```
 SET DECIMAL DOT.

GET DATA  /TYPE=TXT
  /FILE="/Users/pieter/Documents/BCSLab/Deliverables/D22_Tools_M24/ContractMut/data_and_images/kill_detail_TxEvMethLimit.csv"
  /DELIMITERS=","
  /QUALIFIER='"'
  /ARRANGEMENT=DELIMITED
  /FIRSTCASE=2
  /DATATYPEMIN PERCENTAGE=95.0
  /VARIABLES=
   comment F1
   contract A269
   mutant F2
   SLOC F4
   line F4
   operator A6
   status A24
   notes A10
   details a10
  /MAP.

COMPUTE operator_class = 0.
IF( operator = "LR_A" | operator = "RAR" | operator = "TRD" | operator = "MORD" ) operator_class = 1.

ADD VALUE LABELS operator_class
0 "Mothra operator"
1 "Solidity operator".

COMPUTE potential = 0.
IF( notes = "Semantically equivalent" ) potential = 1.
IF( notes = "New test needed" ) potential = 2.
IF( status = "Killed by gas" | status = "Killed by output" | status = "Killed by output and gas" ) potential = 2.

ADD VALUE LABELS potential
0 "Not killed"
1 "Semantically equivalent"
2 "Killed or Killable".
```

```
VARIABLE LABELS
contract 'Contract name'
mutant 'Mutant number'
SLOC 'Source lines of Code'
line 'Line number where the mutant change occurs'
operator 'Mutation operator'
operator_class 'Mohtra or Solidity operator'
status 'Current mutant status'
potential 'Potential mutant status'
notes 'What to do to improve the mutation score'.

* Ignore comments and mutants without an operator.
COMPUTE my_filter = 1 - comment.
IF( operator = "" ) my_filter = 0.
FILTER BY my_filter.

DESCRIPTIVES VARIABLES=
operator
operator_class
mutant
SLOC
line
status
potential
  /STATISTICS=MIN MAX MEAN STDDEV SUM.

Data written to the working file.
9 variables and 49113 cases written.
Variable: comment           Type: Number  Format : F1
Variable: contract          Type: String  Format : A269
Variable: mutant            Type: Number  Format : F2        One or more values were set to system-missing.
Variable: SLOC              Type: Number  Format : F4        One or more values were set to system-missing.
Variable: line              Type: Number  Format : F4        One or more values were set to system-missing.
Variable: operator          Type: String  Format : A6
Variable: status            Type: String  Format : A24
Variable: notes             Type: String  Format : A10
Variable: details           Type: String  Format : A10
```

Descriptives

Notes

Output Created		01-OCT-2019 10:43:...
Comments		
Input	Data	/Users/pieter/Documents/BCSLab/Deliverables/D22_Tools_M24/ContractMut/data_and_images/kill_detail_TxEvMethLimit.csv
	Filter	my_filter
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	47870
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	All non-missing data are used.
Syntax		DESCRIPTIVES VARIABLES= operator operator_class mutant SLOC line status potential /STATISTICS=MIN MAX MEAN STDDEV SUM.
Resources	Processor Time	00:00:01.22
	Elapsed Time	00:00:01.00

Warnings

No statistics are computed for the following variables because they are strings: Mutation operator, Current mutant status.

Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Mohtra or Solidity operator	47870	.00	1.00	8130.00	.1698	.37549
Mutant number	47870	1	50	1218385	25.45	14.430
Source lines of Code	47870	5	2492	17362438	362.70	305.128
Line number where the mutant change occurs	47870	5	2473	10425925	217.80	226.014
Potential mutant status	47870	.00	2.00	34112.00	.7126	.95782
Valid N (listwise)	47870					

```
 FREQUENCIES VARIABLES=
operator
operator_class
status
potential
  /STATISTICS=MEAN
  /ORDER=ANALYSIS.
```

Frequencies

Notes

Output Created		01-OCT-2019 10:43:...
Comments		
Input	Data	/Users/pieter/Documents/BCSLab/Deliverables/D22_Tools_M24/ContractMut/data_and_images/kill_detail_TxEvMethLimit.csv
	Filter	my_filter
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	47870
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data.
Syntax		FREQUENCIES VARIABLES= operator operator_class status potential /STATISTICS=MEAN /ORDER=ANALYSIS.
Resources	Processor Time	00:00:01.10
	Elapsed Time	00:00:01.00

