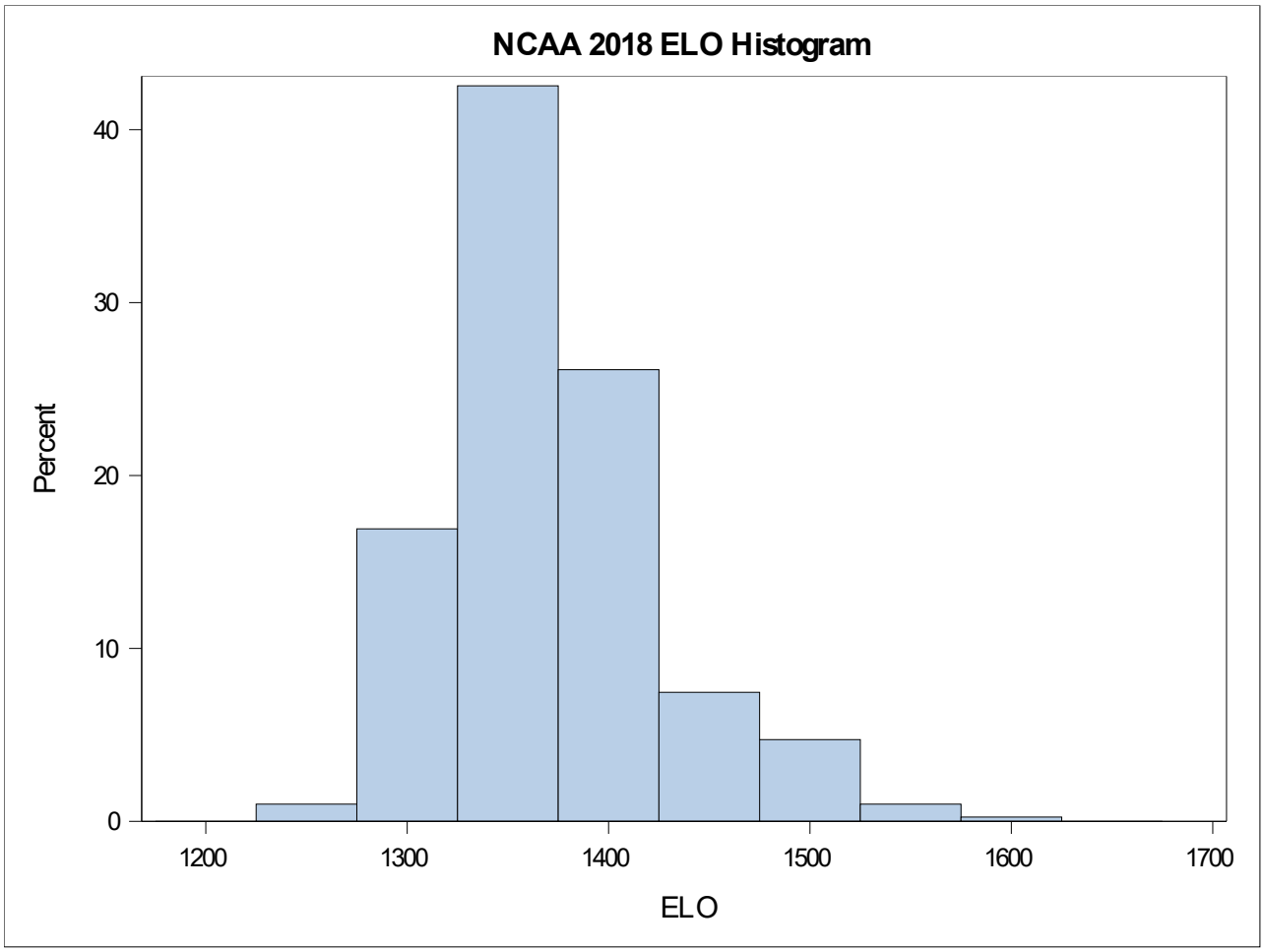
Gavin Gunawardena
7/30/21
STAT 600
Dr Claussen
Assignment 7
Ver. 1.0

Part 1C Plot:



NCAA 2018 ELO QQ Norm Chart

The UNIVARIATE Procedure
Variable:
ELO

Moments			
N	402	**Sum Weights**	402
Mean	1371.60438	**Sum Observations**	551384.96
Std Deviation	54.4528655	**Variance**	2965.11456
Skewness	0.87249947	**Kurtosis**	1.06096049
Uncorrected SS	757471036	**Corrected SS**	1189010.94
Coeff Variation	3.97001252	**Std Error Mean**	2.71586209

Basic Statistical Measures			
Location		**Variability**	
Mean	1371.604	**Std Deviation**	54.45287
Median	1364.095	**Variance**	2965
Mode	1342.500	**Range**	356.03000
		Interquartile Range	61.19000

Note: The mode displayed is the smallest of 3 modes with a count of 2.

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	505.0346	**Pr > |t|**	<.0001
Sign	**M**	201	**Pr >= |M|**	<.0001
Signed Rank	**S**	40501.5	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	1583.73
99%	1534.24
95%	1477.13
90%	1445.12
75% Q3	1396.78
50% Median	1364.10
25% Q1	1335.59

NCAA 2018 ELO QQ Norm Chart

The UNIVARIATE Procedure
Variable:
ELO

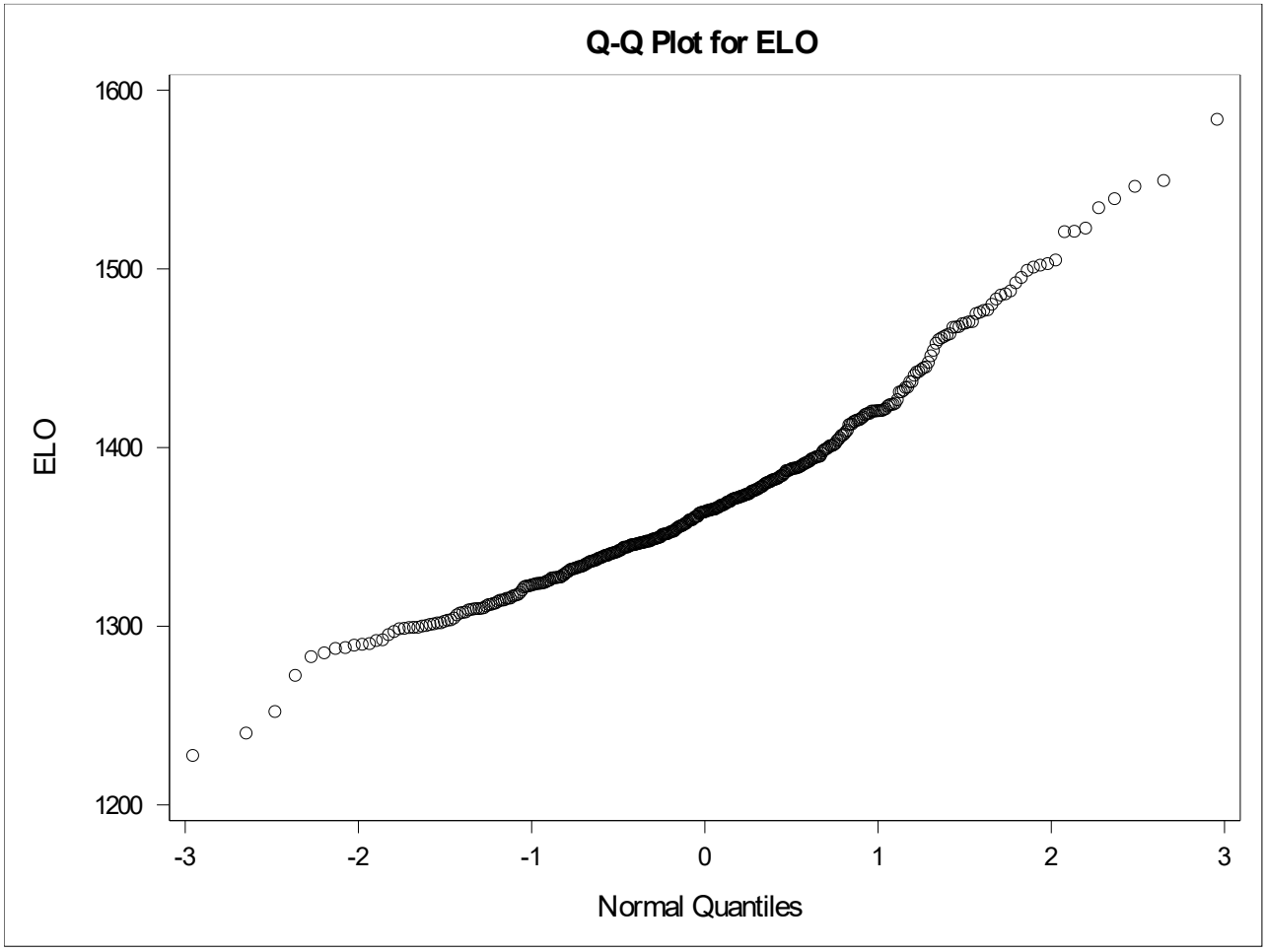
Quantiles (Definition 5)	
Level	**Quantile**
10%	1310.36
5%	1300.11
1%	1282.98
0% Min	1227.70

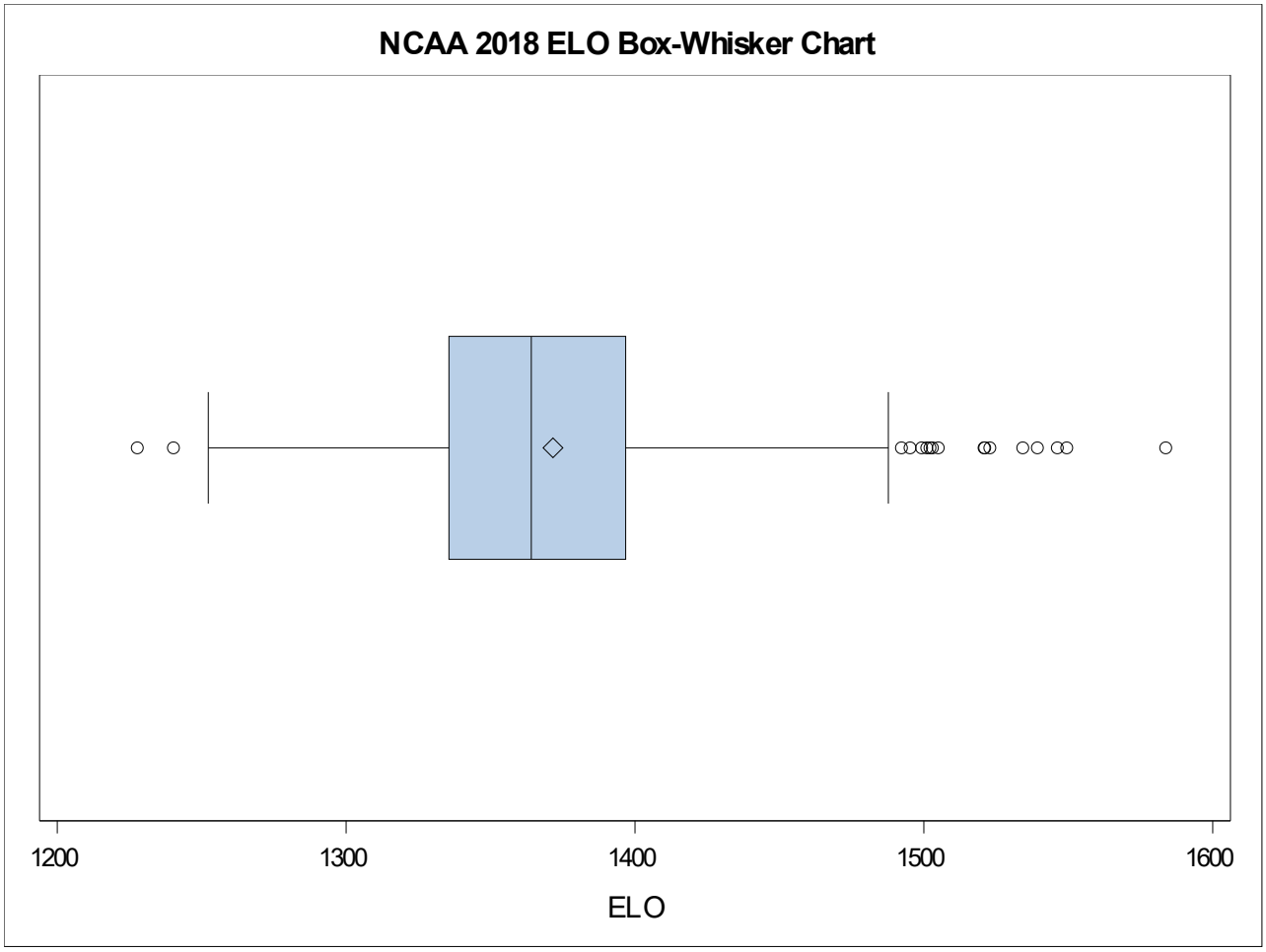
Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
1227.70	694	1534.24	565
1240.21	696	1539.30	22
1252.28	596	1546.21	485
1272.51	690	1549.47	331
1282.98	680	1583.73	257

Missing Values			
		Percent Of	
Missing Value	**Count**	**All Obs**	**Missing Obs**
.	364	47.52	100.00

