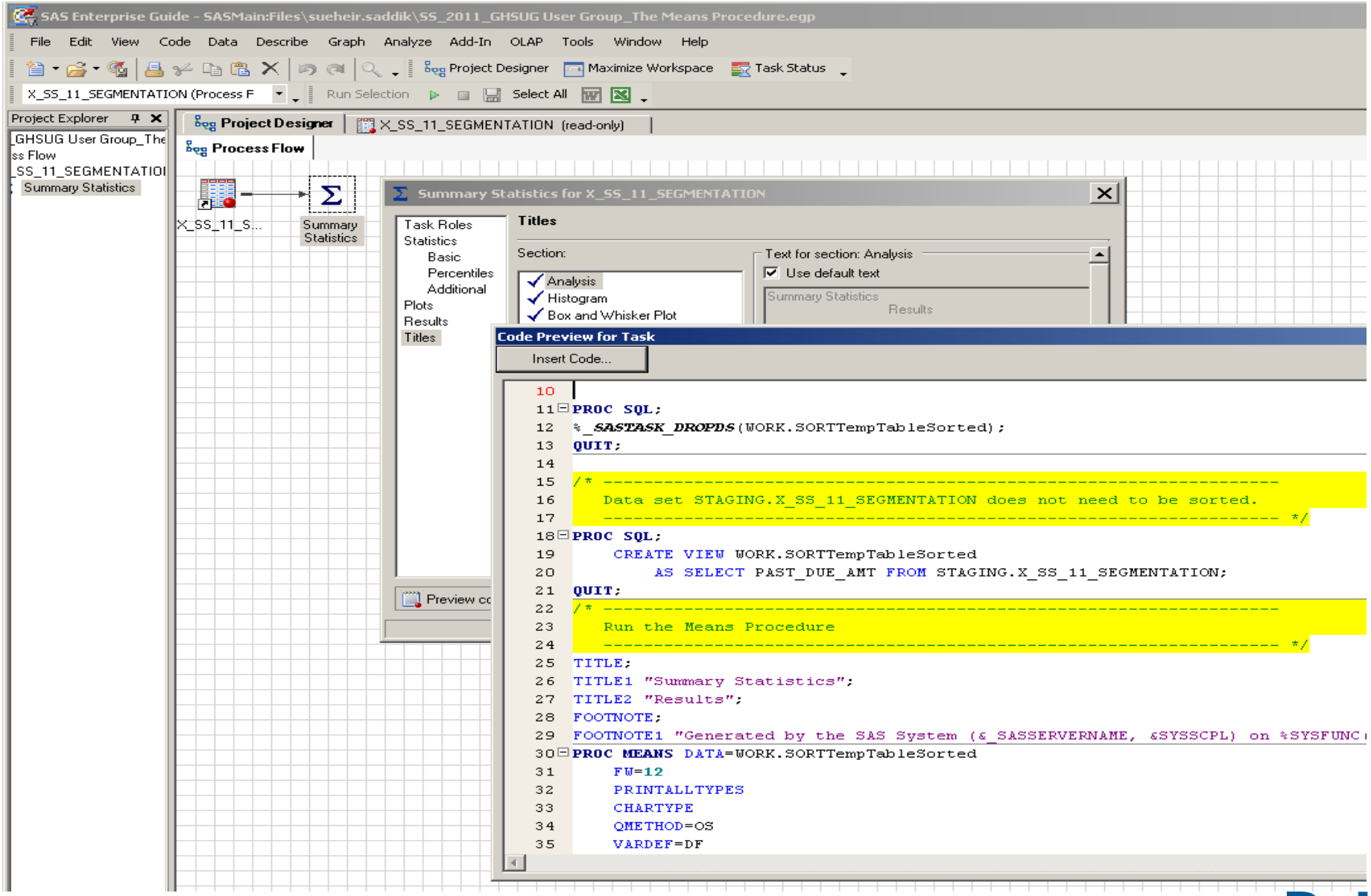
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Titles