Statistics

		Mutation operator	Mohtra or Solidity operator	Current mutant status	Potential mutant status
N	Valid	47870	47870	47870	47870
	Missing	0	0	0	0
Mean			.1698		.7126

Frequency Table

Mutation operator

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	AOR	3217	6.7	6.7	6.7
	BOR	5794	12.1	12.1	18.8
	ESD	7841	16.4	16.4	35.2
	ITSCR	11881	24.8	24.8	60.0
	JSRD	2956	6.2	6.2	66.2
	LR_A	104	.2	.2	66.4
	LR_B	1198	2.5	2.5	68.9
	LR_I	2615	5.5	5.5	74.4
	LR_S	487	1.0	1.0	75.4
	MORD	1064	2.2	2.2	77.6
	RAR	4160	8.7	8.7	86.3
	TRD	2802	5.9	5.9	92.2
	UORD	486	1.0	1.0	93.2
	VDTSCS	3265	6.8	6.8	100.0
	Total	47870	100.0	100.0	

Mohtra or Solidity operator

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mothra operator	39740	83.0	83.0	83.0
	Solidity operator	8130	17.0	17.0	100.0
	Total	47870	100.0	100.0	

Current mutant status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Killed by gas	2623	5.5	5.5	5.5
	Killed by output	13068	27.3	27.3	32.8
	Killed by output and gas	1365	2.9	2.9	35.6
	Not killed	30814	64.4	64.4	100.0
	Total	47870	100.0	100.0	

Potential mutant status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not killed	30814	64.4	64.4	64.4
	Killed or Killable	17056	35.6	35.6	100.0
	Total	47870	100.0	100.0	

```
CROSSTABS
  /TABLES=
operator
```

```
operator_class
  BY
status
potential
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT ROW
  /COUNT ROUND CELL.
```

Crosstabs

Notes

Output Created		01-OCT-2019 10:43:...
Comments		
Input	Data	/Users/pieter/Documents/BCSLab/Deliverables/D22_Tools_M24/ContractMut/data_and_images/kill_detail_TxEvMethLimit.csv
	Filter	my_filter
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	47870
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each table are based on all the cases with valid data in the specified range(s) for all variables in each table.

Notes

Syntax		CROSSTABS /TABLES= operator operator_class BY status potential /FORMAT=AVALUE TABLES /STATISTICS=CHISQ /CELLS=COUNT ROW /COUNT ROUND CELL.
Resources	Processor Time	00:00:01.15
	Elapsed Time	00:00:00.00
	Dimensions Requested	2
	Cells Available	524245

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Mutation operator * Current mutant status	47870	100.0%	0	0.0%	47870	100.0%
Mutation operator * Potential mutant status	47870	100.0%	0	0.0%	47870	100.0%
Mohtra or Solidity operator * Current mutant status	47870	100.0%	0	0.0%	47870	100.0%
Mohtra or Solidity operator * Potential mutant status	47870	100.0%	0	0.0%	47870	100.0%

Mutation operator * Current mutant status

Crosstab

			Current mutant status				
			Killed by gas	Killed by output	Killed by output and gas	Not killed	Total
Mutation operator	AOR	Count	217	667	155	2178	3217
		% within Mutation operator	6.7%	20.7%	4.8%	67.7%	100.0%
	BOR	Count	358	1661	226	3549	5794
		% within Mutation operator	6.2%	28.7%	3.9%	61.3%	100.0%
	ESD	Count	382	2073	140	5246	7841
		% within Mutation operator	4.9%	26.4%	1.8%	66.9%	100.0%
	ITSCR	Count	649	3083	353	7796	11881
		% within Mutation operator	5.5%	25.9%	3.0%	65.6%	100.0%
	JSRD	Count	168	880	42	1866	2956
		% within Mutation operator	5.7%	29.8%	1.4%	63.1%	100.0%
	LR_A	Count	2	54	2	46	104
		% within Mutation operator	1.9%	51.9%	1.9%	44.2%	100.0%
	LR_B	Count	85	128	12	973	1198
		% within Mutation operator	7.1%	10.7%	1.0%	81.2%	100.0%
	LR_I	Count	102	917	70	1526	2615
		% within Mutation operator	3.9%	35.1%	2.7%	58.4%	100.0%