NCAA 2018 ELO QQ Norm Chart

The UNIVARIATE Procedure



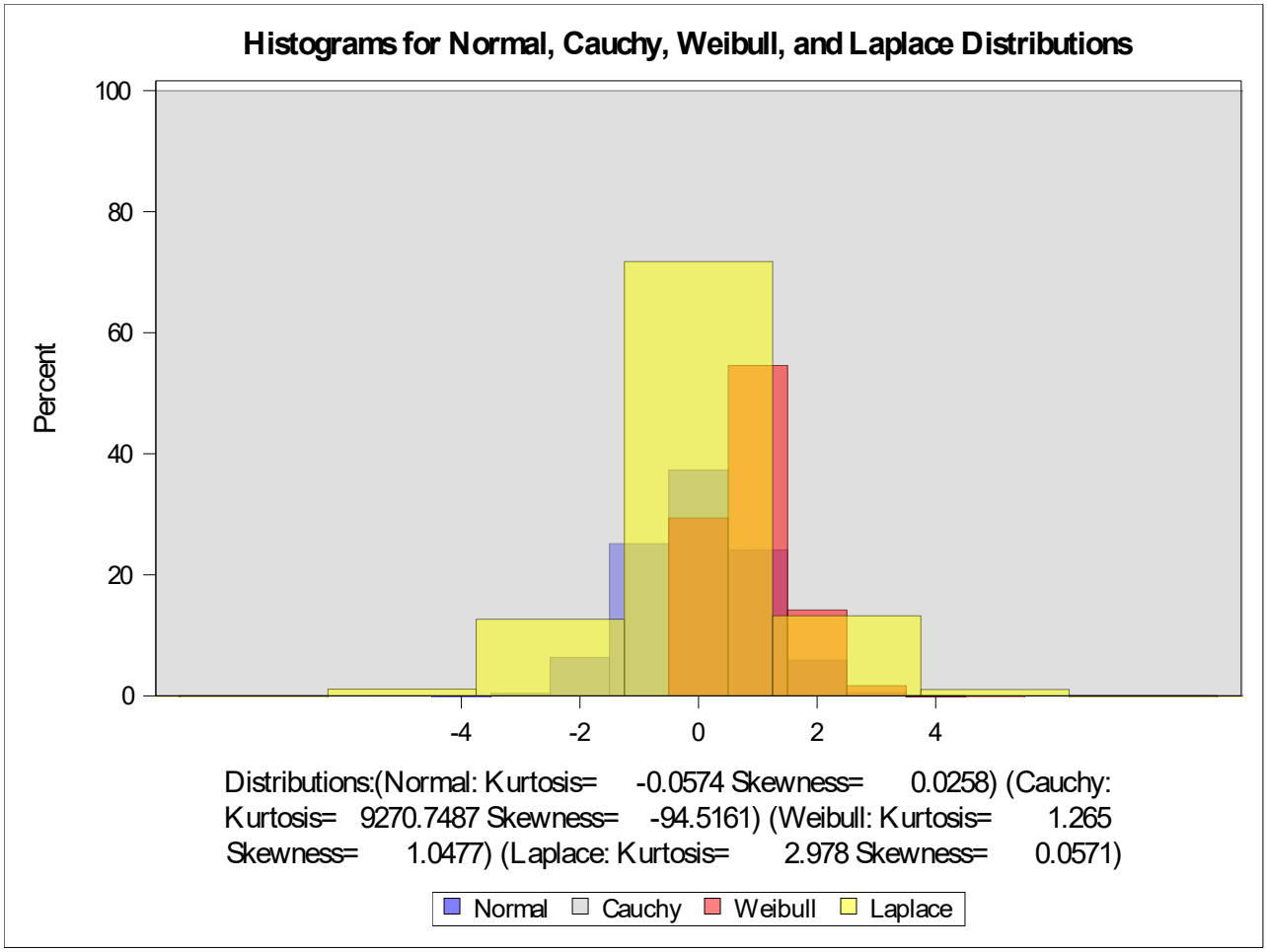

NCAA 2018 ELO Box-Whisker Chart
1200
1300
1400
1500
1600
ELO

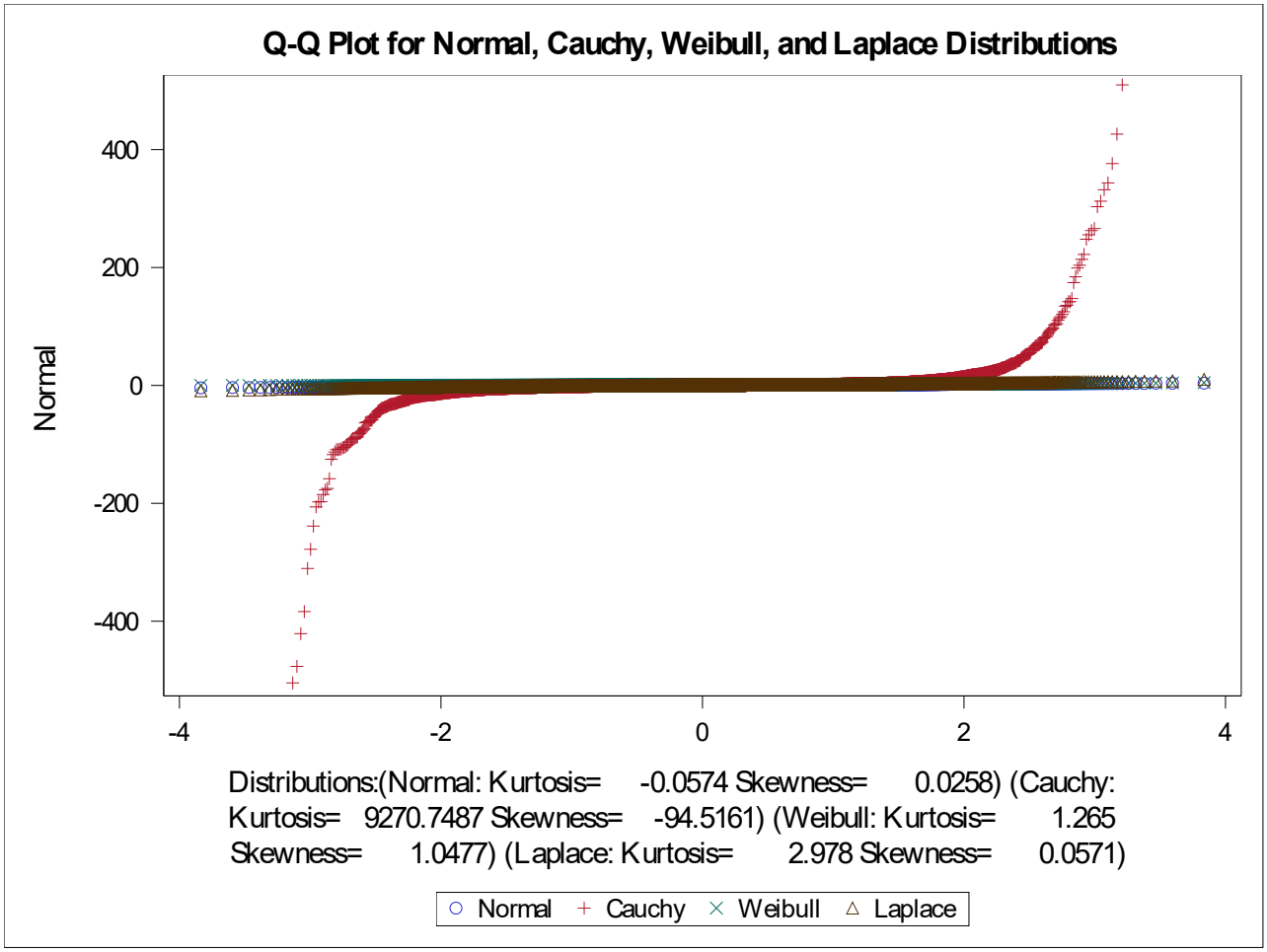
Exercise 2 Part A

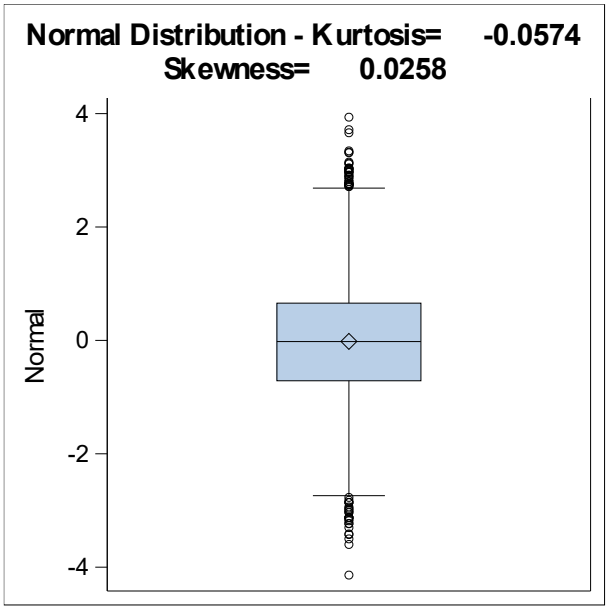
Results

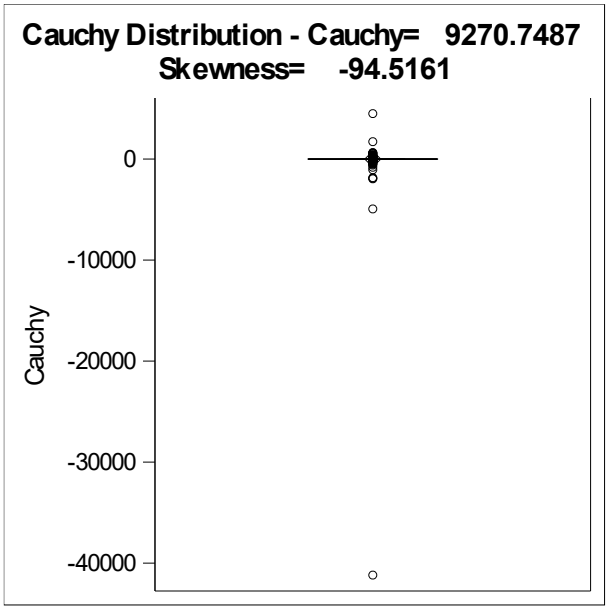
kurtosis_Normal	kurtosis_Cauchy	kurtosis_Weibull	kurtosis_Laplace
-0.0574	9270.7487	1.265	2.978

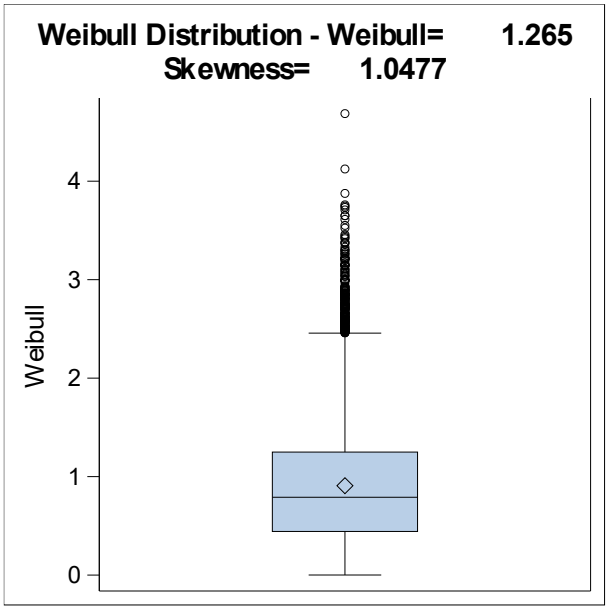
skewness_Normal	skewness_Cauchy	skewness_Weibull	skewness_Laplace
0.0258	-94.5161	1.0477	0.0571

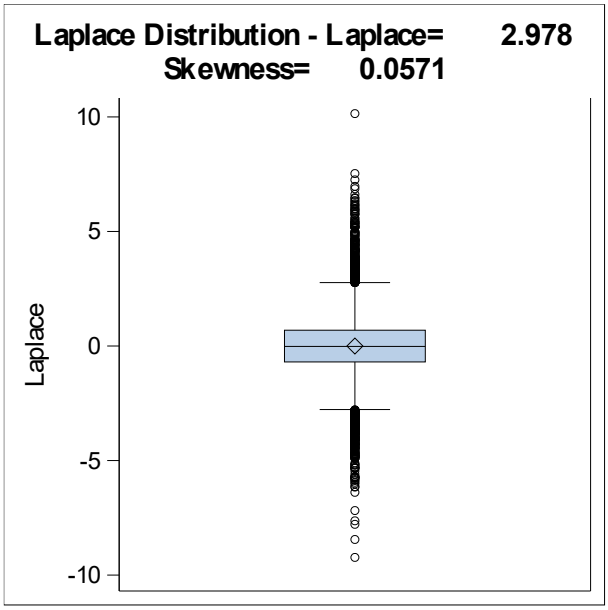

Histograms for Normal, Cauchy, Weibull, and Laplace Distributions
Percent
100
80
60
40
20
0
-4
-2
0
2
4
Distributions:(Normal: Kurtosis= -0.0574 Skewness= 0.0258) (Cauchy: Kurtosis= 9270.7487 Skewness= -94.5161) (Weibull: Kurtosis= 1.265 Skewness= 1.0477) (Laplace: Kurtosis= 2.978 Skewness= 0.0571)
Normal
Cauchy
Weibull
Laplace

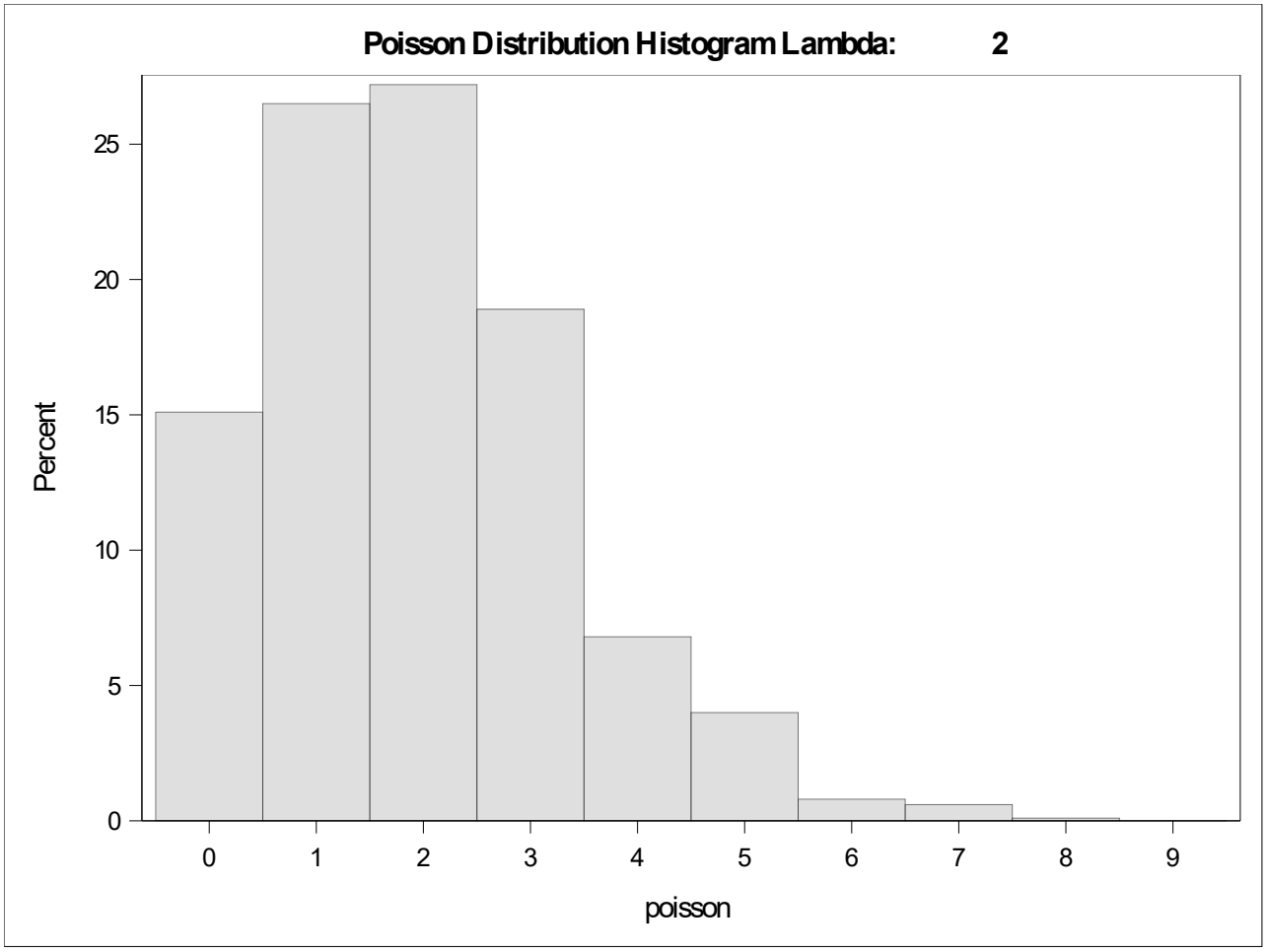

Q-Q Plot for Normal, Cauchy, Weibull, and Laplace Distributions
Normal
400
200
0
-200
-400
-4
-2
0
2
4
Distributions:(Normal: Kurtosis= -0.0574 Skewness= 0.0258) (Cauchy: Kurtosis= 9270.7487 Skewness= -94.5161) (Weibull: Kurtosis= 1.265 Skewness= 1.0477) (Laplace: Kurtosis= 2.978 Skewness= 0.0571)
Normal
Cauchy
Weibull
Laplace

