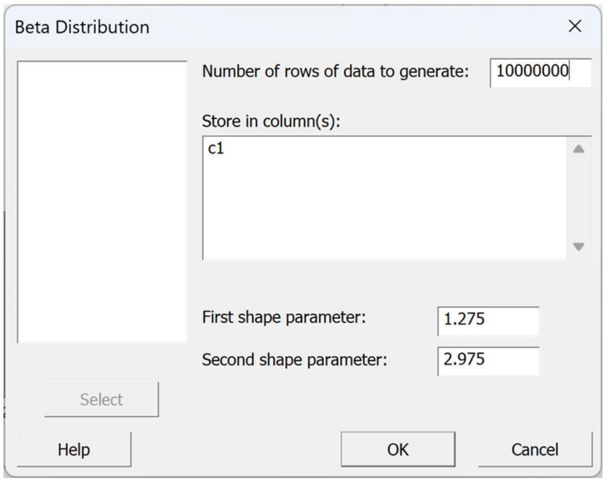
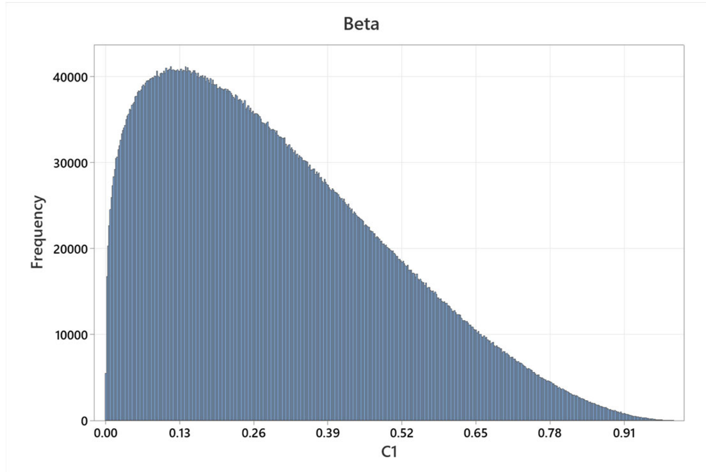
Beta Distribution





Variable	Mean	StDev	Minimum	Maximum	Skewness	Kurtosis
C1	0.30005	0.20013	0.000003	0.99679	0.64	-0.30

Note $0 < \mu < 1$ and $\sigma^2 < \mu(1-\mu)$

First Shape Parameter = $\alpha = \mu^*(\,(\,\mu^*(1-\mu)/\sigma^2 - 1)\,)$

Second Shape Parameter $= \beta = (1-\mu)^*(\,(\,\mu^*(1-\mu)/\sigma^2 - 1)\,)$

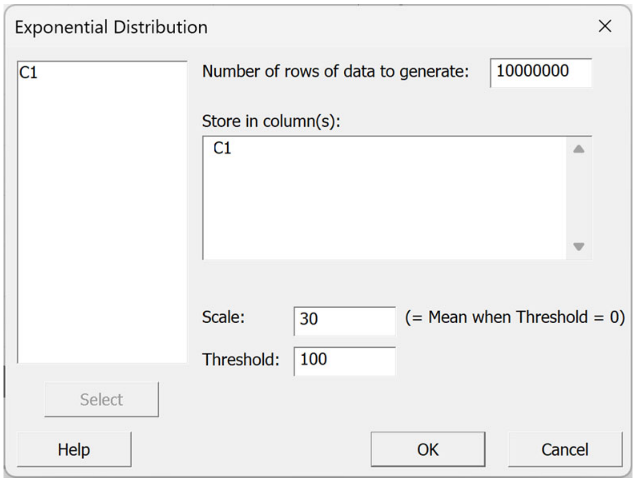
1. In **First shape parameter** α, enter a number that is greater than zero for the first shape parameter.
2. In **Second shape parameter** β, enter a number that is greater than zero for the second shape parameter

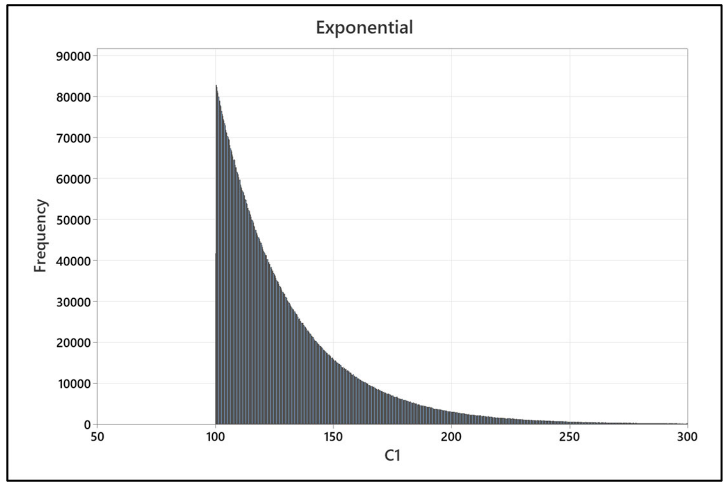
For example for $\mu=0.3$ and $\sigma=0.2$