Crosstab

			Current mutant status				
			Killed by gas	Killed by output	Killed by output and gas	Not killed	Total
	LR_S	Count	5	300	24	158	487
		% within Mutation operator	1.0%	61.6%	4.9%	32.4%	100.0%
	MORD	Count	62	75	6	921	1064
		% within Mutation operator	5.8%	7.0%	0.6%	86.6%	100.0%
	RAR	Count	295	781	82	3002	4160
		% within Mutation operator	7.1%	18.8%	2.0%	72.2%	100.0%
	TRD	Count	128	1483	150	1041	2802
		% within Mutation operator	4.6%	52.9%	5.4%	37.2%	100.0%
	UORD	Count	21	154	14	297	486
		% within Mutation operator	4.3%	31.7%	2.9%	61.1%	100.0%
	VDTSCS	Count	149	812	89	2215	3265
		% within Mutation operator	4.6%	24.9%	2.7%	67.8%	100.0%
Total		Count	2623	13068	1365	30814	47870
		% within Mutation operator	5.5%	27.3%	2.9%	64.4%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2387.540 [a]	39	.000
Likelihood Ratio	2372.688	39	.000
N of Valid Cases	47870		

a. 1 cells (1.8%) have expected count less than 5. The minimum expected count is 2.97.

Mutation operator * Potential mutant status

Crosstab

			Potential mutant status		
			Not killed	Killed or Killable	Total
Mutation operator	AOR	Count	2178	1039	3217
		% within Mutation operator	67.7%	32.3%	100.0%
	BOR	Count	3549	2245	5794
		% within Mutation operator	61.3%	38.7%	100.0%
	ESD	Count	5246	2595	7841
		% within Mutation operator	66.9%	33.1%	100.0%
	ITSCR	Count	7796	4085	11881
		% within Mutation operator	65.6%	34.4%	100.0%

Crosstab

		Potential mutant status		
		Not killed	Killed or Killable	Total
JSRD	Count	1866	1090	2956
	% within Mutation operator	63.1%	36.9%	100.0%
LR_A	Count	46	58	104
	% within Mutation operator	44.2%	55.8%	100.0%
LR_B	Count	973	225	1198
	% within Mutation operator	81.2%	18.8%	100.0%
LR_I	Count	1526	1089	2615
	% within Mutation operator	58.4%	41.6%	100.0%
LR_S	Count	158	329	487
	% within Mutation operator	32.4%	67.6%	100.0%
MORD	Count	921	143	1064
	% within Mutation operator	86.6%	13.4%	100.0%
RAR	Count	3002	1158	4160
	% within Mutation operator	72.2%	27.8%	100.0%
TRD	Count	1041	1761	2802
	% within Mutation operator	37.2%	62.8%	100.0%

Crosstab

			Potential mutant status		
			Not killed	Killed or Killable	Total
	UORD	Count	297	189	486
		% within Mutation operator	61.1%	38.9%	100.0%
	VDTSCS	Count	2215	1050	3265
		% within Mutation operator	67.8%	32.2%	100.0%
Total		Count	30814	17056	47870
		% within Mutation operator	64.4%	35.6%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1759.571 [a]	13	.000
Likelihood Ratio	1754.316	13	.000
N of Valid Cases	47870		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 37.06.

Mohtra or Solidity operator * Current mutant status

Crosstab

			Current mutant status				
			Killed by gas	Killed by output	Killed by output and gas	Not killed	Total
Mohtra or Solidity operator	Mothra operator	Count	2136	10675	1125	25804	39740
		% within Mohtra or Solidity operator	5.4%	26.9%	2.8%	64.9%	100.0%
	Solidity operator	Count	487	2393	240	5010	8130
		% within Mohtra or Solidity operator	6.0%	29.4%	3.0%	61.6%	100.0%
Total		Count	2623	13068	1365	30814	47870
		% within Mohtra or Solidity operator	5.5%	27.3%	2.9%	64.4%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	32.842[a]	3	.000
Likelihood Ratio	32.536	3	.000
N of Valid Cases	47870		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 231.82.

Mohtra or Solidity operator * Potential mutant status

Crosstab

			Potential mutant status		
			Not killed	Killed or Killable	Total
Mohtra or Solidity operator	Mothra operator	Count	25804	13936	39740
		% within Mohtra or Solidity operator	64.9%	35.1%	100.0%
	Solidity operator	Count	5010	3120	8130
		% within Mohtra or Solidity operator	61.6%	38.4%	100.0%
Total		Count	30814	17056	47870
		% within Mohtra or Solidity operator	64.4%	35.6%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	32.211[a]	1	.000		
Continuity Correction[b]	32.067	1	.000		
Likelihood Ratio	31.936	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	32.210	1	.000		
N of Valid Cases	47870				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 2896.71.

b. Computed only for a 2x2 table