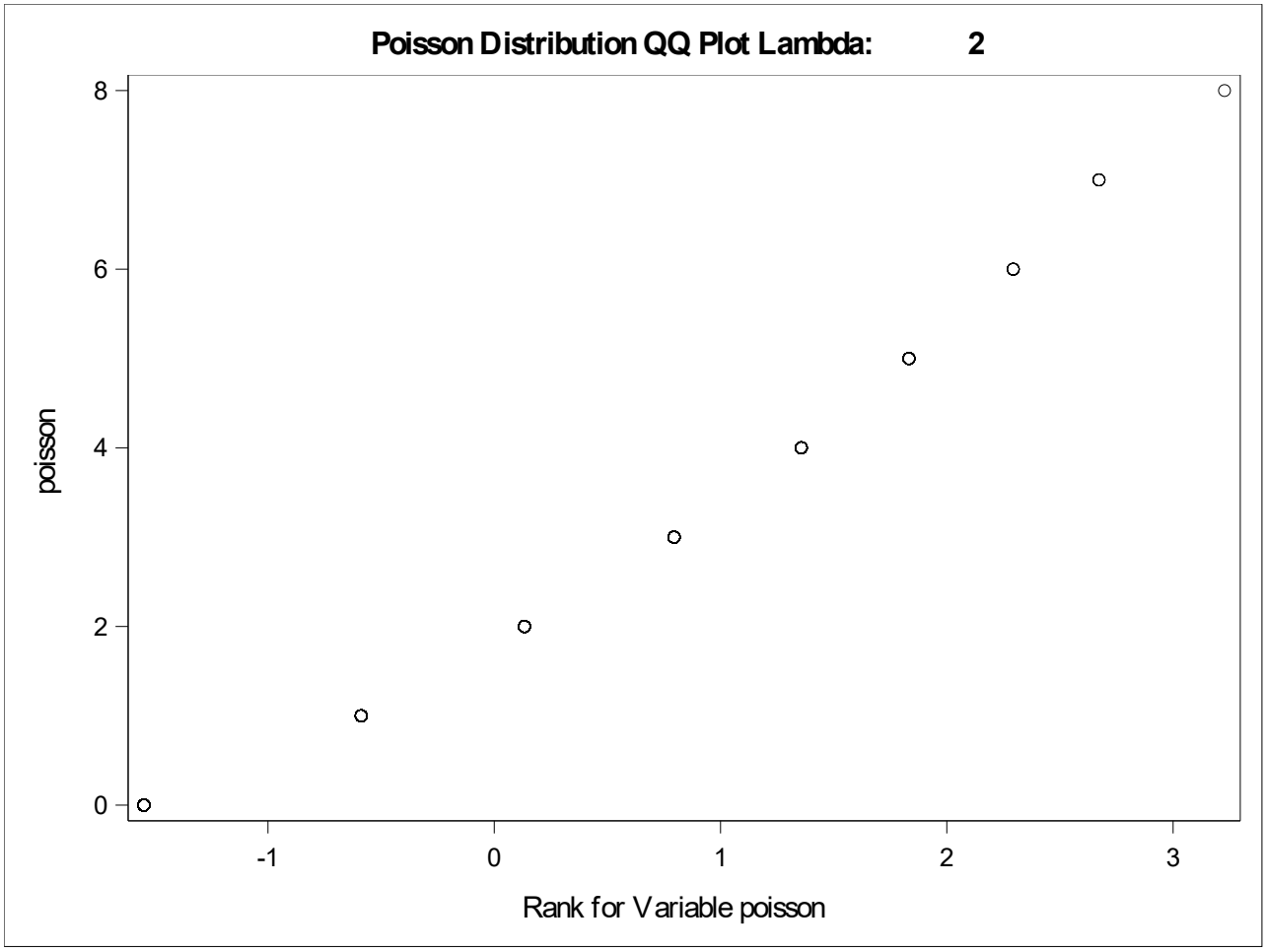

Normal Distribution - Kurtosis= -0.0574
Skewness= 0.0258
Normal
4
2
0
-2
-4

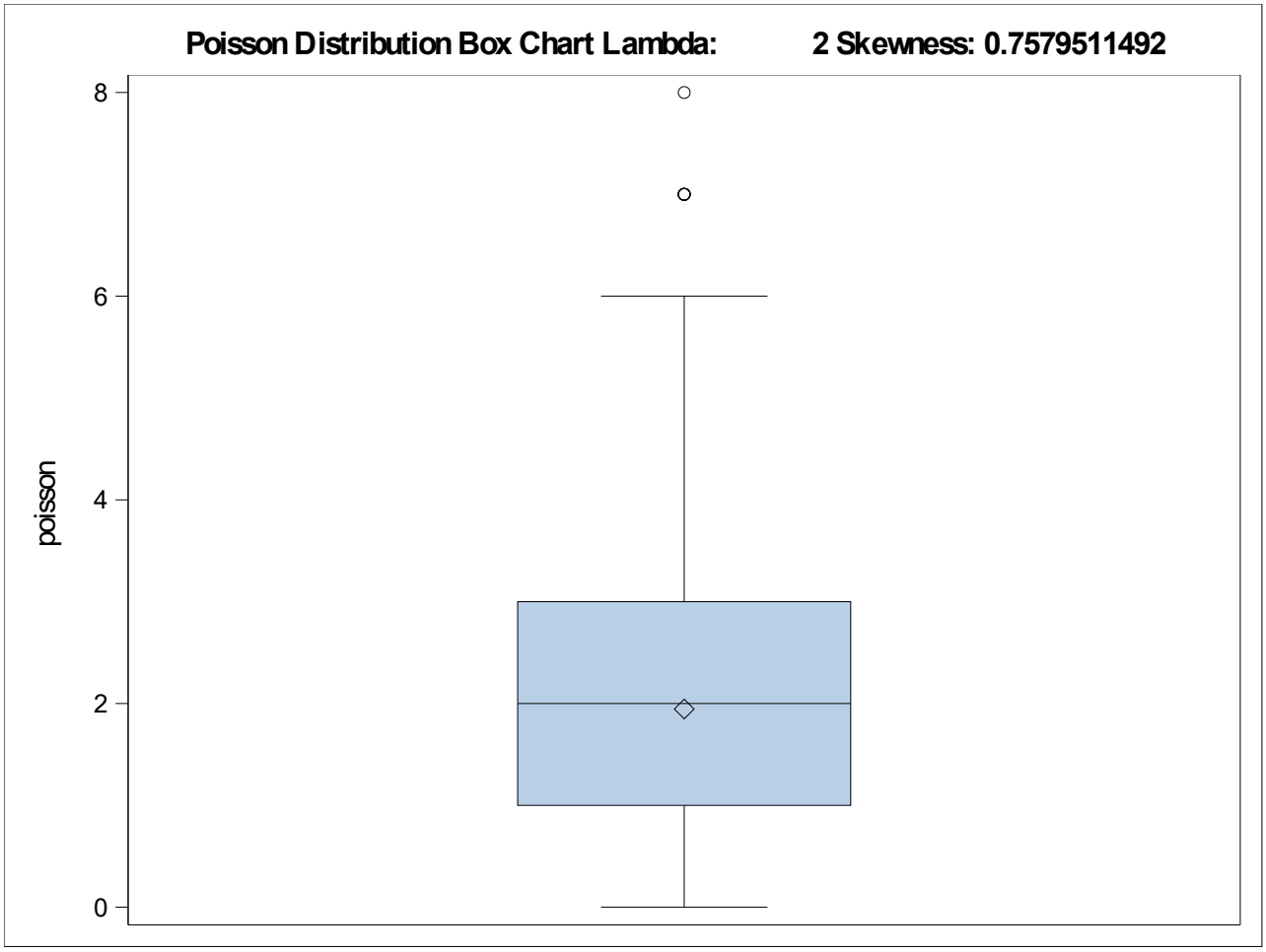

Cauchy Distribution - Cauchy= 9270.7487
Skewness= -94.5161
0
-10000
-20000
-30000
-40000
Cauchy

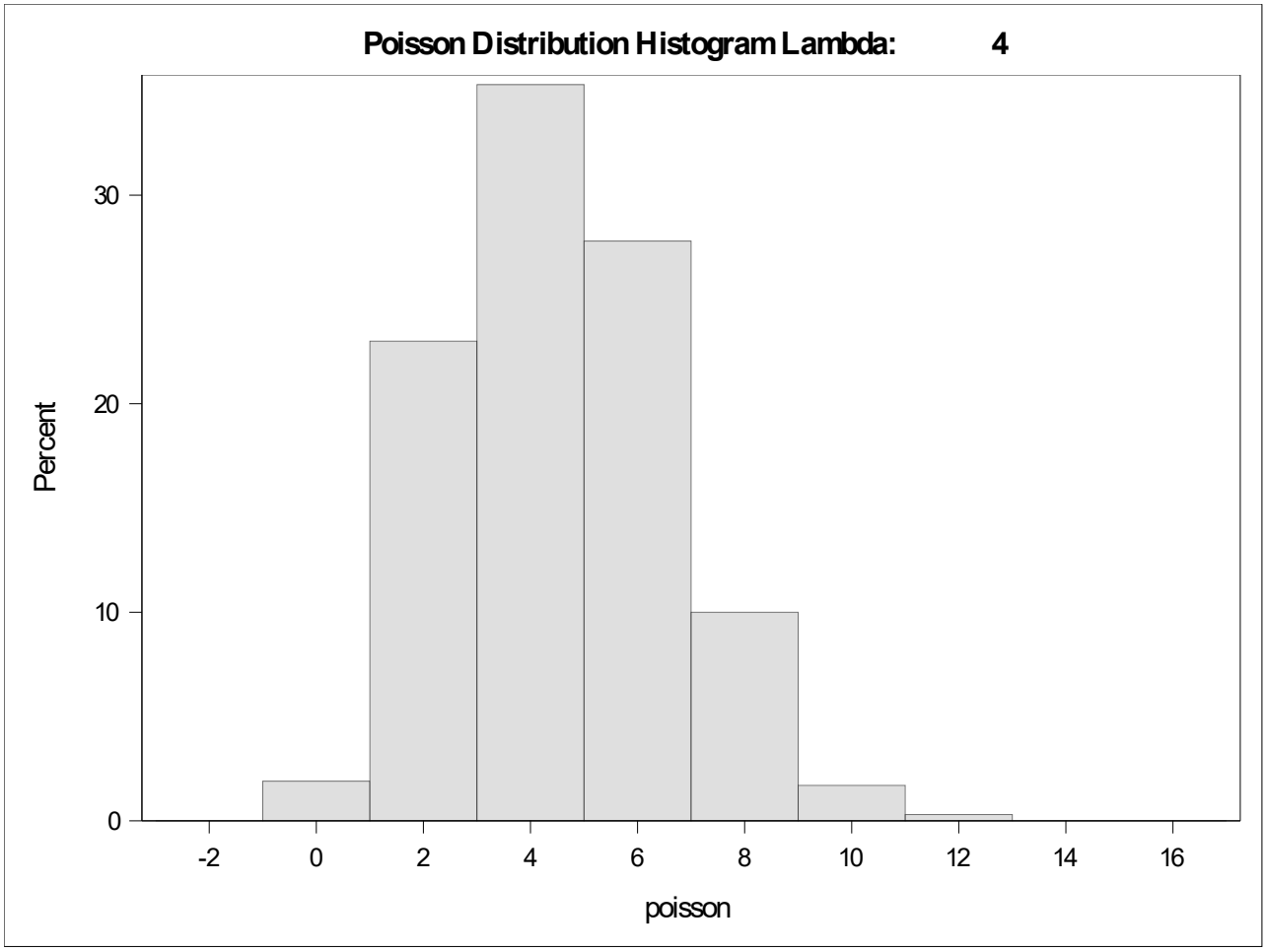

Weibull Distribution - Weibull= 1.265
Skewness= 1.0477
Weibull
4
3
2
1
0

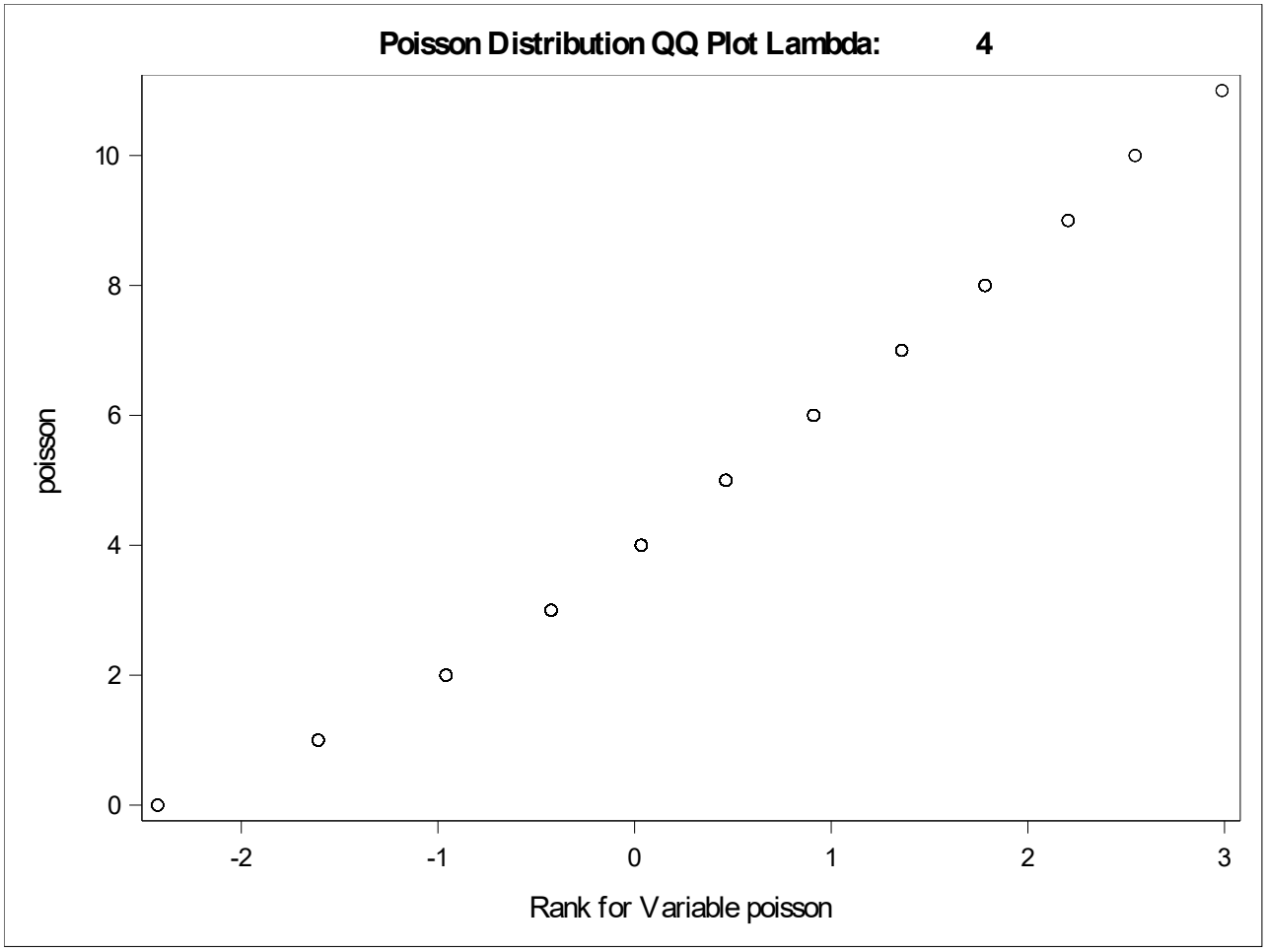

Laplace Distribution - Laplace= 2.978
Skewness= 0.0571
10
5
0
-5
-10
Laplace

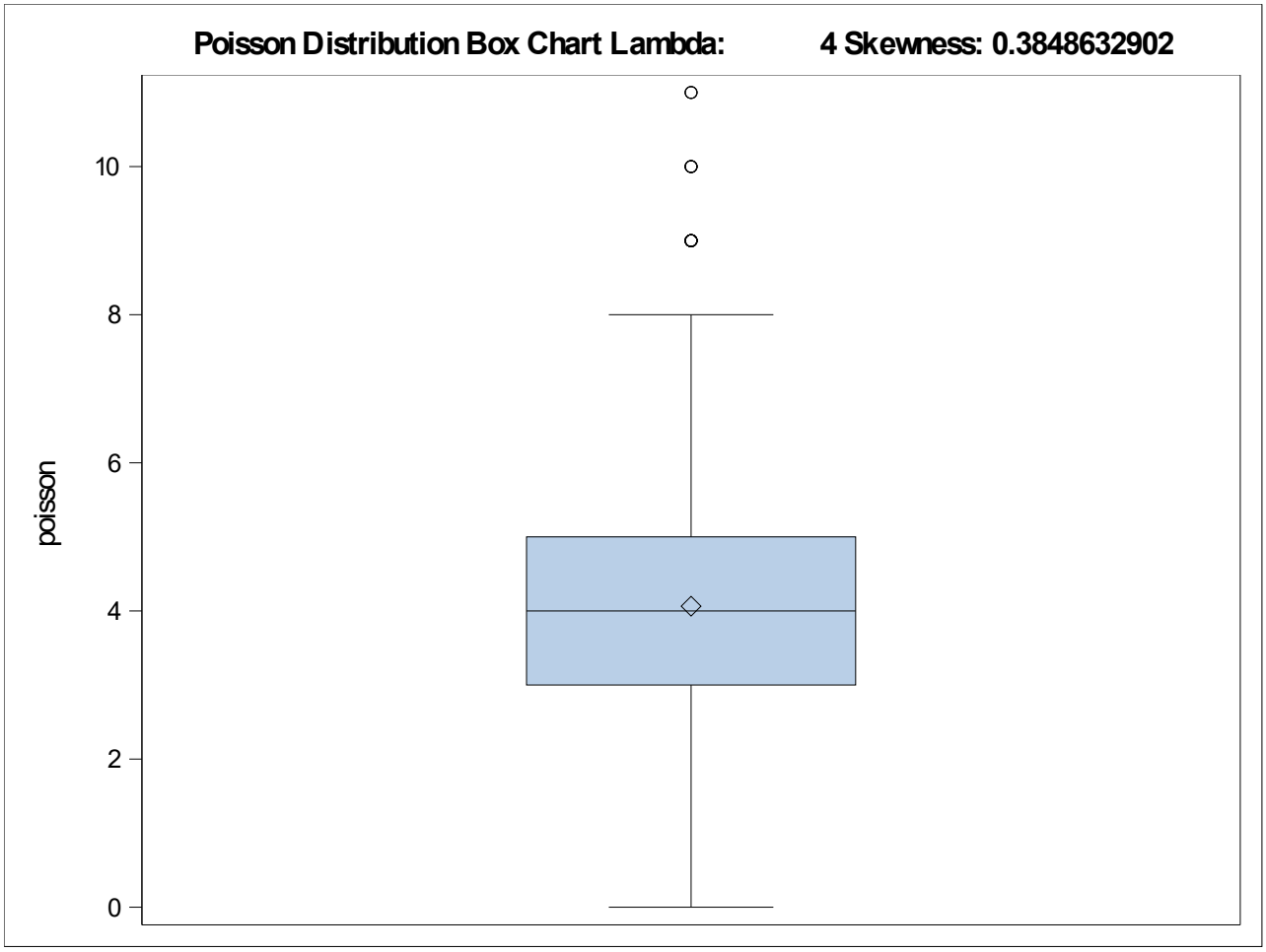

Poisson Distribution Histogram Lambda: 2
Percent
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
9
poisson

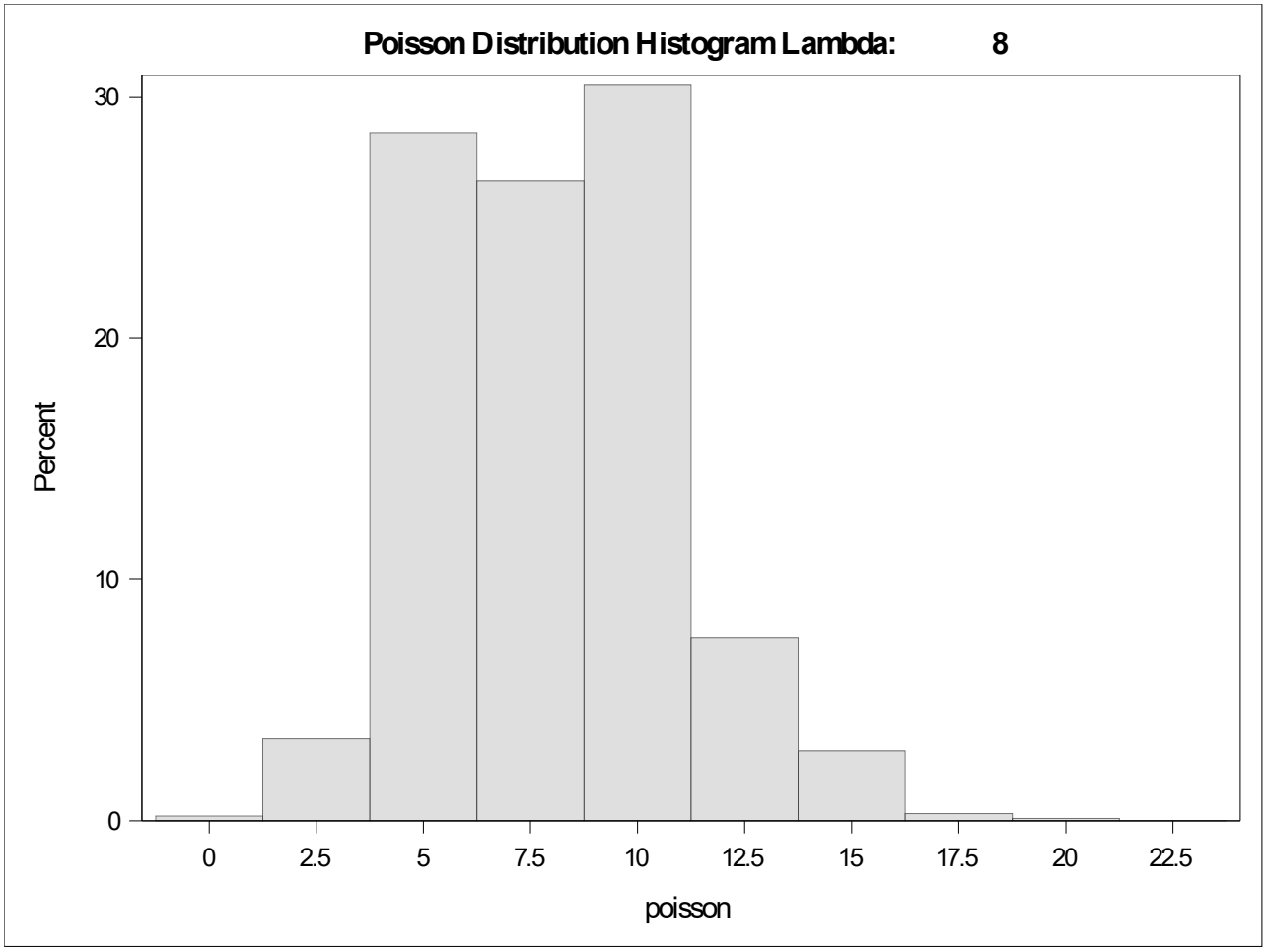

Poisson Distribution QQ Plot Lambda: 2
poisson
8
6
4
2
0
-1
0
1
2
3
Rank for Variable poisson