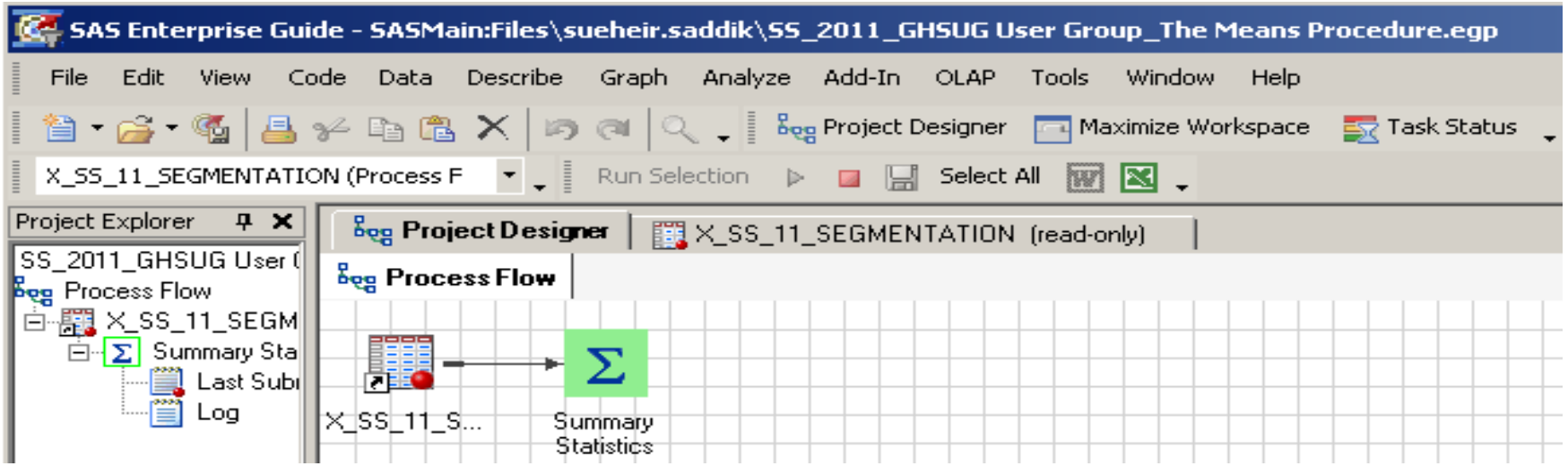
Bell Canada Restricted

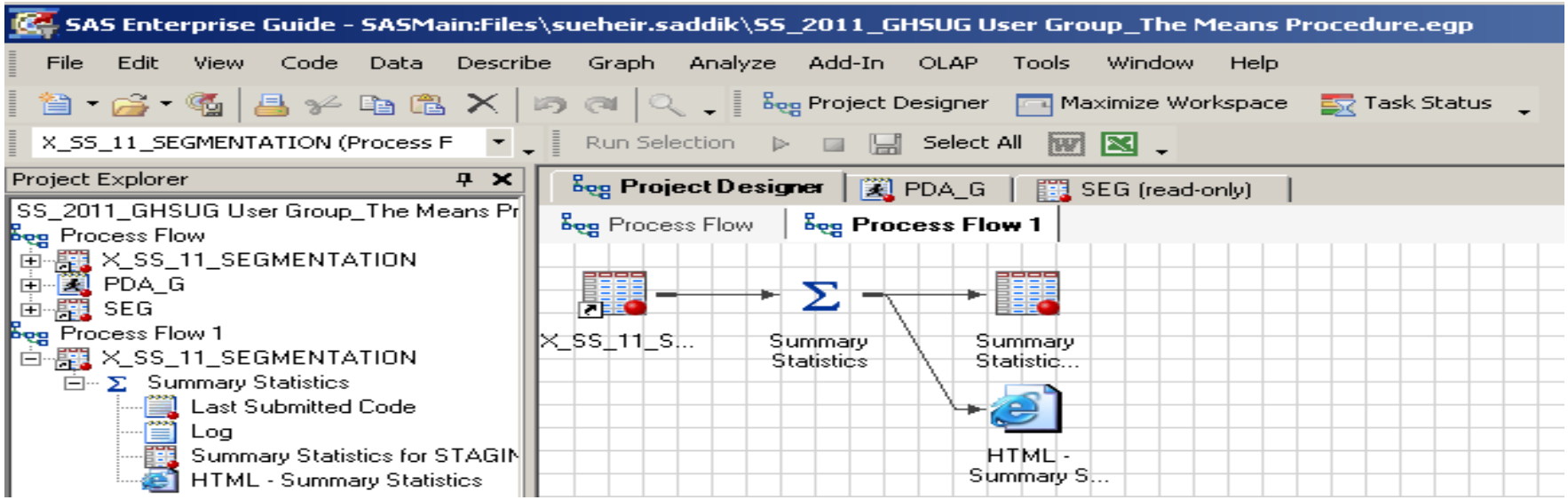
SAS Enterprise Guide – Summary Statistics – Code Viewing



Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Running & Done

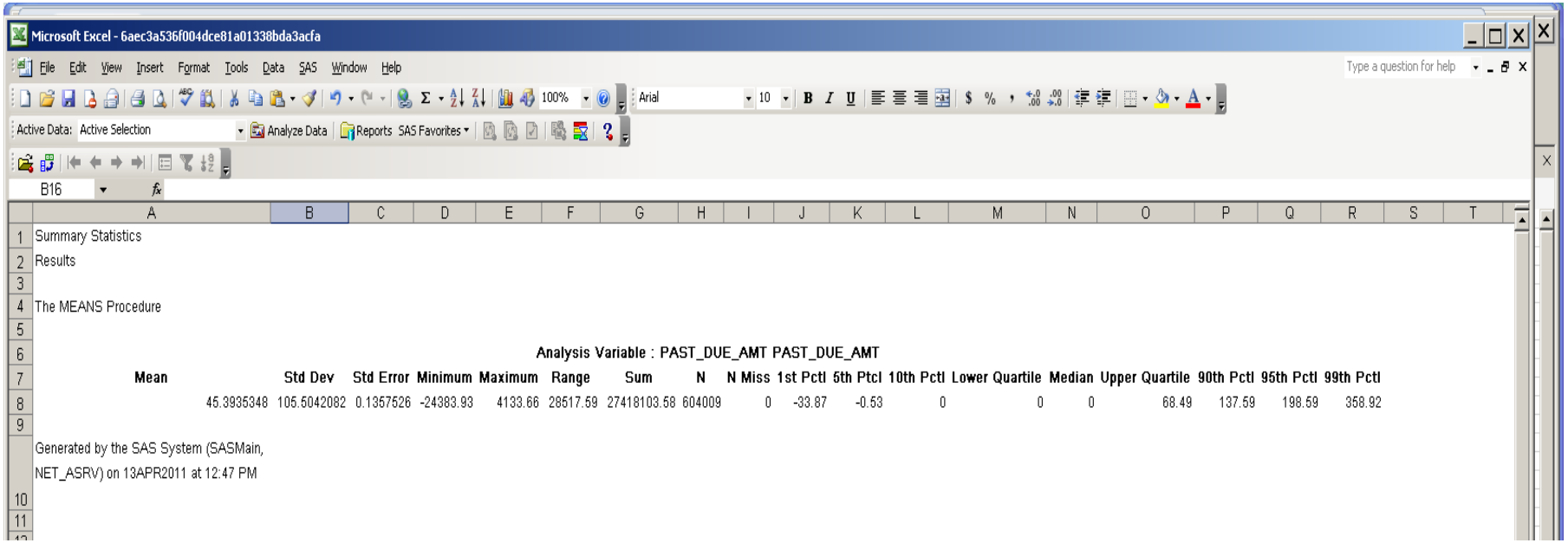




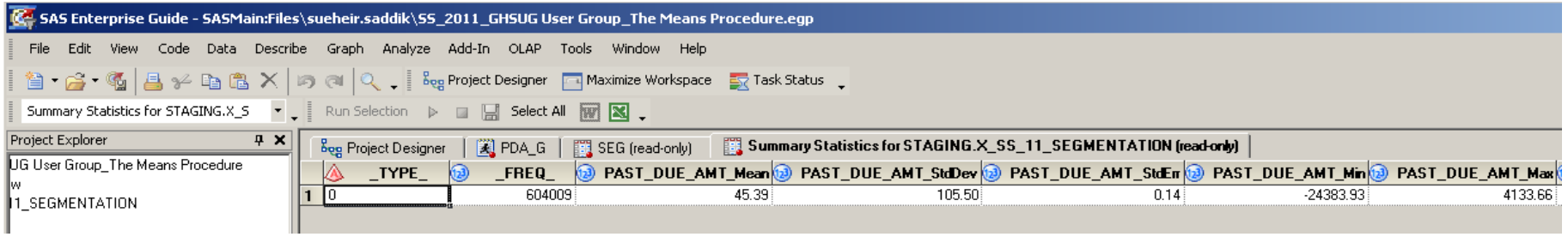
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Output