$\alpha=1.275$

$\beta=2.975$

Exponential Distribution





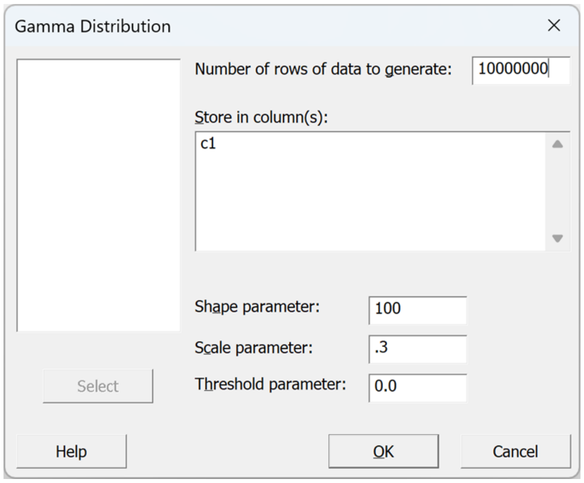
Variable	Mean	StDev	Minimum	Maximum	Skewness	Kurtosis
C1	130.01	30.00	100.00	557.31	2.00	5.99

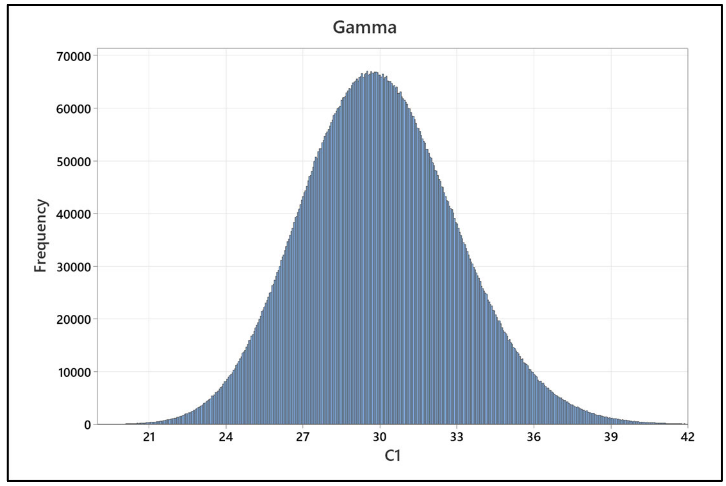
1. **Scale** = σ
2. **Threshold** = μ- σ

For example for μ=130 and σ=30

Scale = 30
Threshold = 100

Gamma Distribution





Variable	Mean	StDev	Minimum	Maximum	Skewness	Kurtosis
C1	30.001	3.001	15.603	48.717	0.20	0.06

$$\text{Scale parameter} = \theta = \frac{\sigma^2}{\mu}$$

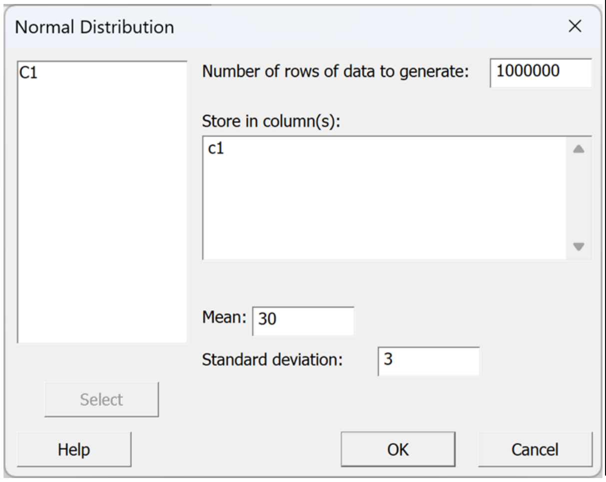
$$\text{Shape parameter} = \frac{\mu}{\theta}$$