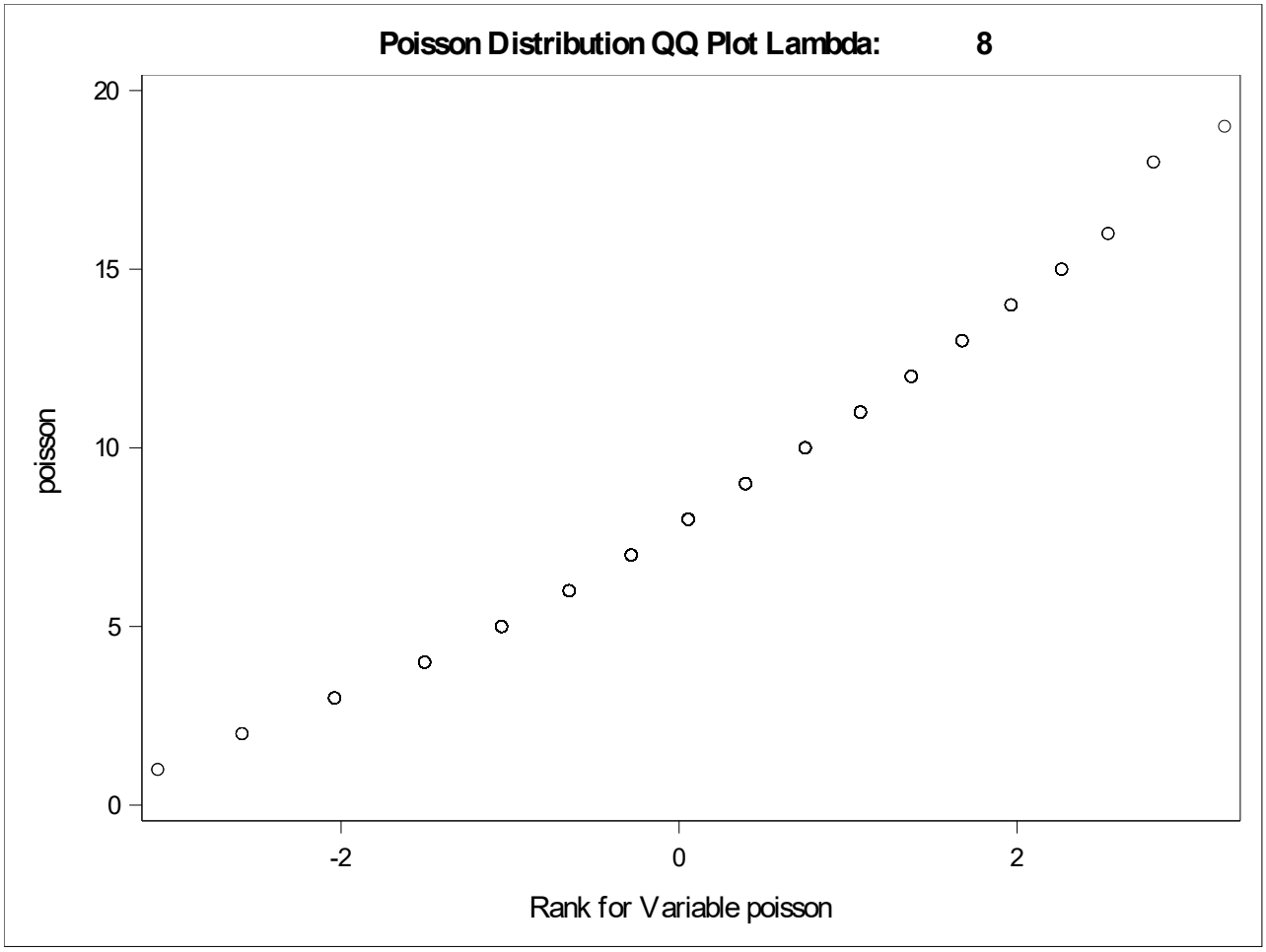

Poisson Distribution Box Chart Lambda: 2 Skewness: 0.7579511492
poisson
8
6
4
2
0

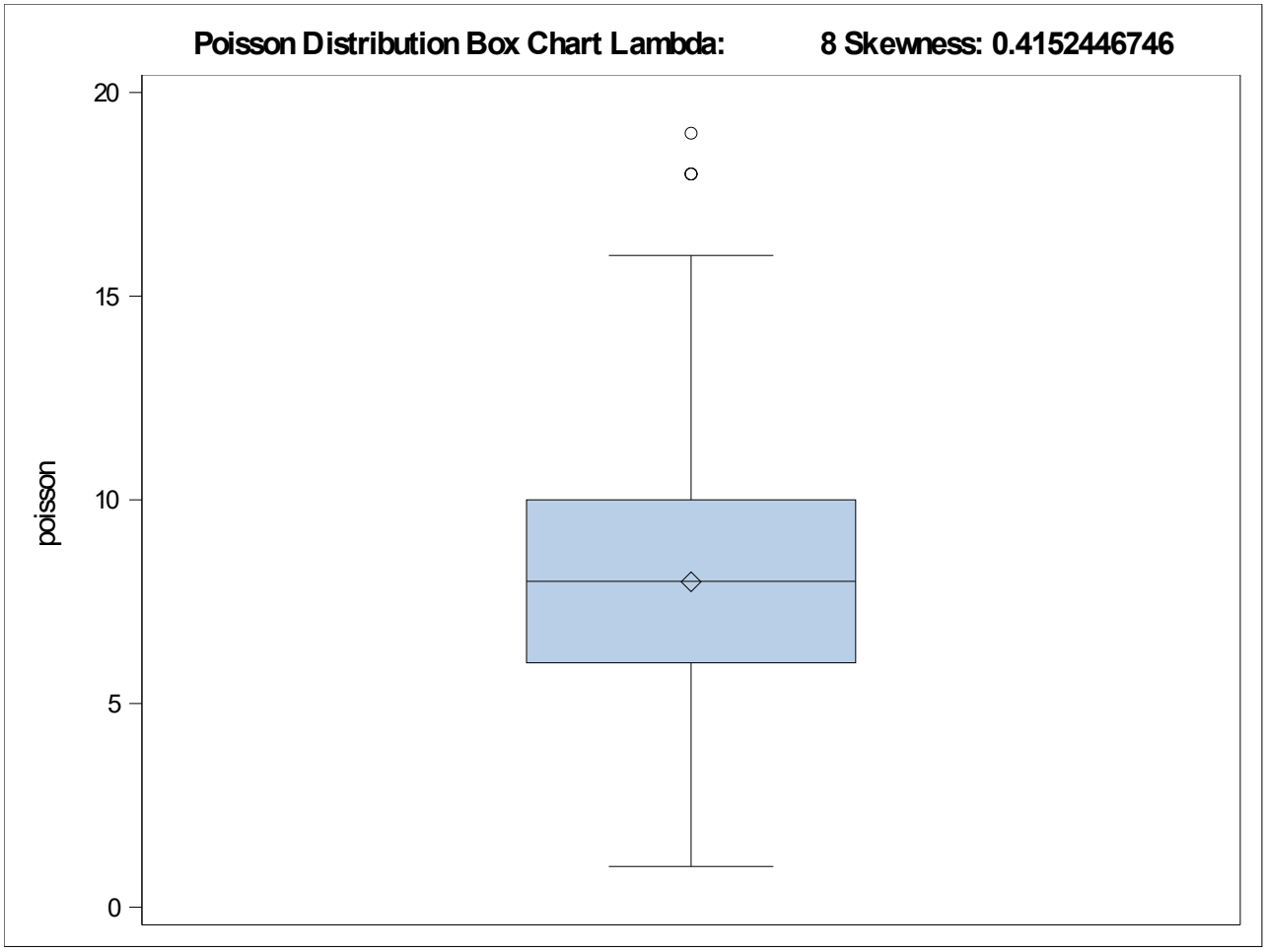

Poisson Distribution Histogram Lambda: 4
Percent
30
20
10
0
-2
0
2
4
6
8
10
12
14
16
poisson

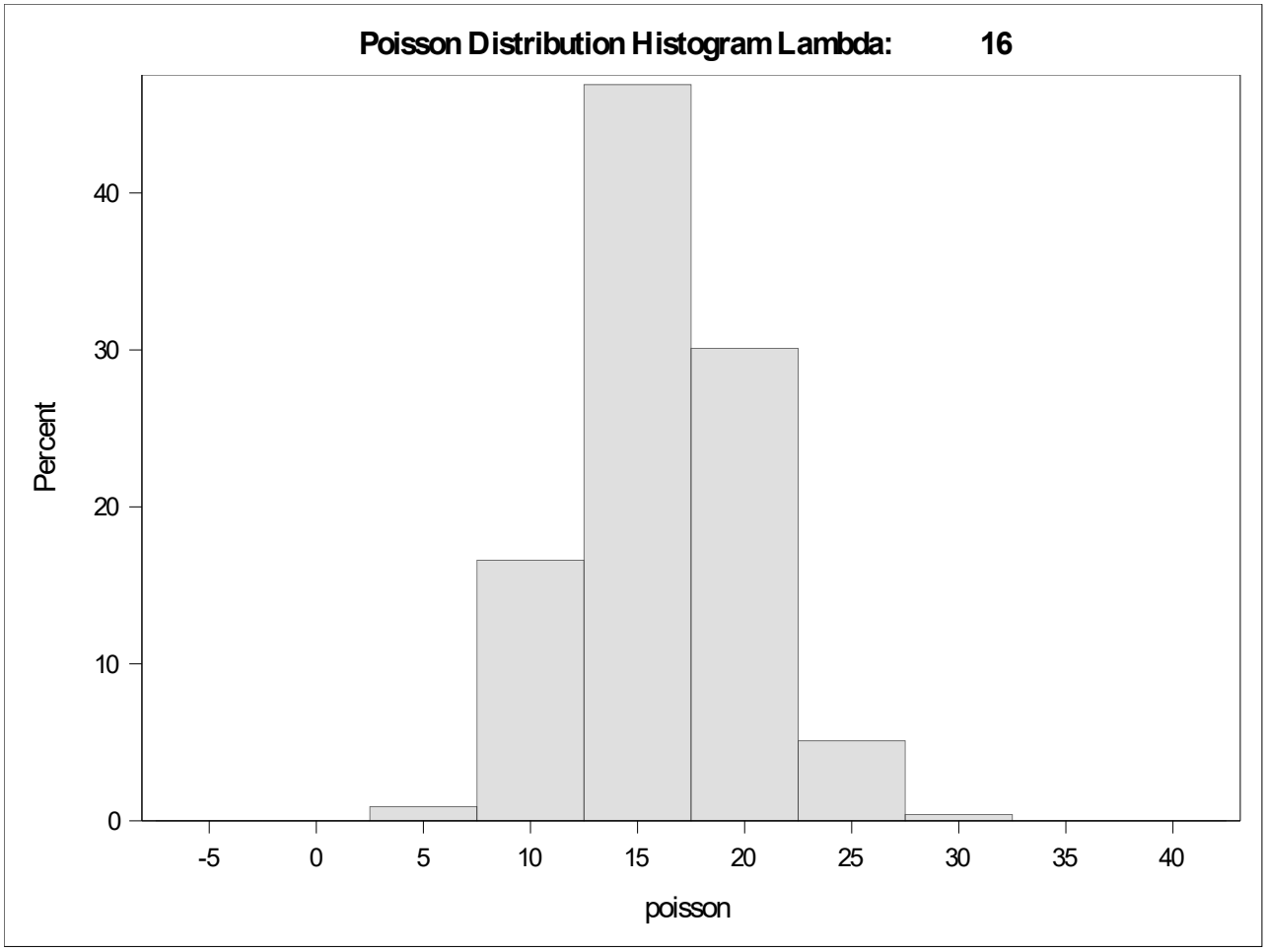

Poisson Distribution QQ Plot Lambda: 4
poisson
0
2
4
6
8
10
-2
-1
0
1
2
3
Rank for Variable poisson

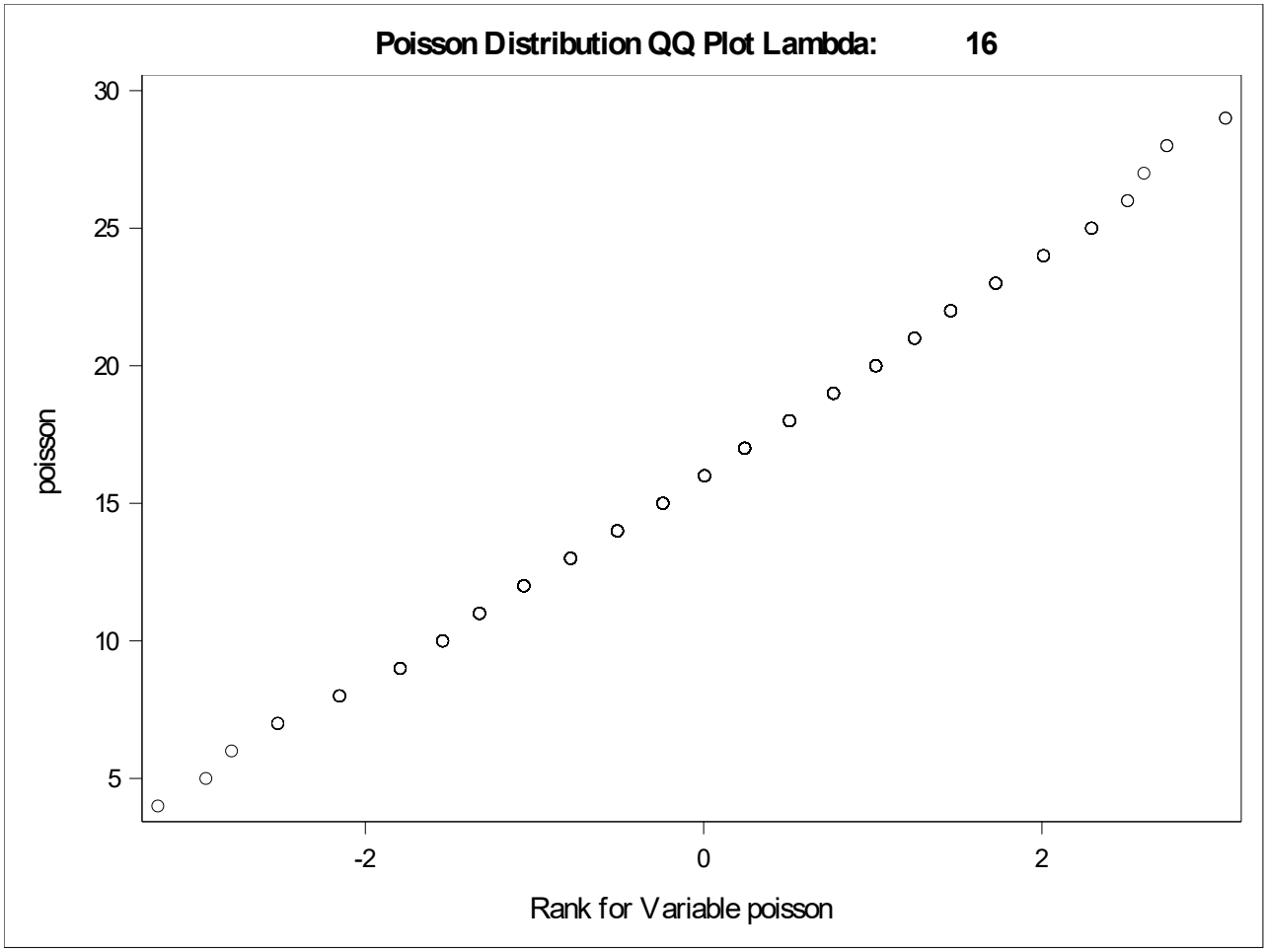

Poisson Distribution Box Chart Lambda: 4 Skewness: 0.3848632902
poisson
10
8
6
4
2
0