SAS output

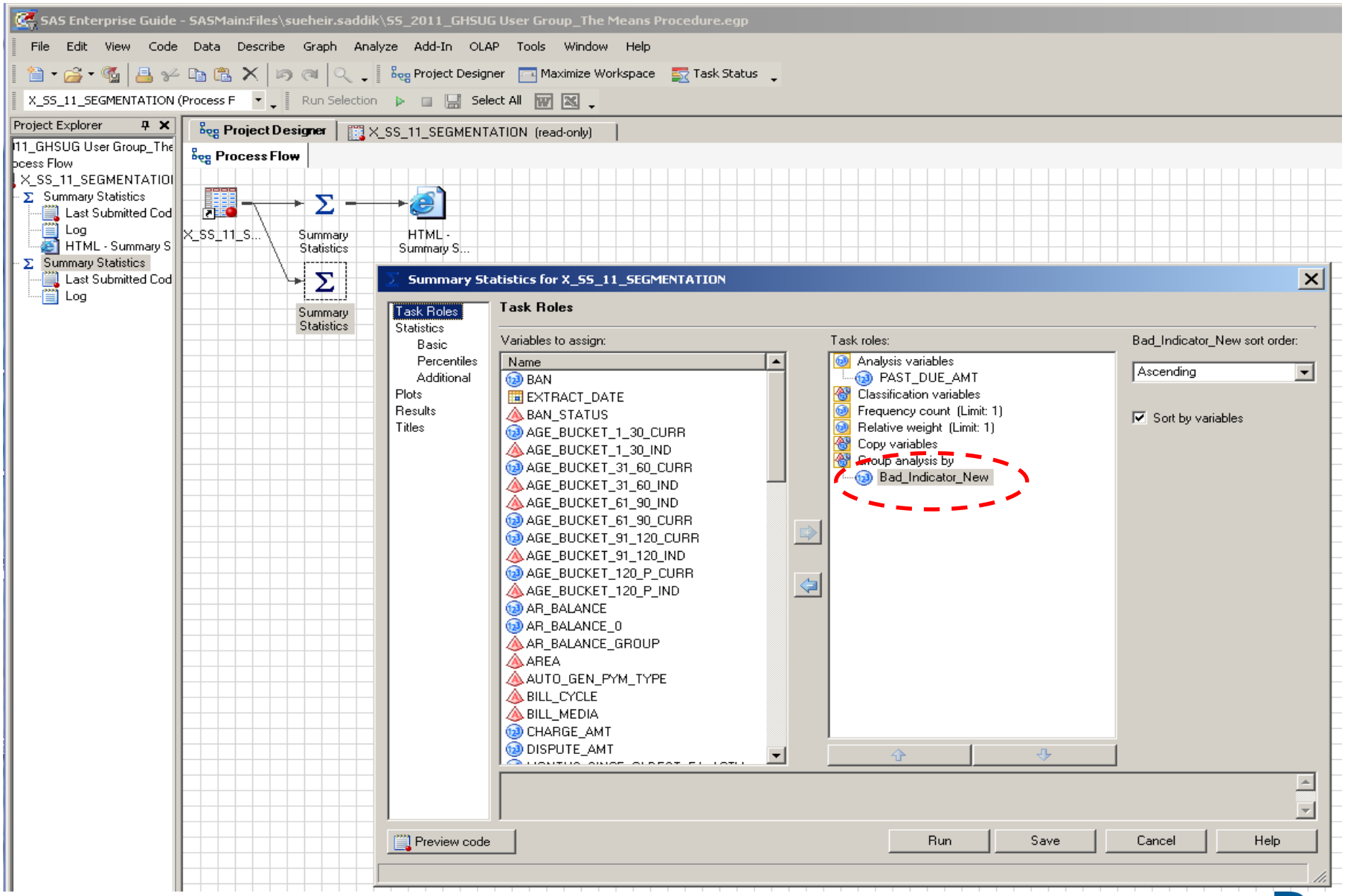


SAS output in a data set



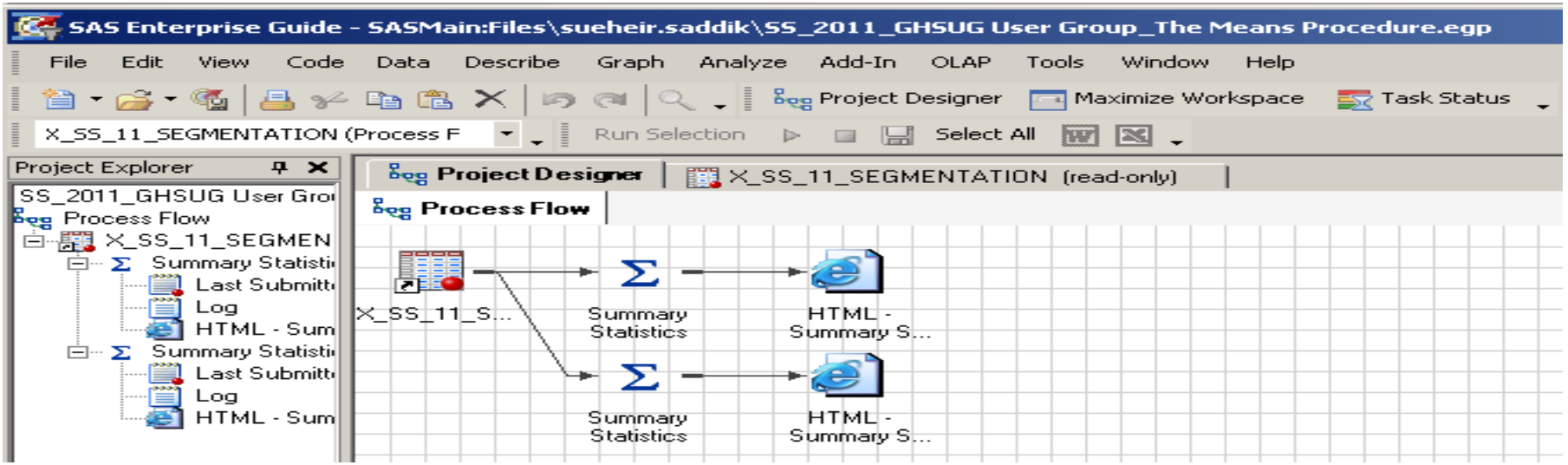
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Using Group By Option



Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Output



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Summary Statistics																
2	Results																
3																	
4	The MEANS Procedure																
5																	
6	Bad_Indicator_New=0																
7																	
8							Analysis Variable : PAST_DUE_AMT PAST_DUE_AMT										
9		Mean	Std Dev	Minimum	Maximum	Range	Sum	N	N Miss	1st Pctl	5th Pctl	10th Pctl	Lower Quartile	Median	Upper Quartile	90th Pctl	95th Pctl	99th Pctl
10		39.4407213	102.0300758	-24383.93	3467.54	27851.47	20377088.09	516651	0	-36.08	-0.73	0	0	0	64.16	122.17	174.67	305.77
11																		
12	Bad_Indicator_New=1																	
13																		
14							Analysis Variable : PAST_DUE_AMT PAST_DUE_AMT										
15		Mean	Std Dev	Minimum	Maximum	Range	Sum	N	N Miss	1st Pctl	5th Pctl	10th Pctl	Lower Quartile	Median	Upper Quartile	90th Pctl	95th Pctl	99th Pctl
16		80.59955	118.0948121	-2921.95	4133.66	7055.61	7041015.49	87358	0	-20.79	0	0	0	50.27	114.38	226.18	308.38	514.57
17																		
	Generated by the SAS System (SASMain, NET_ASRV) on 14MAR2011 at 12:49 PM																	

Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Past Due Amount Summary

	Analysis Variable : PAST_DUE_AMT																
Bad_Indicator _New	N	N Miss	Sum	Mean	Std Dev	Minimum	Maximum	Range	1st Pctl	5th Ptcl	10th Pctl	Lower Quartile	Median	Upper Quartile	90th Pctl	95th Pctl	99th Pctl
0	516,651	0	$20,377,088	$39	$102	-$24,384	$3,468	$27,851	-$36	-$1	$0	$0	$0	$64	$122	$175	$306
1	87,358	0	$7,041,015	$81	$118	-$2,922	$4,134	$7,056	-$21	$0	$0	$0	$50	$114	$226	$308	$515
All	604,009	0	$27,418,104	$45	$106	-$24,384	$4,134	$28,518	-$34	-$1	$0	$0	$0	$68	$138	$199	$359

- There are no missing past due amount values
- 604,009 observation
  - 516,651 good (86%)
  - 87,358 Bad (14%)
- Bad rate = (87,358 / 604,009) = 14%
- 50% of all customers have no past due amount
- 50% of bad customers have a past due amount of $50 or less
- Few extreme values /outliers (Min & Max) such as (-$24,384, -$2,922, ..., $3,468, $4,134)
- .
- .
- .
- There average past due amount for good is significantly lower than that of bad

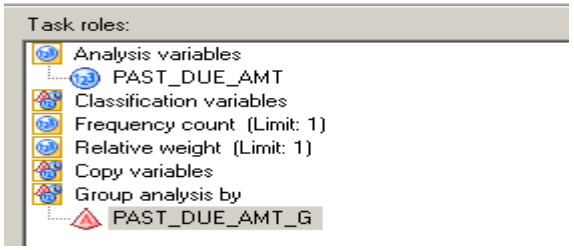
Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Data / Code Checking

SAS Code created

```
      if        PAST_DUE_AMT    < 0    then PAST_DUE_AMT_G = '-ive                ';
else if         PAST_DUE_AMT    = 0    then PAST_DUE_AMT_G = '$0                  ';
else if  0    < PAST_DUE_AMT <= 75    then PAST_DUE_AMT_G = '1-$0.01 to $75      ';
else if 75    < PAST_DUE_AMT <= 150   then PAST_DUE_AMT_G = '2-$75.01 to $150 ';
else if 150 < PAST_DUE_AMT <= 250   then PAST_DUE_AMT_G = '3-$150.01 to $250';
else if 250 < PAST_DUE_AMT <= 500   then PAST_DUE_AMT_G = '4-$250.01 to $500';
else if         PAST_DUE_AMT  >  500   then PAST_DUE_AMT_G = '5-$500.01 +          ';
run;
```

Summary Statistics Interface



SAS output

PAST_DUE_AMT_G=$0

Analysis Variable : PAST_DUE_AMT PAST_DUE_AMT

Mean	Minimum	Maximum	N	N Miss	1st Pctl	5th Pctl	Median	95th Pctl	99th Pctl
0	0	0	276403	0	0	0	0	0	0

PAST_DUE_AMT_G=-ive

Analysis Variable : PAST_DUE_AMT PAST_DUE_AMT

Mean	Minimum	Maximum	N	N Miss	1st Pctl	5th Pctl	Median	95th Pctl	99th Pctl
-32.2243993	-24383.93	-0.01	36913	0	-343.11	-100.3	-3.86	-0.09	-0.01