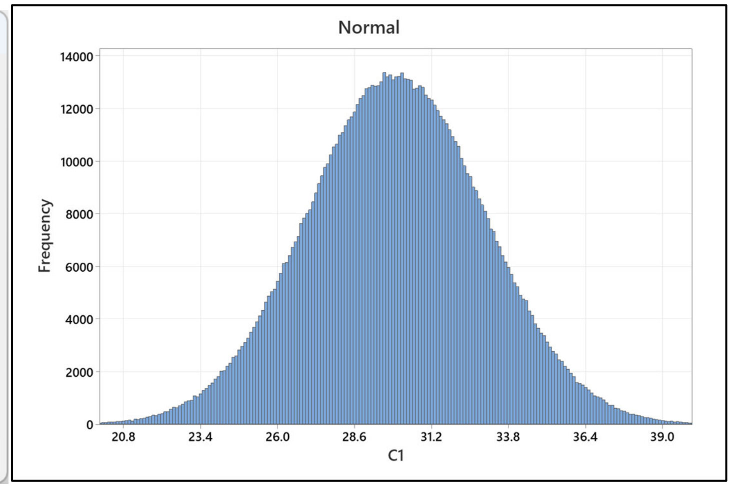
For example, for $\mu = 30$ and $\sigma = 3$

Shape = 30/0.3 = 100

Scale = 3*3/30 = 0.3

Normal





Variable	Mean	StDev	Minimum	Maximum	Skewness	Kurtosis
C1	29.997	3.004	15.758	44.814	0.00	0.00

Mean = μ = 30

Standard deviation = σ = 3

Iterating on distribution parameters to obtain desired mean and standard deviation

The parameters for the following distributions only have suggested starting points and you must iterate to find the parameters that produce the desired mean and standard deviation. The example below used the Largest Extreme Value distribution and a desired mean of 30 and a standard deviation of 3.

The **Location** parameter is approximately the peak of a left skewed distribution with the hint that it is less than the mean.

The Scale parameter is approximately equal to the standard deviation. The starting point for location is 30 while the starting point for Scale is 3.

Use Minitab's Calc/Random Data/Largest Extreme Value… feature, see Figure 1.

The dialog box opens, see Figure 2.

Set the "**Number of rows of data to generate**" at 1,000,000 or 10,000,000. (Red Arrow).

Type "C1" in the "**Store in Column(s):**" (Green Arrow).

Enter 30 for the "**Location**" parameter. (Orange Arrow).

Enter 3 for the "**Scale**" parameter. (Blue Arrow).

See Figure 3.

Press OK and the data is created in column 1, see Figure 4

Run the Display Descriptive Statistics command to view the mean and standard deviation values. See Figure 5.

Enter “**C1**” in the “**Variables**” box, see Figure 6. Press OK to see the results.

Figure 7 shows the results.

The mean is 31.730 and is larger than the entered **Location** parameter of 30. I’d make the next iteration equal to 30-1.73 or 28.27.

The standard deviation is 3.846 and is larger than the entered **Scale** parameter of 3. I’d make the next iteration equal to 3-0.846 or 2.154 and run the Display Descriptive Statistics command to view the new mean and standard deviation estimates.
See Figure 8.
I overshot both the mean and standard deviation and after a few more iterations I arrive at **Location** = 28.65 and **Scale** = 2.36, see Figure 9.

Follow the same instructions for these other distributions.