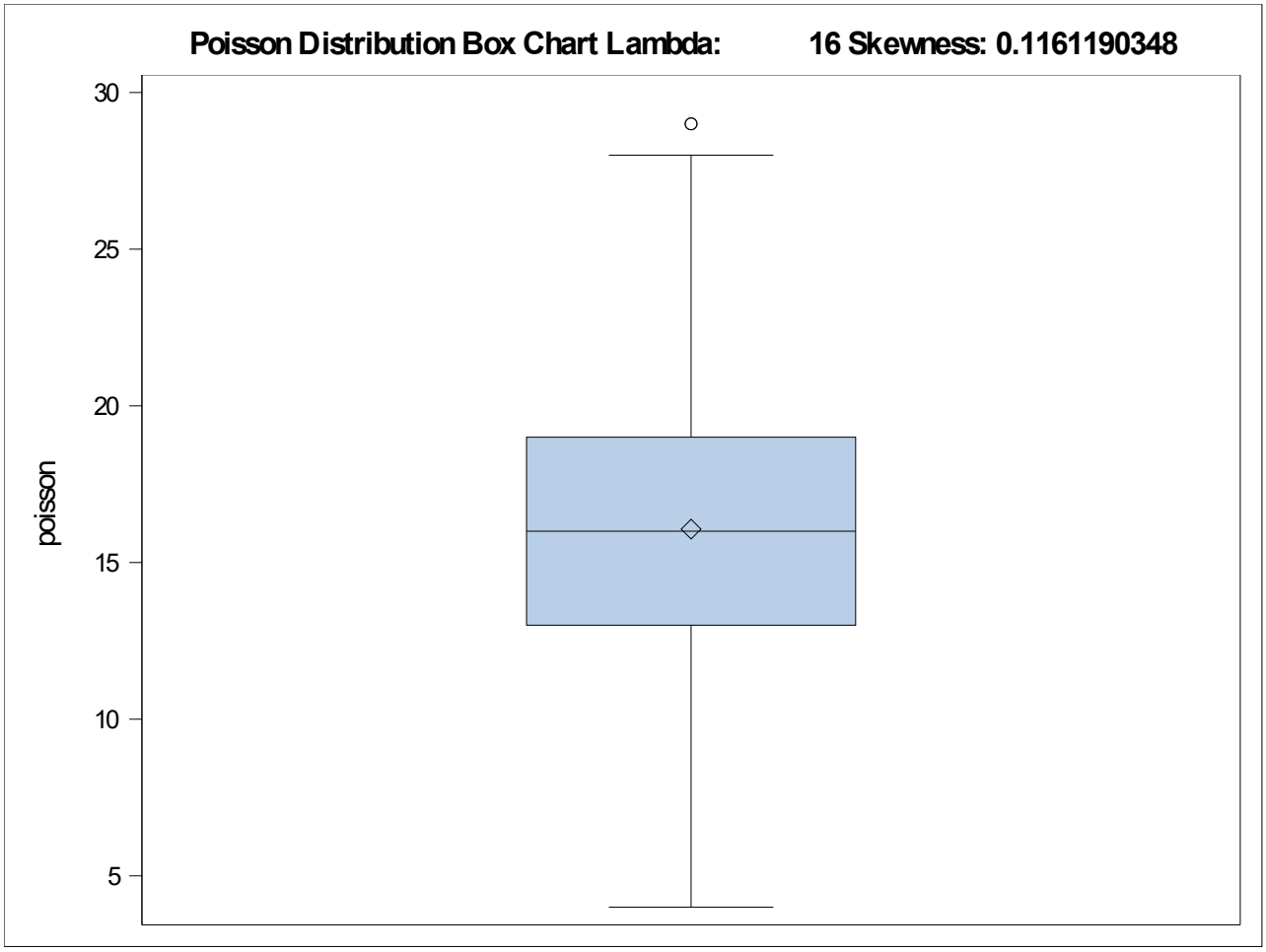

Poisson Distribution Histogram Lambda: 8
Percent
30
20
10
0
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
poisson

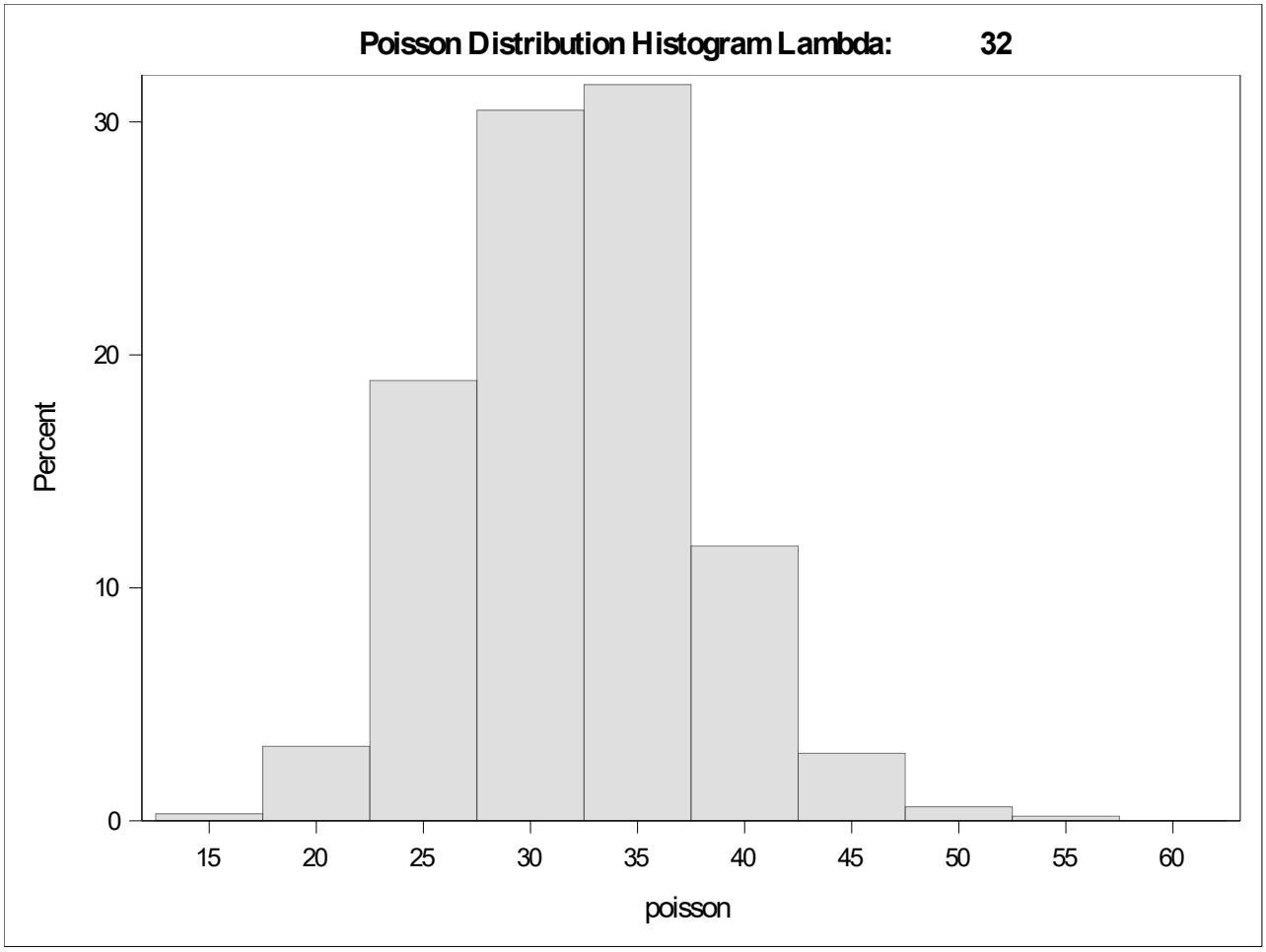

Poisson Distribution QQ Plot Lambda: 8
poisson
20
15
10
5
0
-2
0
2
Rank for Variable poisson

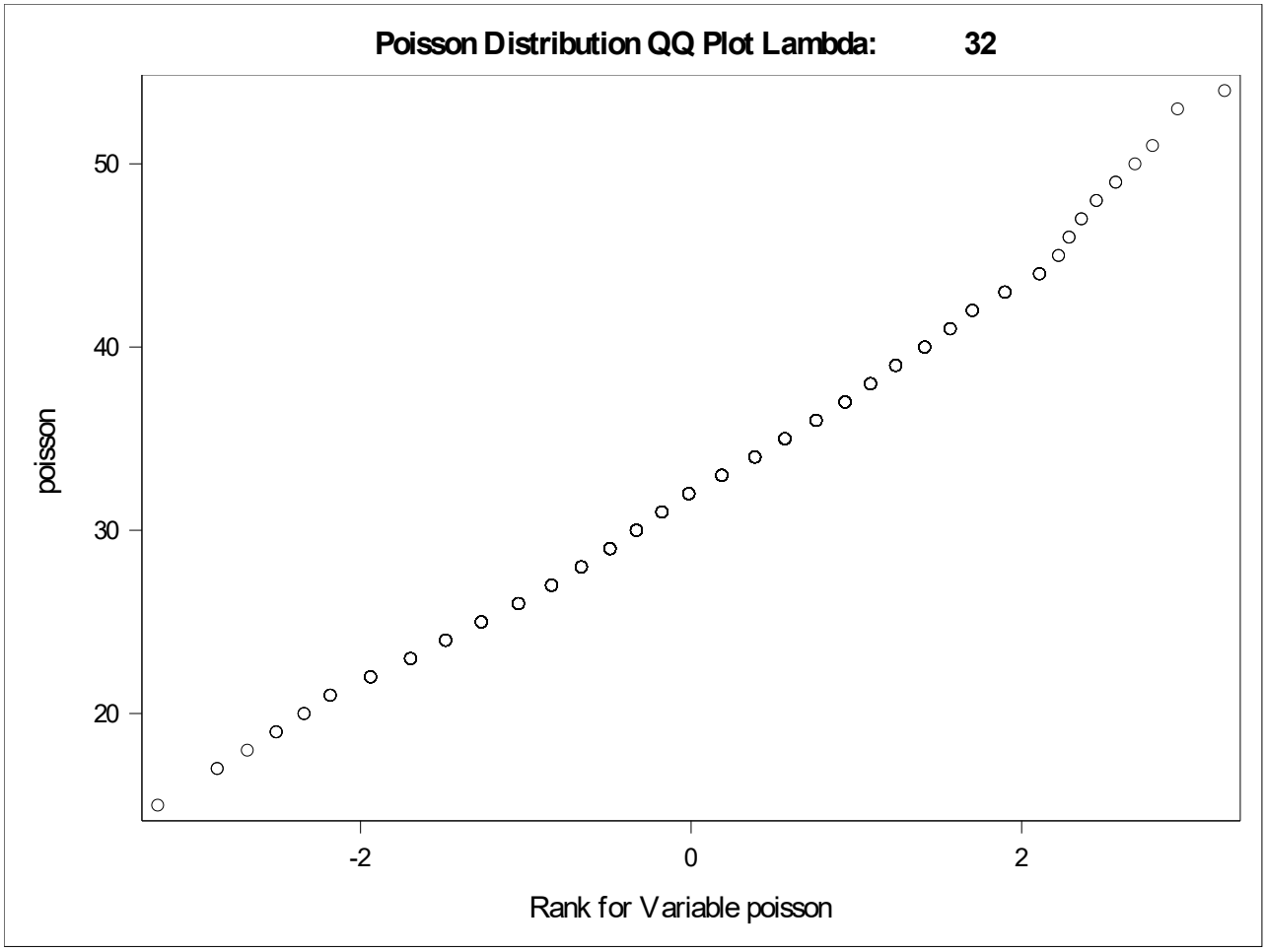

Poisson Distribution Box Chart Lambda: 8 Skewness: 0.4152446746
poisson
20
15
10
5
0

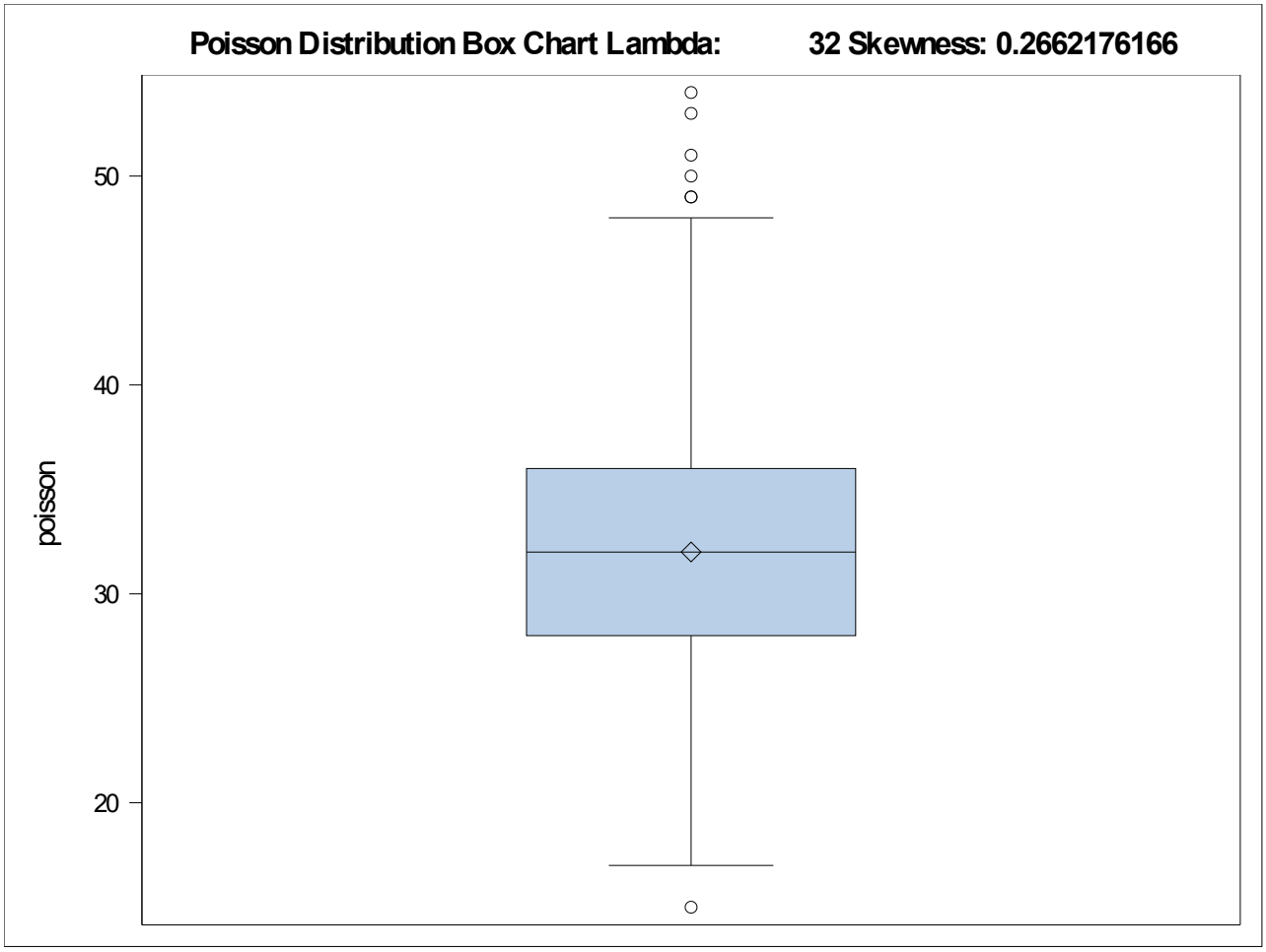

Poisson Distribution Histogram Lambda: 16
Percent
0
10
20
30
40
-5
0
5
10
15
20
25
30
35
40
poisson

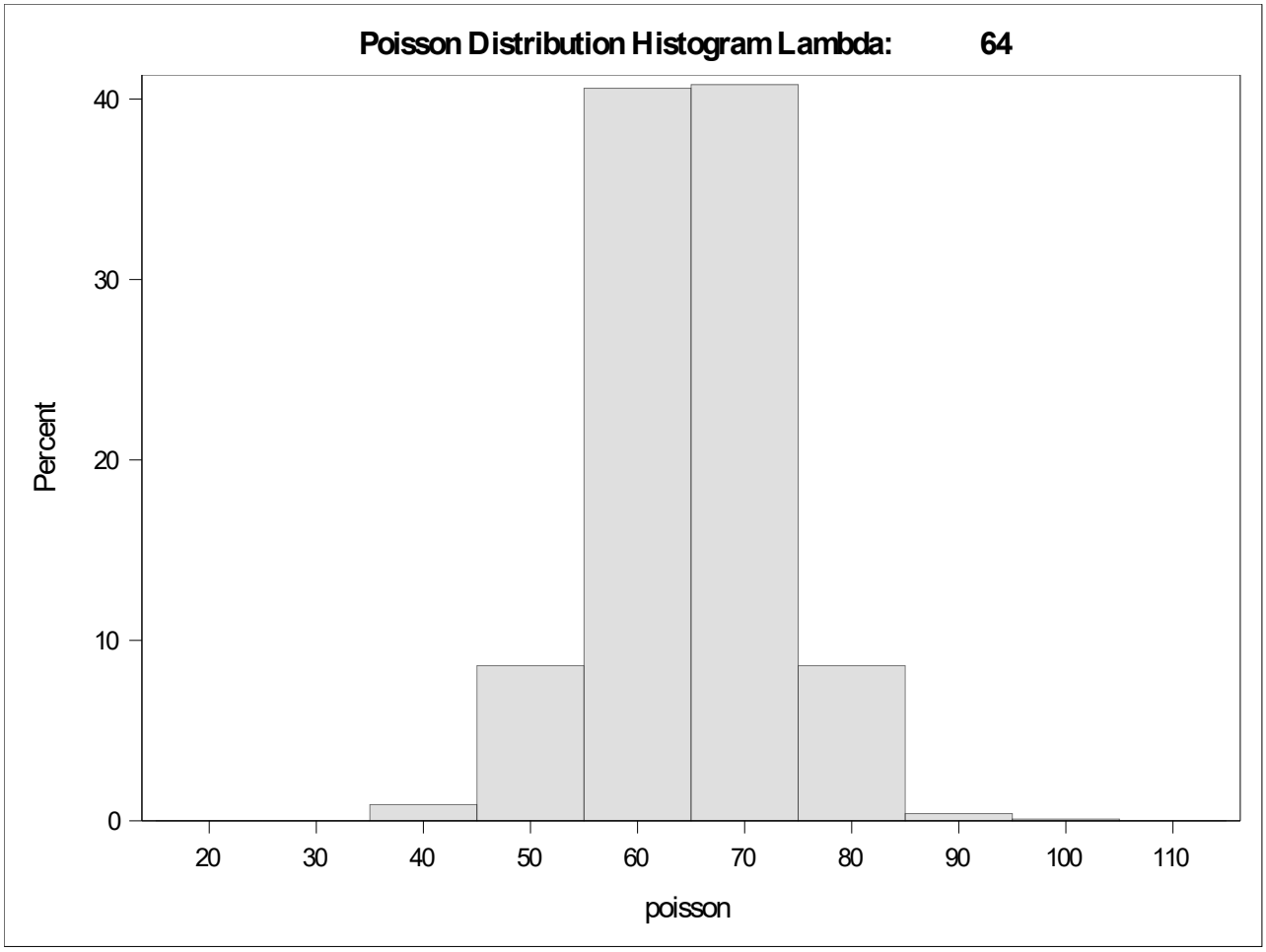

Poisson Distribution QQ Plot Lambda: 16
poisson
30
25
20
15
10
5
-2
0
2
Rank for Variable poisson