PAST_DUE_AMT_G=1-$0.01 to $75

Analysis Variable : PAST_DUE_AMT PAST_DUE_AMT

Mean	Minimum	Maximum	N	N Miss	1st Pctl	5th Pctl	Median	95th Pctl	99th Pctl
46.6463012	0.01	75	160903	0	0.1	2.75	50.94	72.62	74.56

PAST_DUE_AMT_G=2-$75.01 to $150

Analysis Variable : PAST_DUE_AMT PAST_DUE_AMT

Mean	Minimum	Maximum	N	N Miss	1st Pctl	5th Pctl	Median	95th Pctl	99th Pctl
106.2728741	75.01	150	77476	0	75.49	77.38	103.14	143.95	148.91

PAST_DUE_AMT_G=3-$150.01 to $250

Analysis Variable : PAST_DUE_AMT PAST_DUE_AMT

Mean	Minimum	Maximum	N	N Miss	1st Pctl	5th Pctl	Median	95th Pctl	99th Pctl
190.4260796	150.01	250	35405	0	150.63	153.11	186.4	240.87	248.08

PAST_DUE_AMT_G=4-$250.01 to $500

Analysis Variable : PAST_DUE_AMT PAST_DUE_AMT

Mean	Minimum	Maximum	N	N Miss	1st Pctl	5th Pctl	Median	95th Pctl	99th Pctl
326.9079031	250.01	500	15094	0	250.72	254.11	308.815	459.35	491.93

PAST_DUE_AMT_G=5-$500.01 +

Analysis Variable : PAST_DUE_AMT PAST_DUE_AMT

Mean	Minimum	Maximum	N	N Miss	1st Pctl	5th Pctl	Median	95th Pctl	99th Pctl
656.8003251	500.05	4133.66	1815	0	502.24	507.38	591.94	995.9	1435.91

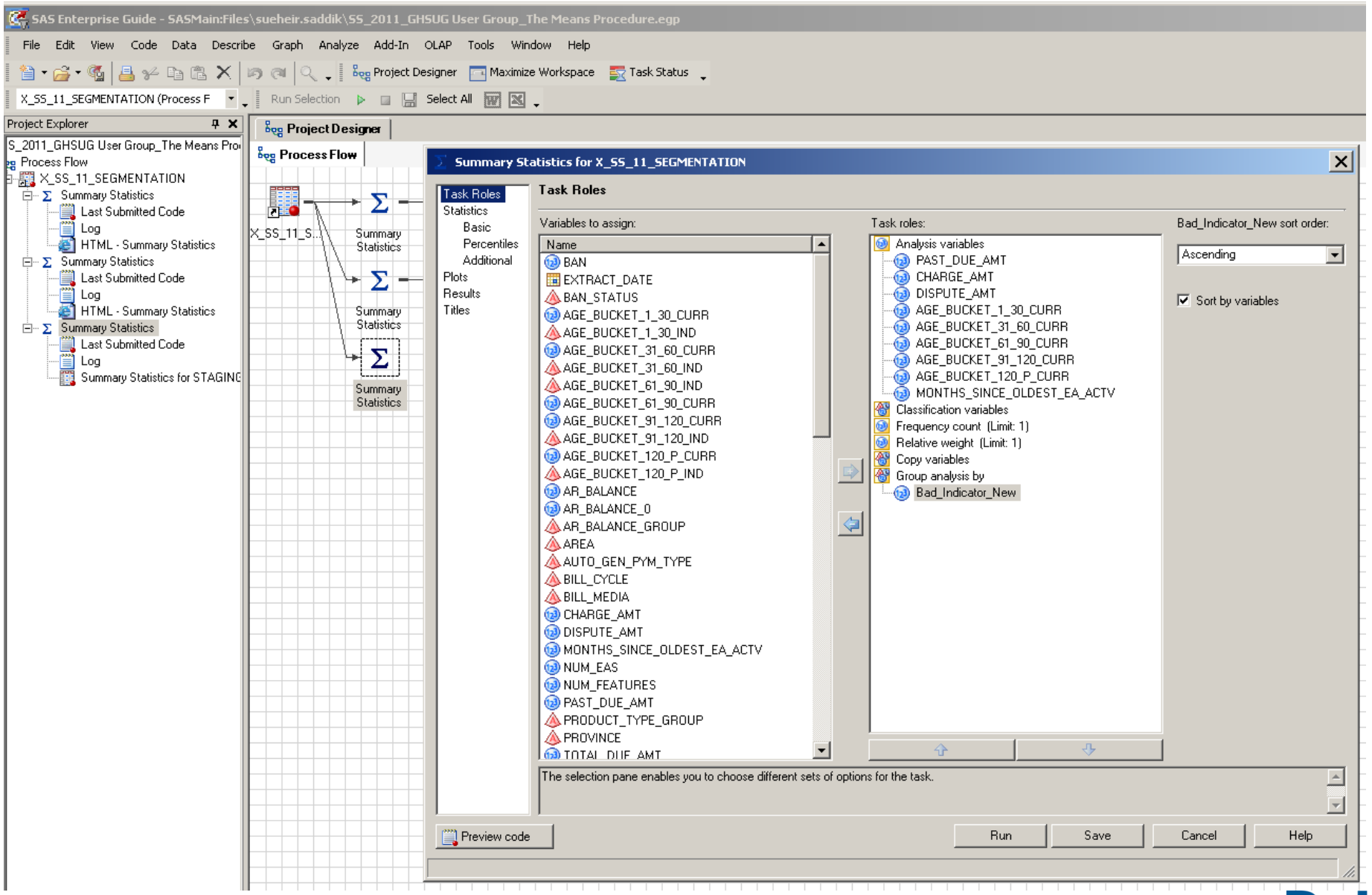
SAS Enterprise Guide – Data Checking Output - Make it Pretty & Add Distributions