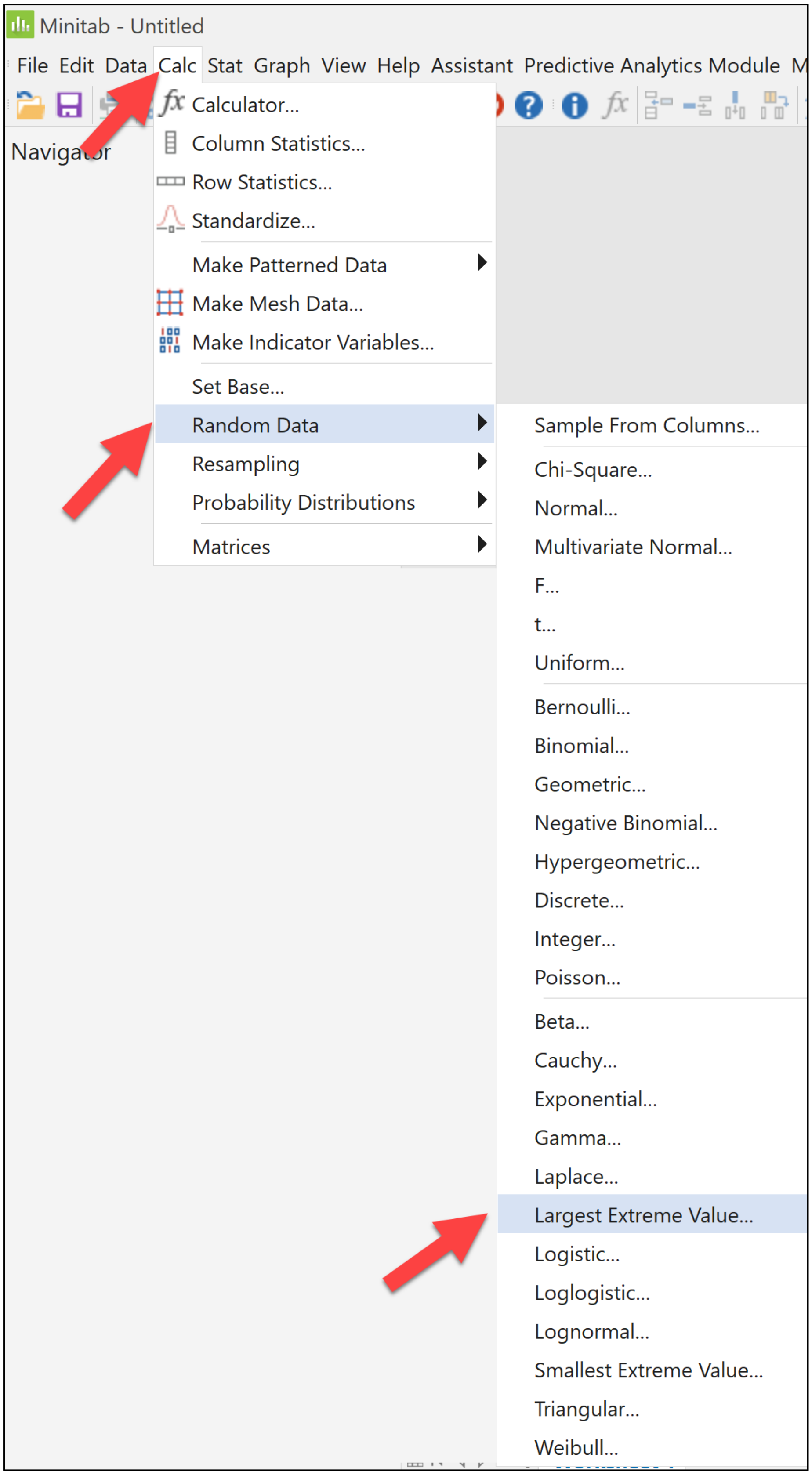


Figure 1 Minitab Calculate Random Data Feature

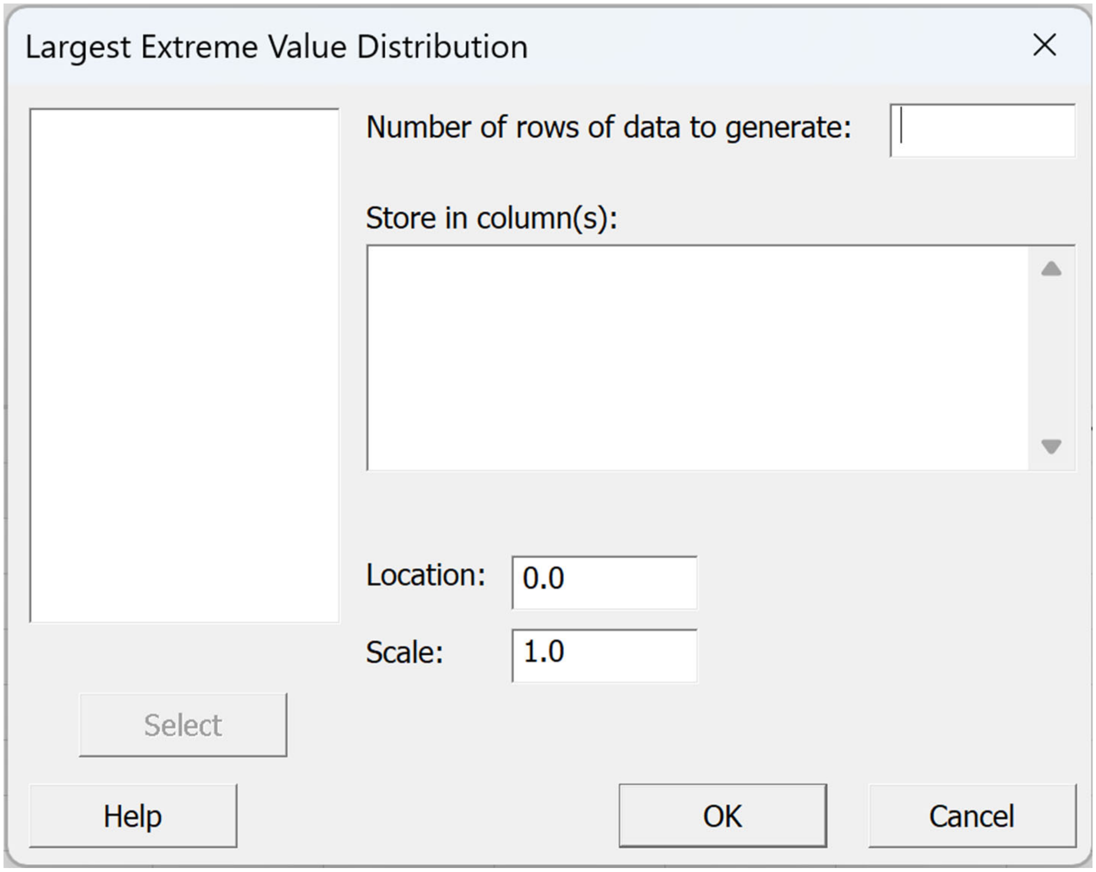