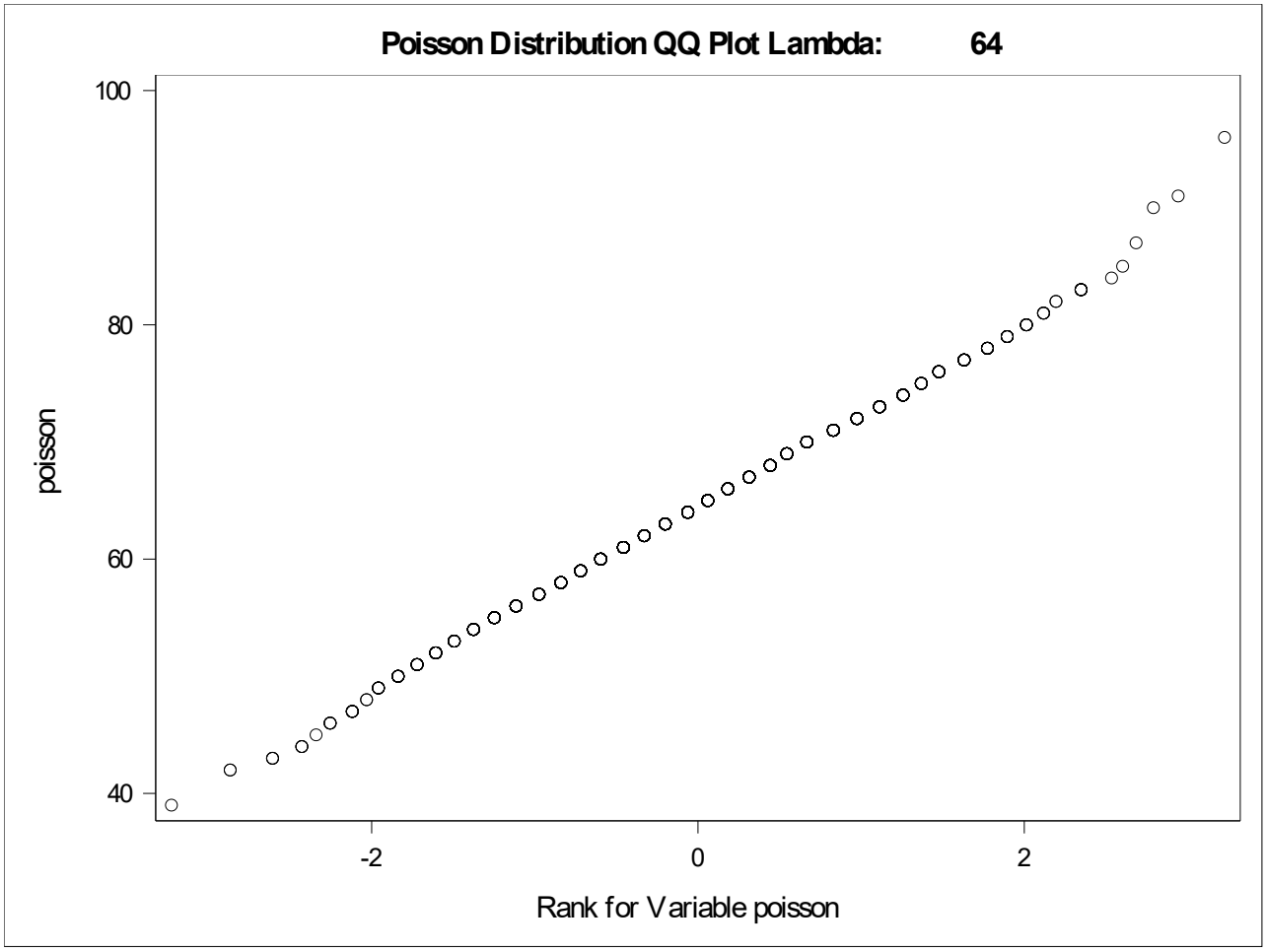

Poisson Distribution Box Chart Lambda: 16 Skewness: 0.1161190348
poisson
30
25
20
15
10
5

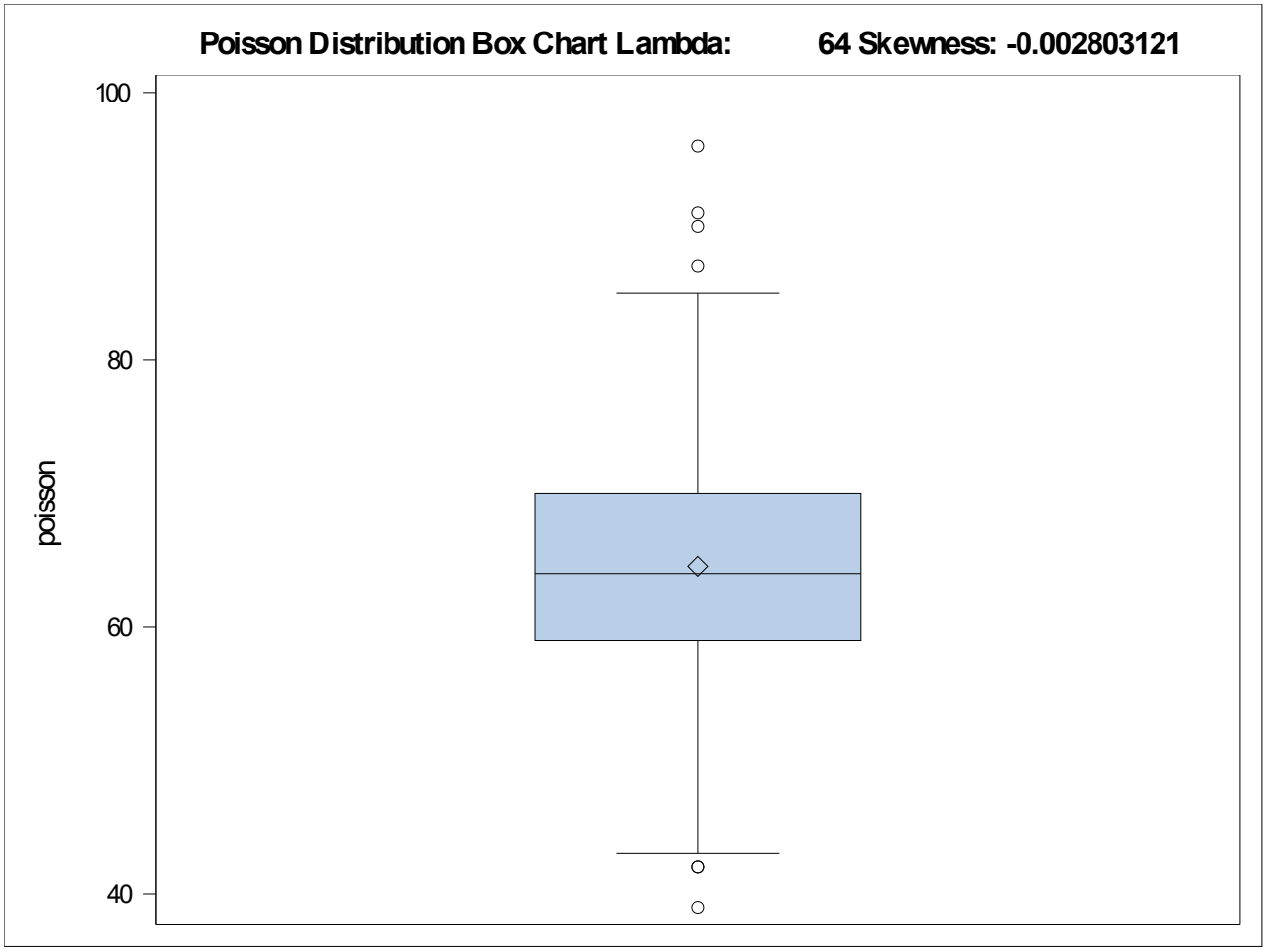

Poisson Distribution Histogram Lambda: 32
Percent
0
10
20
30
15
20
25
30
35
40
45
50
55
60
poisson


Poisson Distribution QQ Plot Lambda: 32
poisson
50
40
30
20
-2
0
2
Rank for Variable poisson


Poisson Distribution Box Chart Lambda: 32 Skewness: 0.2662176166
poisson
50
40
30
20


Poisson Distribution Histogram Lambda: 64
Percent
0
10
20
30
40
20
30
40
50
60
70
80
90
100
110
poisson


Poisson Distribution QQ Plot Lambda: 64
100
80
60
40
poisson
-2
0
2
Rank for Variable poisson


Poisson Distribution Box Chart Lambda: 64 Skewness: -0.002803121
poisson
100
80
60
40

Exercise 3 Part B

Tried combining the tables but started getting max memory errors in SAS. The below method of running the datasets individually seems to work though.

Exercise 3 Part B
lambda 2

The UNIVARIATE Procedure
Variable:
poisson

Moments			
N	1000	**Sum Weights**	1000
Mean	1.946	**Sum Observations**	1946
Std Deviation	1.41530459	**Variance**	2.00308709
Skewness	0.75795115	**Kurtosis**	0.68536133
Uncorrected SS	5788	**Corrected SS**	2001.084
Coeff Variation	72.7289102	**Std Error Mean**	0.04475586

Basic Statistical Measures			
Location		**Variability**	
Mean	1.946000	**Std Deviation**	1.41530
Median	2.000000	**Variance**	2.00309
Mode	2.000000	**Range**	8.00000
		Interquartile Range	2.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	43.48034	**Pr > |t|**	<.0001
Sign	**M**	424.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	180412.5	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	8
99%	6
95%	5
90%	4
75% Q3	3
50% Median	2
25% Q1	1
10%	0

Exercise 3 Part B
lambda 2

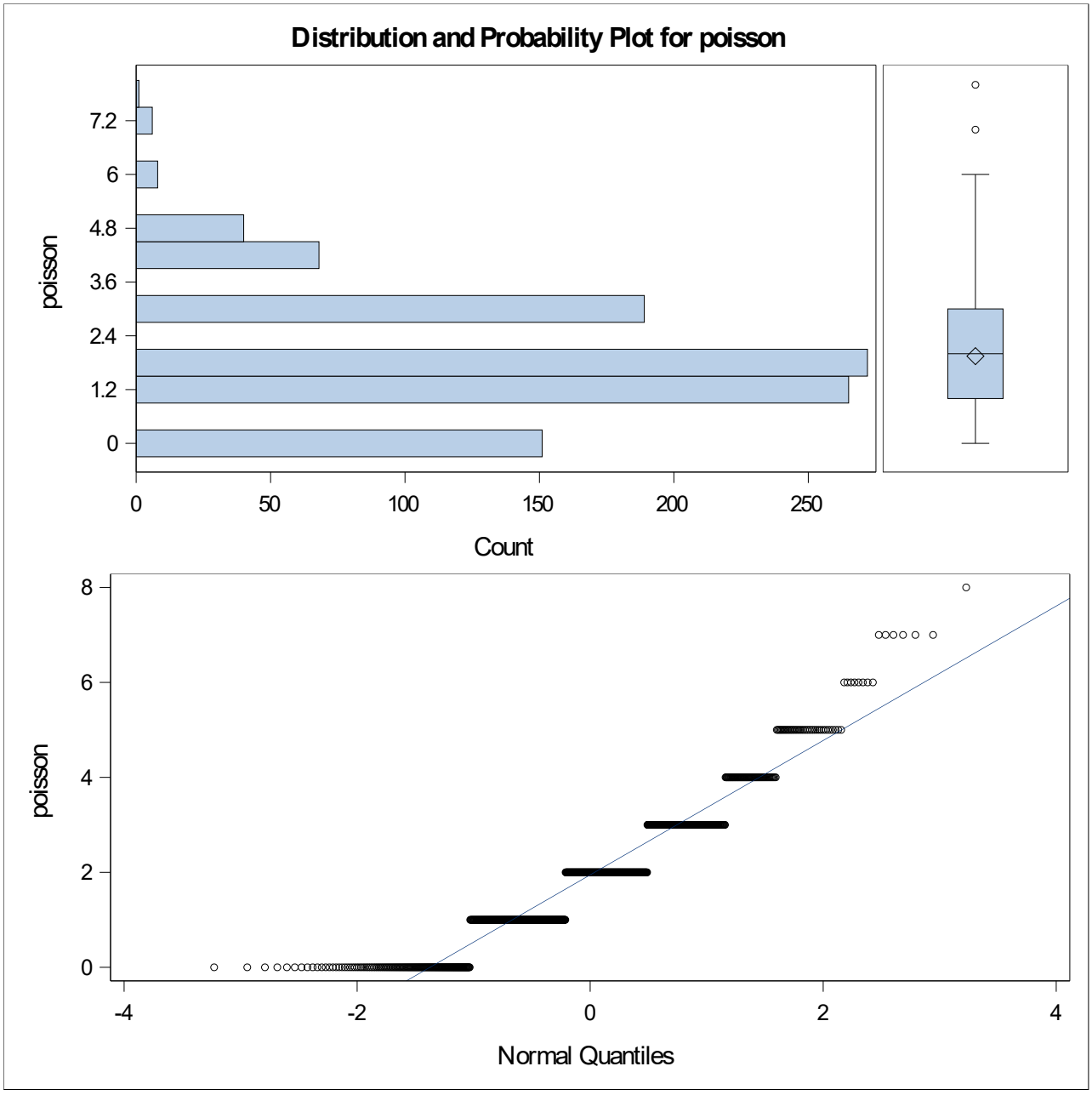
The UNIVARIATE Procedure
Variable:
poisson

Quantiles (Definition 5)	
Level	**Quantile**
5%	0
1%	0
0% Min	0

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
0	990	7	451
0	987	7	864
0	983	7	934
0	981	7	995
0	979	8	552

Exercise 3 Part B
lambda 2

The UNIVARIATE Procedure



Exercise 3 Part B
lambda 4

The UNIVARIATE Procedure
Variable:
poisson

Moments			
N	1000	**Sum Weights**	1000
Mean	4.064	**Sum Observations**	4064
Std Deviation	2.05672899	**Variance**	4.23013413
Skewness	0.38486329	**Kurtosis**	-0.1553396
Uncorrected SS	20742	**Corrected SS**	4225.904
Coeff Variation	50.6084889	**Std Error Mean**	0.06503948

Basic Statistical Measures			
Location		**Variability**	
Mean	4.064000	**Std Deviation**	2.05673
Median	4.000000	**Variance**	4.23013
Mode	4.000000	**Range**	11.00000
		Interquartile Range	2.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	62.48512	**Pr > |t|**	<.0001
Sign	**M**	490.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	240835.5	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	11
99%	9
95%	8
90%	7
75% Q3	5
50% Median	4
25% Q1	3
10%	2

Exercise 3 Part B
lambda 4

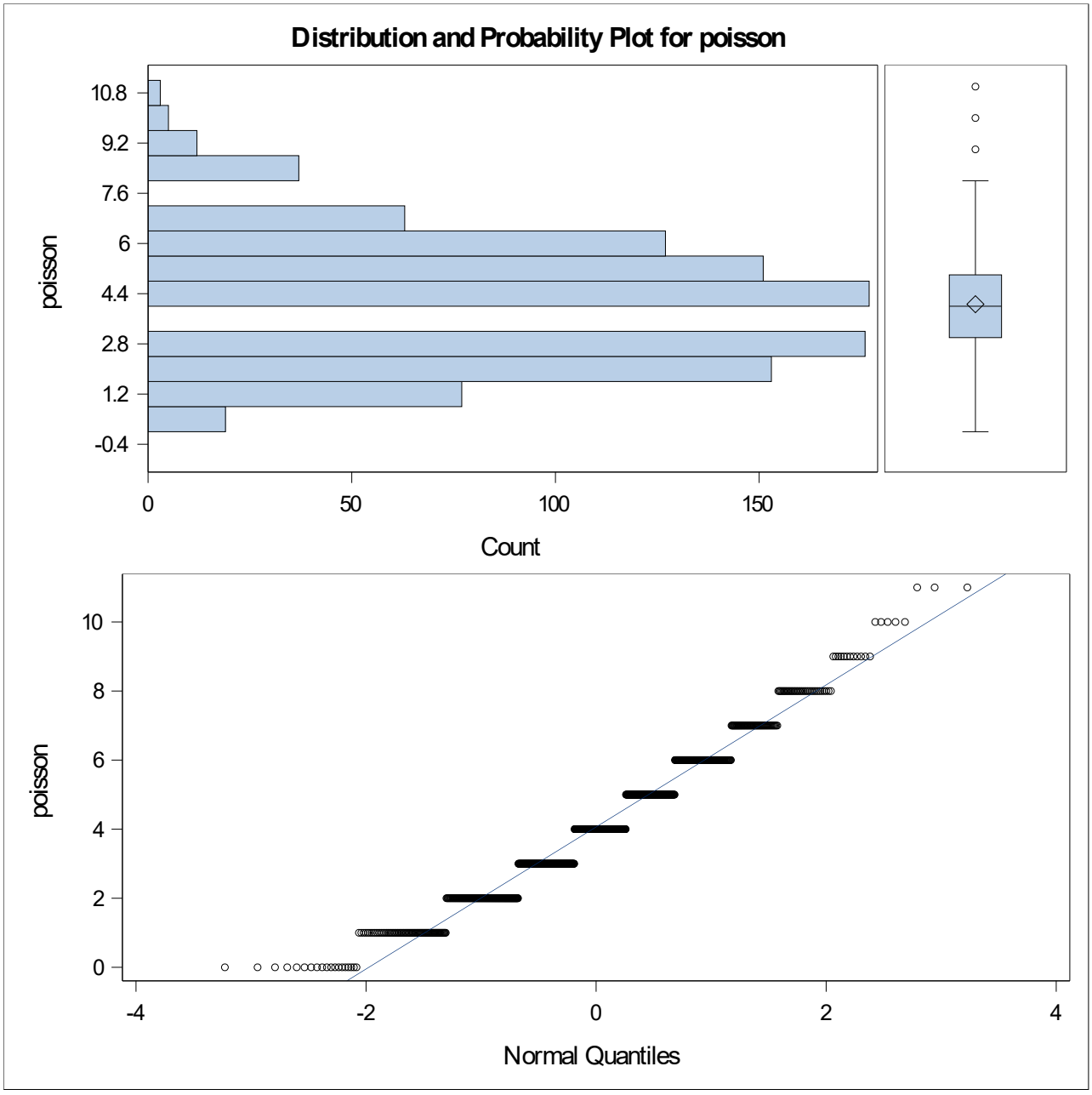
The UNIVARIATE Procedure
Variable:
poisson