	Analysis Variable : PAST_DUE_AMT PAST_DUE_AMT												
PAST_DUE_AMT_G	Mean	Min	Max	N	N Miss	1st Pctl	5th Ptcl	Median	95th Pctl	99th Pctl	Distribution	Cumulative Distribution	Inverse Cumulative Distribution
$0	$0	$0	$0	276,403	0	$0	$0	$0	$0	$0	46%	46%	100%
-ive	-$32	-$24,384	-$0	36,913	0	-$343	-$100	-$4	-$0	-$0	6%	52%	54%
1-$0.01 to $75	$47	$0	$75	160,903	0	$0	$3	$51	$73	$75	27%	79%	48%
2-$75.01 to $150	$106	$75	$150	77,476	0	$75	$77	$103	$144	$149	13%	91%	21%
3-$150.01 to $250	$190	$150	$250	35,405	0	$151	$153	$186	$241	$248	6%	97%	9%
4-$250.01 to $500	$327	$250	$500	15,094	0	$251	$254	$309	$459	$492	2%	100%	3%
5-$500.01 +	$657	$500	$4,134	1,815	0	$502	$507	$592	$996	$1,436	0%	100%	0%
All	$45	-$24,384	$4,134	604,009	0	-$34	-$1	$0	$199	$359	100%		

- Data created is correct ...
- 46% of customers have no past due amount
- 6% of customer have credits
- 79% of all customers have at most $75 past due amount
- 21% of customers have at least $75 past due amount

Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Profiling (Key Variables)



Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Profiling Output

Summary Statistics

Results

The MEANS Procedure

Bad_Indicator_New=0

Variable	Mean	Std Dev	Minimum	Maximum	Range	Sum	N	N Miss	1st Pctl	5th Ptcl	10th Pctl	Lower Quartile	Median	Upper Quartile	90th Pctl	95th Pctl	99th Pctl
PAST_DUE_AMT	39	102	-24384	3468	27851	20377088	516651	0	-36	-1	0	0	0	64	122	175	306
CHARGE_AMT	127	134	0	57886	57886	65719403	516521	130	24	38	47	72	102	155	226	286	491
DISPUTE_AMT	0	1	-400	98	498	-1002	516521	130	0	0	0	0	0	0	0	0	0
AGE_BUCKET_1_30_CURR	25	47	0	1829	1829	12805405	516521	130	0	0	0	0	0	41	75	113	211
AGE_BUCKET_31_60_CURR	4	17	0	824	824	2088773	516521	130	0	0	0	0	0	0	5	28	83
AGE_BUCKET_61_90_CURR	1	6	0	994	994	330437	516521	130	0	0	0	0	0	0	0	0	21
AGE_BUCKET_91_120_CURR	0	2	0	454	454	67627	516521	130	0	0	0	0	0	0	0	0	2
AGE_BUCKET_120_P_CURR	0	2	0	321	321	64620	516521	130	0	0	0	0	0	0	0	0	0
MONTHS_SINCE_OLDEST_EA_ACTV	132	116	0	359	359	68067605	516651	0	1	2	8	33	99	214	351	354	356

Bad_Indicator_New=1

Variable	Mean	Std Dev	Minimum	Maximum	Range	Sum	N	N Miss	1st Pctl	5th Ptcl	10th Pctl	Lower Quartile	Median	Upper Quartile	90th Pctl	95th Pctl	99th Pctl
PAST_DUE_AMT	81	118	-2922	4134	7056	7041015	87358	0	-21	0	0	0	50	114	226	308	515
CHARGE_AMT	185	168	0	15140	15140	16129541	87328	30	26	41	51	78	141	238	364	481	761
DISPUTE_AMT	0	2	-387	0	387	-617	87328	30	0	0	0	0	0	0	0	0	0
AGE_BUCKET_1_30_CURR	44	69	0	3826	3826	3862311	87328	30	0	0	0	0	10	63	131	184	295
AGE_BUCKET_31_60_CURR	13	37	0	1477	1477	1091917	87328	30	0	0	0	0	0	0	40	80	185
AGE_BUCKET_61_90_CURR	2	14	0	622	622	190703	87328	30	0	0	0	0	0	0	0	6	62
AGE_BUCKET_91_120_CURR	0	5	0	439	439	30289	87328	30	0	0	0	0	0	0	0	0	8
AGE_BUCKET_120_P_CURR	0	5	0	688	688	23557	87328	30	0	0	0	0	0	0	0	0	1
MONTHS_SINCE_OLDEST_EA_ACTV	32	61	0	356	356	2814915	87358	0	0	1	1	2	8	31	94	155	351