Quantiles (Definition 5)	
Level	**Quantile**
5%	1
1%	0
0% Min	0

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
0	974	10	723
0	966	10	851
0	933	11	80
0	849	11	442
0	846	11	864

Exercise 3 Part B
lambda 4

The UNIVARIATE Procedure



Exercise 3 Part B
lambda 8

The UNIVARIATE Procedure
Variable:
poisson

Moments			
N	1000	**Sum Weights**	1000
Mean	7.988	**Sum Observations**	7988
Std Deviation	2.8045894	**Variance**	7.86572172
Skewness	0.41524467	**Kurtosis**	0.18050821
Uncorrected SS	71666	**Corrected SS**	7857.856
Coeff Variation	35.1100326	**Std Error Mean**	0.0886889

Basic Statistical Measures			
Location		**Variability**	
Mean	7.988000	**Std Deviation**	2.80459
Median	8.000000	**Variance**	7.86572
Mode	7.000000	**Range**	18.00000
		Interquartile Range	4.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	90.06764	**Pr > |t|**	<.0001
Sign	**M**	500	**Pr >= |M|**	<.0001
Signed Rank	**S**	250250	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	19.0
99%	15.0
95%	13.0
90%	12.0
75% Q3	10.0
50% Median	8.0
25% Q1	6.0
10%	4.5

Exercise 3 Part B
lambda 8

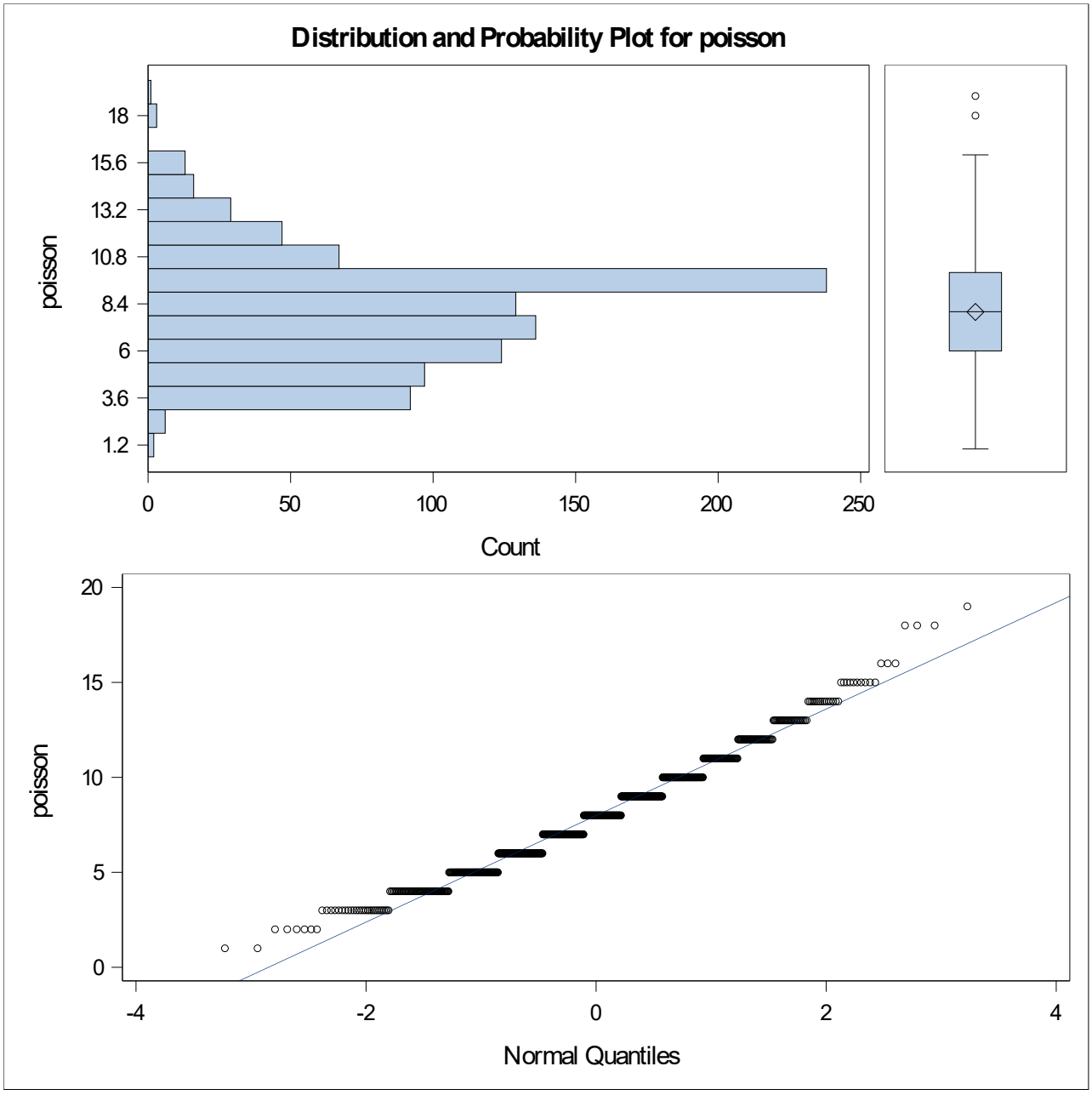
The UNIVARIATE Procedure
Variable:
poisson

Quantiles (Definition 5)	
Level	**Quantile**
5%	4.0
1%	3.0
0% Min	1.0

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
1	601	16	968
1	337	18	524
2	934	18	527
2	804	18	564
2	634	19	45

Exercise 3 Part B
lambda 8

The UNIVARIATE Procedure



Exercise 3 Part B
lambda 16

The UNIVARIATE Procedure
Variable:
poisson

Moments			
N	1000	**Sum Weights**	1000
Mean	16.066	**Sum Observations**	16066
Std Deviation	3.89291649	**Variance**	15.1547988
Skewness	0.11611903	**Kurtosis**	-0.0210442
Uncorrected SS	273256	**Corrected SS**	15139.644
Coeff Variation	24.2307761	**Std Error Mean**	0.12310483

Basic Statistical Measures			
Location		**Variability**	
Mean	16.06600	**Std Deviation**	3.89292
Median	16.00000	**Variance**	15.15480
Mode	15.00000	**Range**	25.00000
		Interquartile Range	6.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	130.5067	**Pr > |t|**	<.0001
Sign	**M**	500	**Pr >= |M|**	<.0001
Signed Rank	**S**	250250	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	29
99%	25
95%	23
90%	21
75% Q3	19
50% Median	16
25% Q1	13
10%	11

Exercise 3 Part B
lambda 16

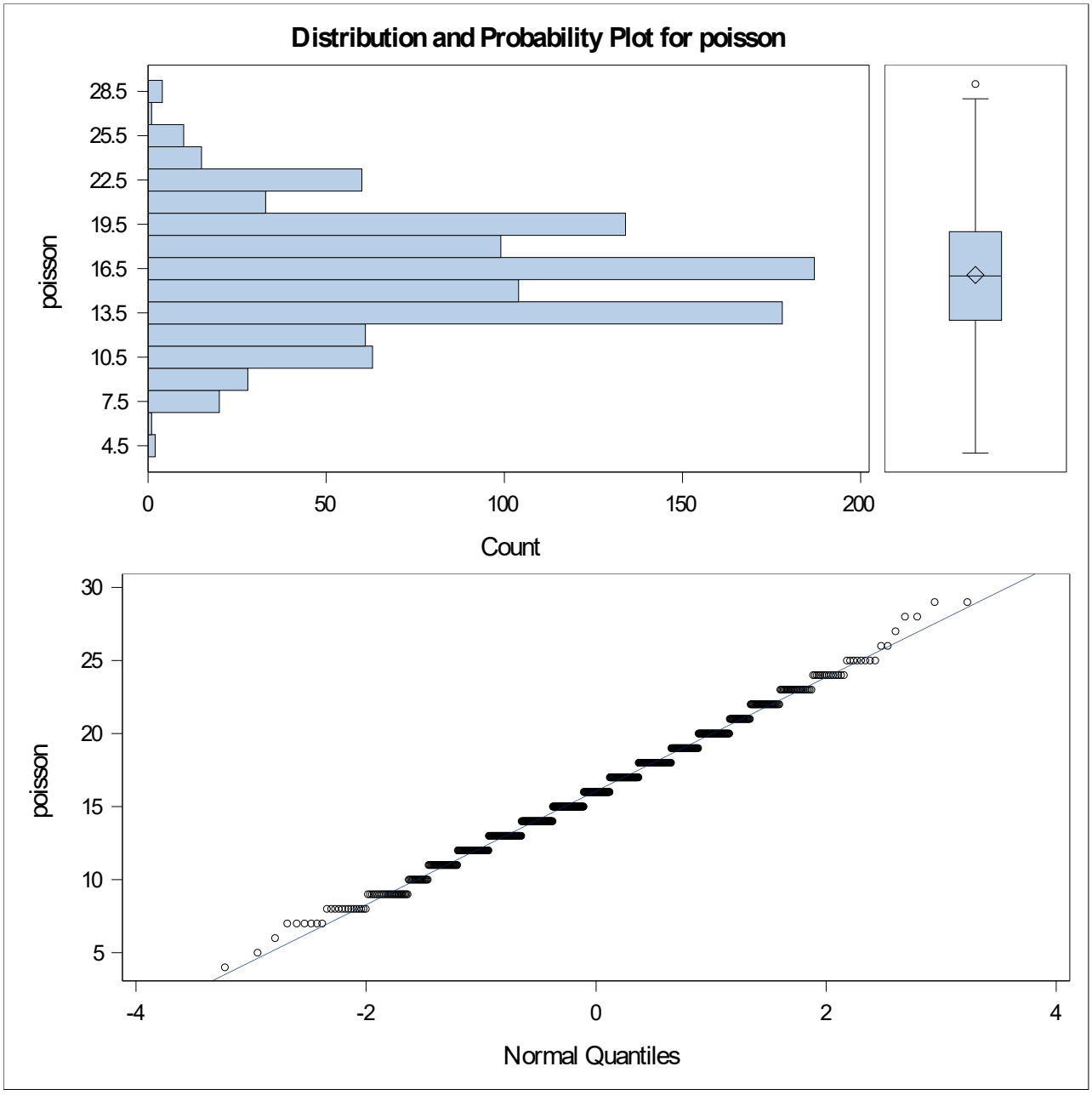
The UNIVARIATE Procedure
Variable:
poisson

Quantiles (Definition 5)	
Level	**Quantile**
5%	9
1%	8
0% Min	4

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
4	875	27	464
5	565	28	743
6	856	28	983
7	975	29	90
7	897	29	859

Exercise 3 Part B
lambda 16

The UNIVARIATE Procedure



Exercise 3 Part B
lambda 32

The UNIVARIATE Procedure
Variable:
poisson

Moments			
N	1000	**Sum Weights**	1000
Mean	32.005	**Sum Observations**	32005
Std Deviation	5.61306347	**Variance**	31.5064815
Skewness	0.26621762	**Kurtosis**	0.25561976
Uncorrected SS	1055795	**Corrected SS**	31474.975
Coeff Variation	17.538083	**Std Error Mean**	0.17750065

Basic Statistical Measures			
Location		**Variability**	
Mean	32.00500	**Std Deviation**	5.61306
Median	32.00000	**Variance**	31.50648
Mode	33.00000	**Range**	39.00000
		Interquartile Range	8.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	180.3092	**Pr > |t|**	<.0001
Sign	**M**	500	**Pr >= |M|**	<.0001
Signed Rank	**S**	250250	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	54.0
99%	46.5
95%	42.0
90%	39.0
75% Q3	36.0
50% Median	32.0
25% Q1	28.0
10%	25.0

Exercise 3 Part B
lambda 32

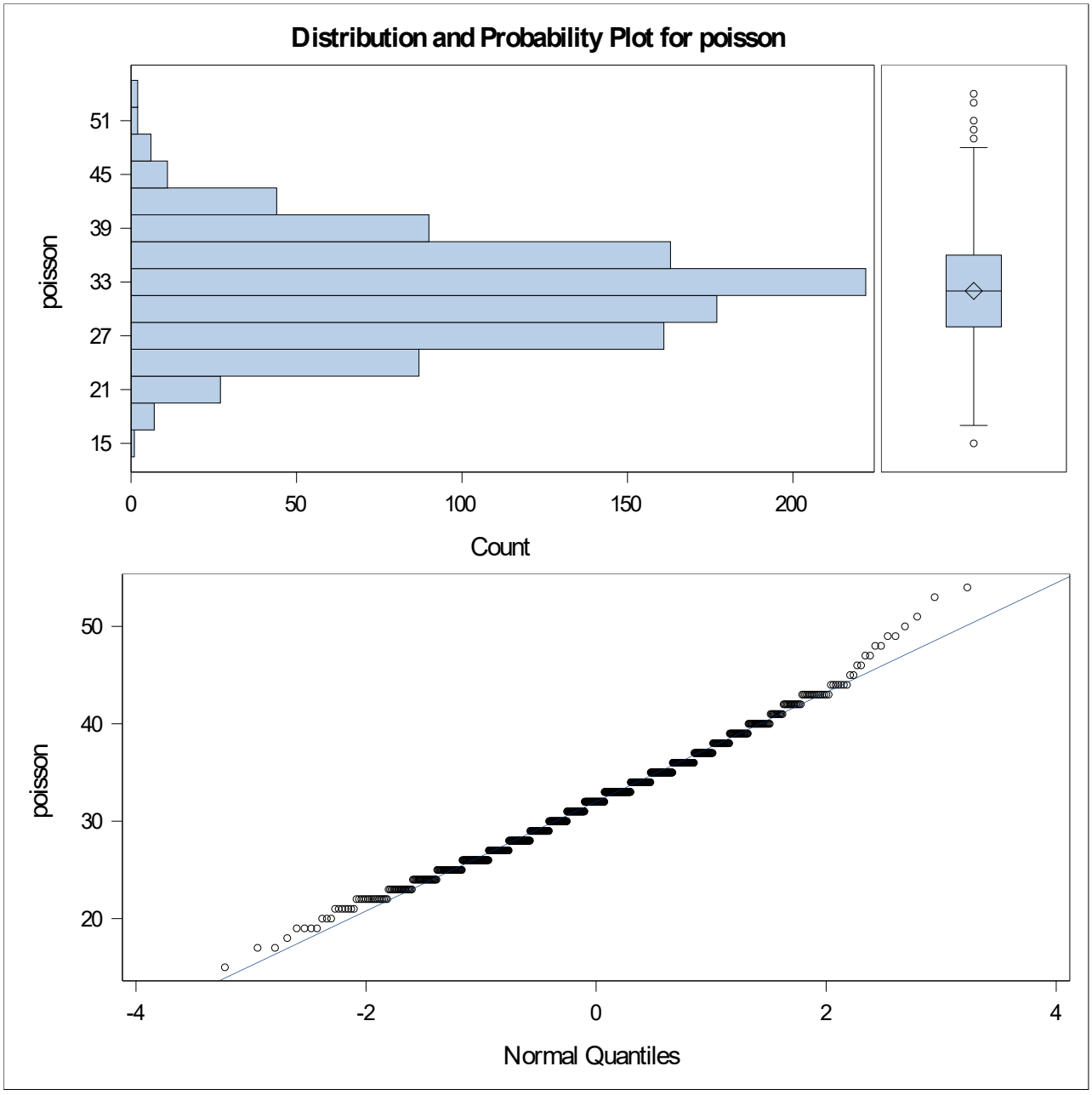
The UNIVARIATE Procedure
Variable:
poisson

Quantiles (Definition 5)	
Level	**Quantile**
5%	23.0
1%	20.0
0% Min	15.0

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
15	918	49	637
17	971	50	713
17	209	51	503
18	618	53	811
19	629	54	724

Exercise 3 Part B
lambda 32

The UNIVARIATE Procedure



Exercise 3 Part B
lambda 64

The UNIVARIATE Procedure
Variable:
poisson

Moments			
N	1000	**Sum Weights**	1000
Mean	64.541	**Sum Observations**	64541
Std Deviation	7.83094136	**Variance**	61.3236426
Skewness	-0.0028031	**Kurtosis**	0.27382897
Uncorrected SS	4226803	**Corrected SS**	61262.319
Coeff Variation	12.1332817	**Std Error Mean**	0.24763611

Basic Statistical Measures			
Location		**Variability**	
Mean	64.54100	**Std Deviation**	7.83094
Median	64.00000	**Variance**	61.32364
Mode	63.00000	**Range**	57.00000
		Interquartile Range	11.00000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	260.6284	**Pr > |t|**	<.0001
Sign	**M**	500	**Pr >= |M|**	<.0001
Signed Rank	**S**	250250	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	96.0
99%	83.0
95%	77.0
90%	74.0
75% Q3	70.0
50% Median	64.0
25% Q1	59.0
10%	55.0

Exercise 3 Part B
lambda 64

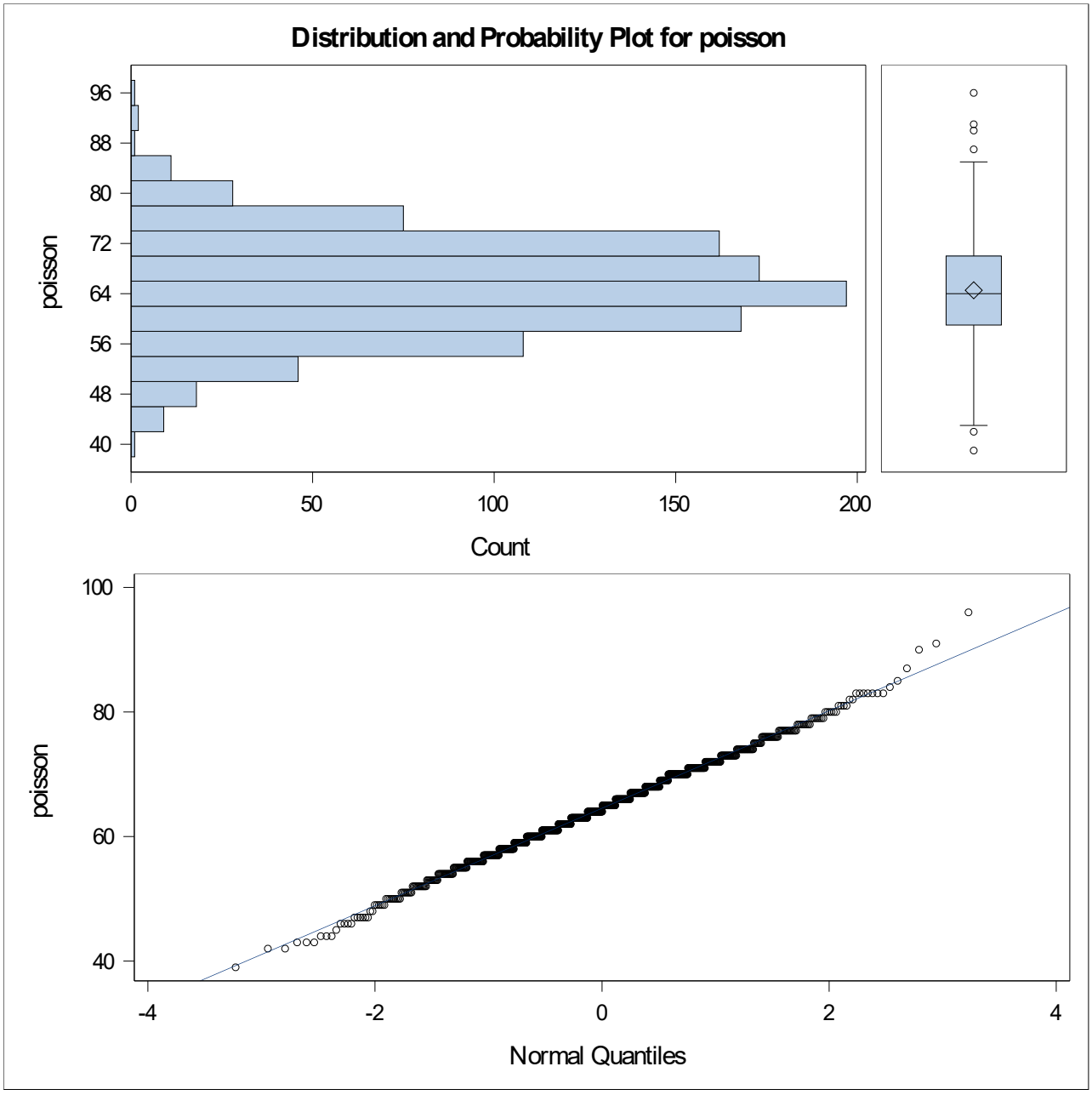
The UNIVARIATE Procedure
Variable:
poisson

Quantiles (Definition 5)	
Level	**Quantile**
5%	52.0
1%	45.5
0% Min	39.0

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
39	728	85	194
42	912	87	299
42	692	90	290
43	826	91	530
43	186	96	48

Exercise 3 Part B
lambda 64

The UNIVARIATE Procedure



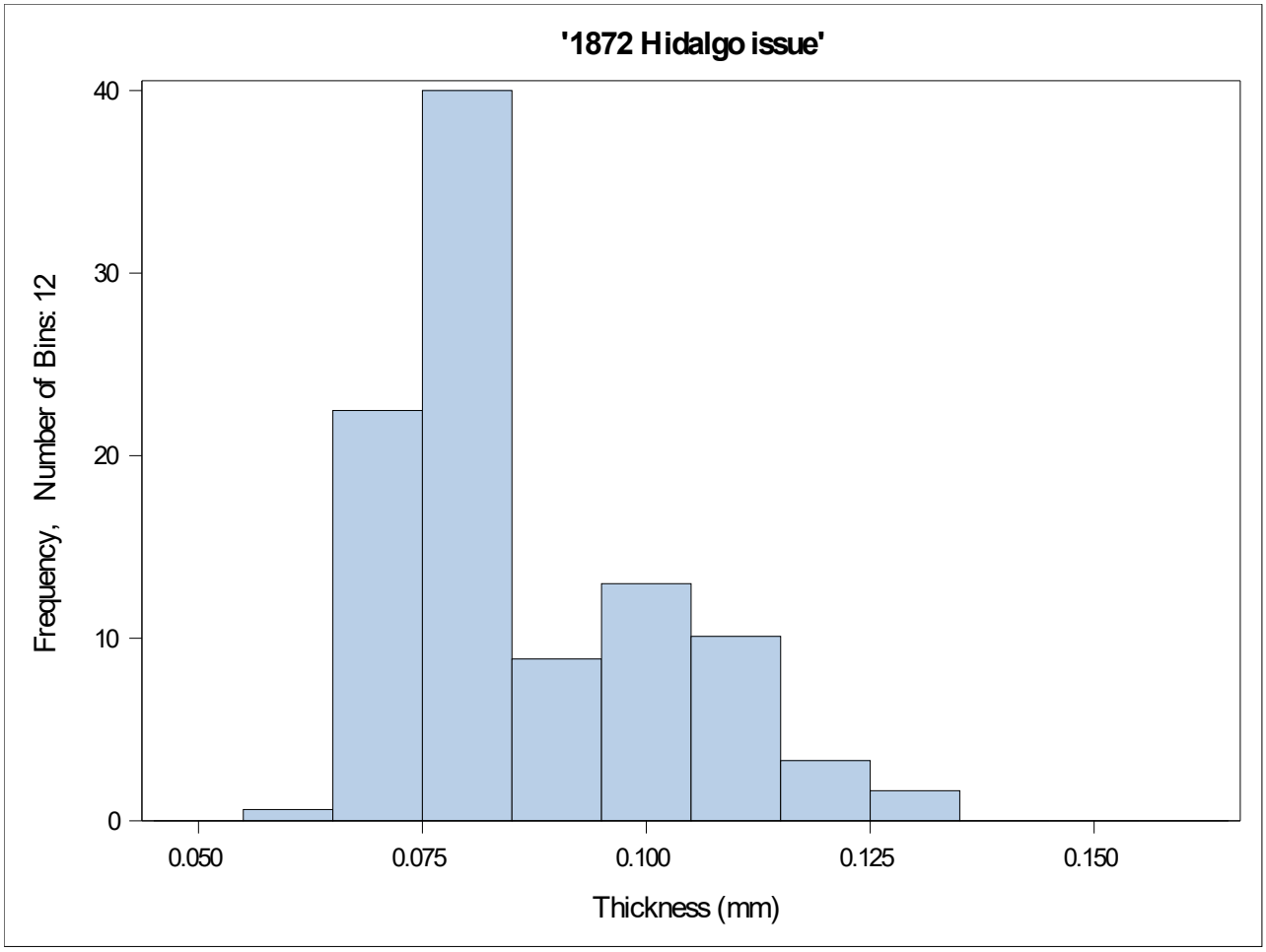
Exercise 3 Part B
lambda 64

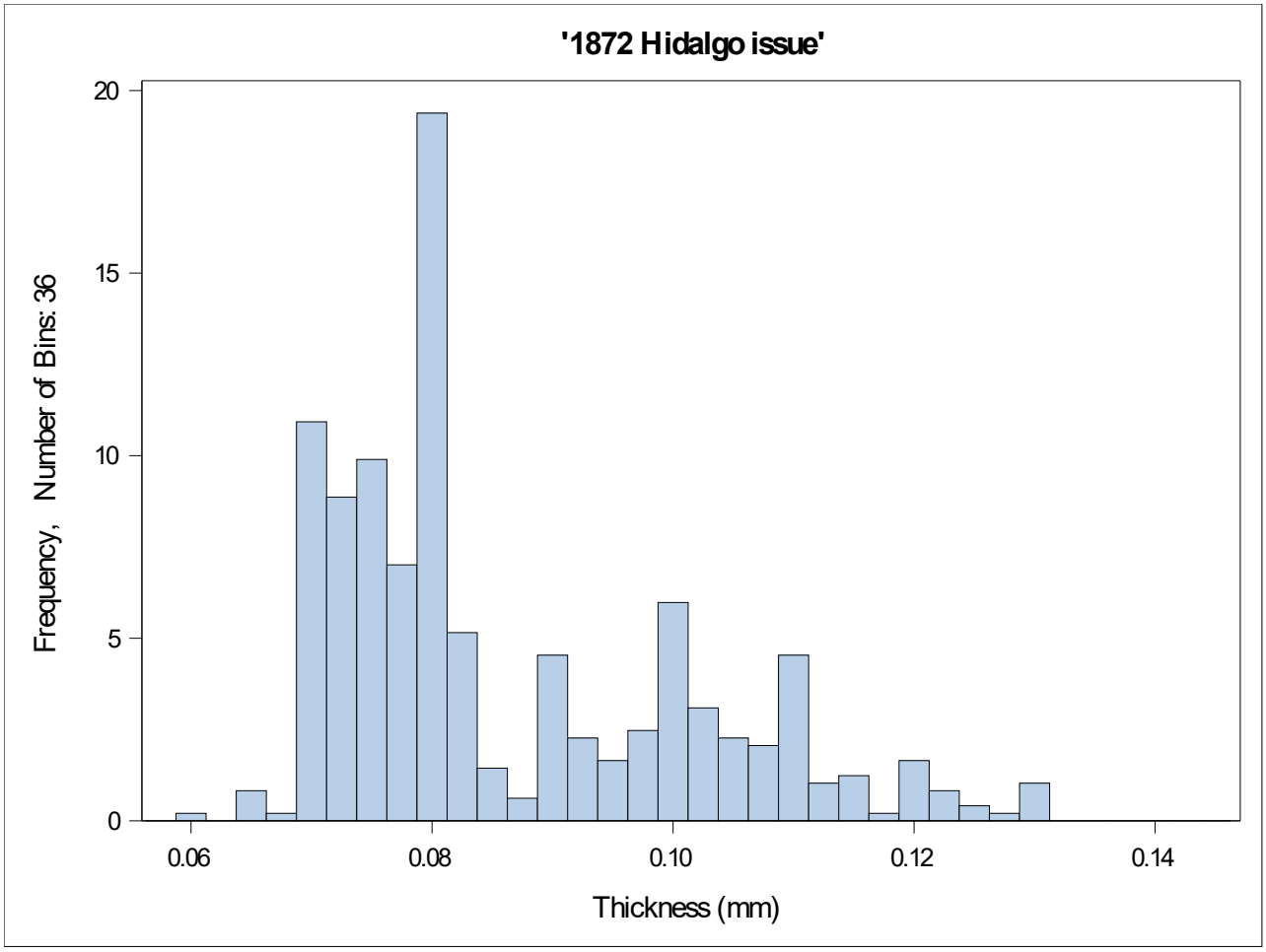
Question: At what size mean is Poisson data no longer skewed, relative to normally distributed data?

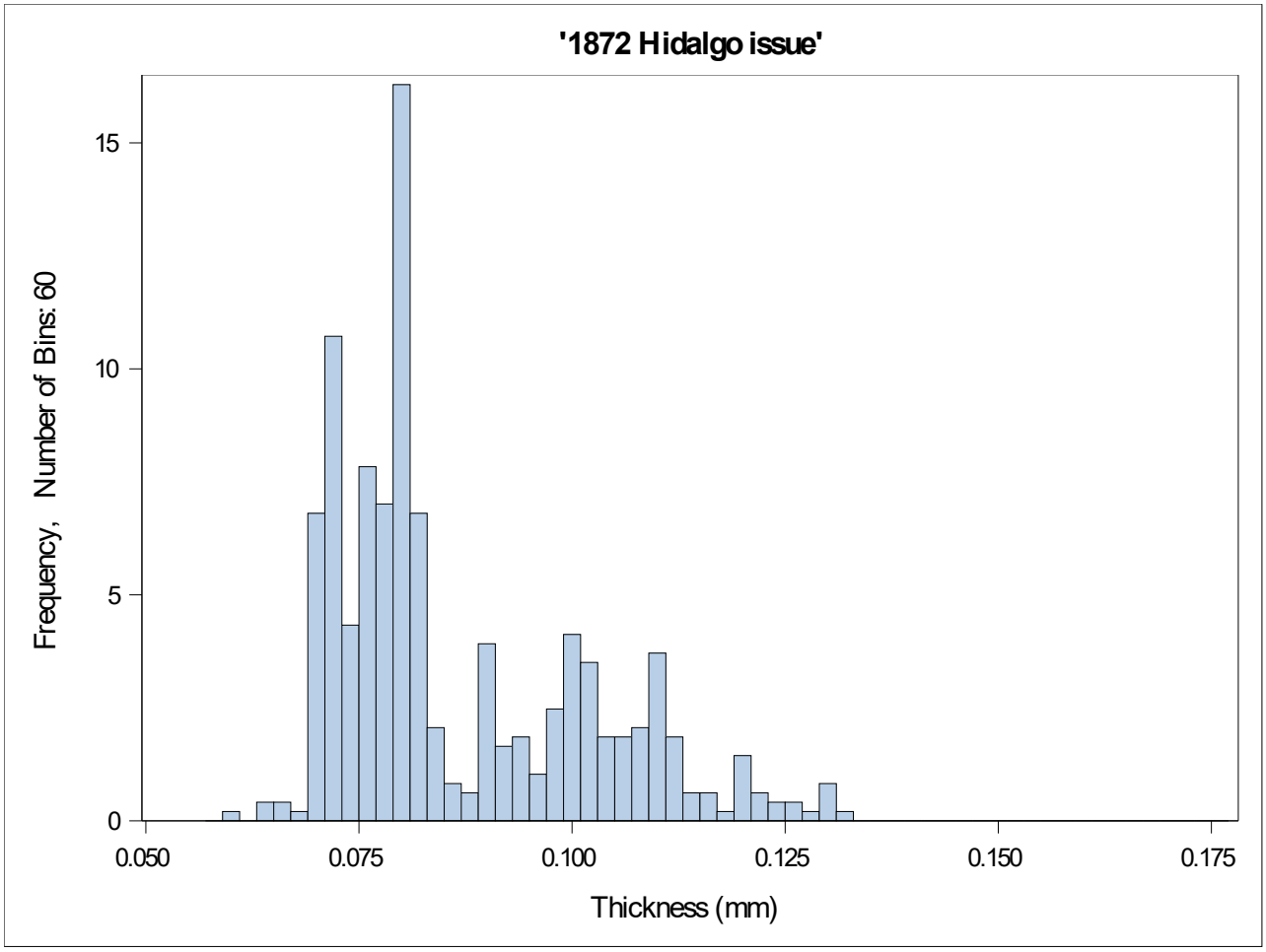
Answer: It seems to be no longer skewed at a mean of 64, as this is where the skewness is closest to 0.

Question: At what μ is skewness of the Poisson distribution small enough to be considered normal?

Answer: Going by my results from exercise 2 and from running it a few times with different seed values, it seems like a normal distribution usually has a skewness between -.06 and .06. Skewness of the poisson distribution seems to get into this range at a μ of 64, and can thus be considered a normal distribution at this point.


'1872 Hidalgo issue'
Frequency, Number of Bins: 12
40
30
20
10
0
0.050
0.075
0.100
0.125
0.150
Thickness (mm)


'1872 Hidalgo issue'
Frequency, Number of Bins: 36
20
15
10
5
0
0.06
0.08
0.10
0.12
0.14
Thickness (mm)


'1872 Hidalgo issue'
Frequency, Number of Bins: 60
15
10
5
0
0.050
0.075
0.100
0.125
0.150
0.175
Thickness (mm)

'1872 Hidalgo issue'

Question: Some analysis suggest there are three different mixtures of paper used to produce the 1872 Hidalgo issue;other analysis suggest seven. Why do you think there might be disagreement about the number of mixtures?

Answer: It makes sense that people would be suspicious of this data after seeing a visualization of it as it is not normally distributed.When visualized on a histogram, the data seems to be heavily skewed and distributed around multiple points including .07 mm, .08 mm, .1 mm, and .11 mm.