Bell Canada Restricted

SAS Enterprise Guide – Summary Statistics – Profiling Summary

Bad customers profile

- Have significantly higher past due amount
- Have significantly higher charge amount
- Have significantly higher $$ in age bucket 1
- Tend to have low tenure
  - New customers !

Bad_Indicator_New	Variable	Mean	Std Dev	Minimum	Maximum	Range	Sum	N	N Miss	1st Pctl	5th Ptcl	10th Pctl	Lower Quartile	Median	Upper Quartile	90th Pctl	95th Pctl	99th Pctl
0	PAST_DUE_AMT	$39	102	-$24,384	$3,468	27,851	20,377,088	516,651	0	-36	-1	0	0	0	64	122	175	306
	CHARGE_AMT	$127	134	$0	$57,886	57,886	$65,719,403	516,521	130	$24	$38	$47	$72	$102	$155	$226	$286	$491
	AGE_BUCKET_1	$25	47	$0	$1,829	1,829	$12,805,405	516,521	130	$0	$0	$0	$0	$0	$41	$75	$113	$211
	AGE_BUCKET_2	$4	17	$0	$824	824	$2,088,773	516,521	130	$0	$0	$0	$0	$0	$0	$5	$28	$83
	AGE_BUCKET_3	$1	6	$0	$994	994	$330,437	516,521	130	$0	$0	$0	$0	$0	$0	$0	$0	$21
	AGE_BUCKET_4	$0	2	$0	$454	454	$67,627	516,521	130	$0	$0	$0	$0	$0	$0	$0	$0	$2
	AGE_BUCKET_5	$0	2	$0	$321	321	$64,620	516,521	130	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Tenure	132	116	0	359	359	68,067,605	516,651	0	1	2	8	33	99	214	351	354	356
1	PAST_DUE_AMT	$81	118	-$2,922	$4,134	7,056	7,041,015	87,358	0	-21	0	0	0	50	114	226	308	515
	CHARGE_AMT	$185	168	$0	$15,140	15,140	$16,129,541	87,328	30	$26	$41	$51	$78	$141	$238	$364	$481	$761
	AGE_BUCKET_1	$44	69	$0	$3,826	3,826	$3,862,311	87,328	30	$0	$0	$0	$0	$10	$63	$131	$184	$295
	AGE_BUCKET_2	$13	37	$0	$1,477	1,477	$1,091,917	87,328	30	$0	$0	$0	$0	$0	$0	$40	$80	$185
	AGE_BUCKET_3	$2	14	$0	$622	622	$190,703	87,328	30	$0	$0	$0	$0	$0	$0	$0	$6	$62
	AGE_BUCKET_4	$0	5	$0	$439	439	$30,289	87,328	30	$0	$0	$0	$0	$0	$0	$0	$0	$8
	AGE_BUCKET_5	$0	5	$0	$688	688	$23,557	87,328	30	$0	$0	$0	$0	$0	$0	$0	$0	$1
	Tenure	32	61	0	356	356	2,814,915	87,358	0	0	1	1	2	8	31	94	155	351
All	PAST_DUE_AMT	$45	106	-$24,384	$4,134	28,518	27,418,104	604,009	0	-34	-1	0	0	0	68	138	199	359
	CHARGE_AMT	$136	141	$0	$57,886	57,886	$81,848,943	603,849	160	$24	$39	$48	$72	$105	$166	$247	$320	$563
	AGE_BUCKET_1	$28	51	$0	$3,826	3,826	$16,667,716	603,849	160	$0	$0	$0	$0	$0	$45	$82	$125	$230
	AGE_BUCKET_2	$5	22	$0	$1,477	1,477	$3,180,691	603,849	160	$0	$0	$0	$0	$0	$0	$11	$34	$106
	AGE_BUCKET_3	$1	8	$0	$994	994	$521,141	603,849	160	$0	$0	$0	$0	$0	$0	$0	$0	$25
	AGE_BUCKET_4	$0	3	$0	$454	454	$97,916	603,849	160	$0	$0	$0	$0	$0	$0	$0	$0	$3
	AGE_BUCKET_5	$0	3	$0	$688	688	$88,178	603,849	160	$0	$0	$0	$0	$0	$0	$0	$0	$0
	Tenure	117	115	0	359	359	70,882,520	604,009	0	0	1	3	19	80	189	337	353	355

Bell Canada Restricted

Questions ?