Figure 2 Largest Extreme Value Dialog

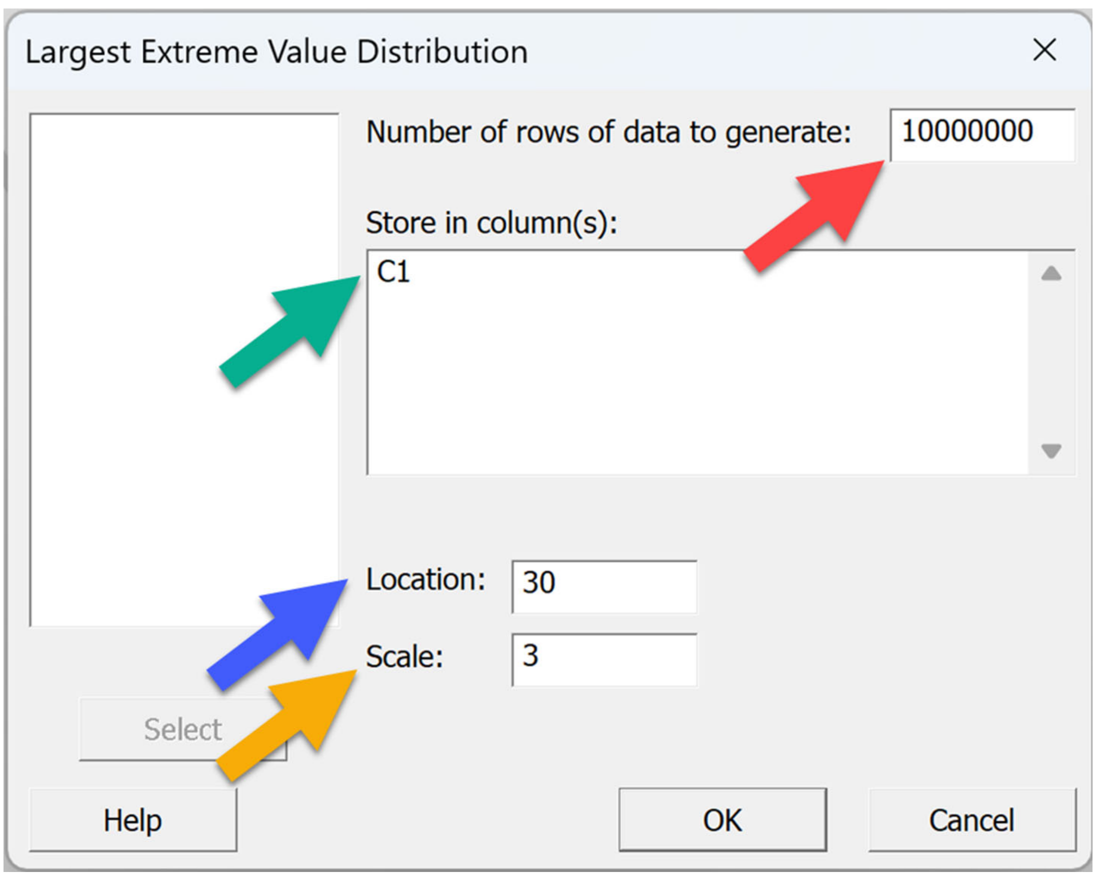


Figure 3 Completed Dialog

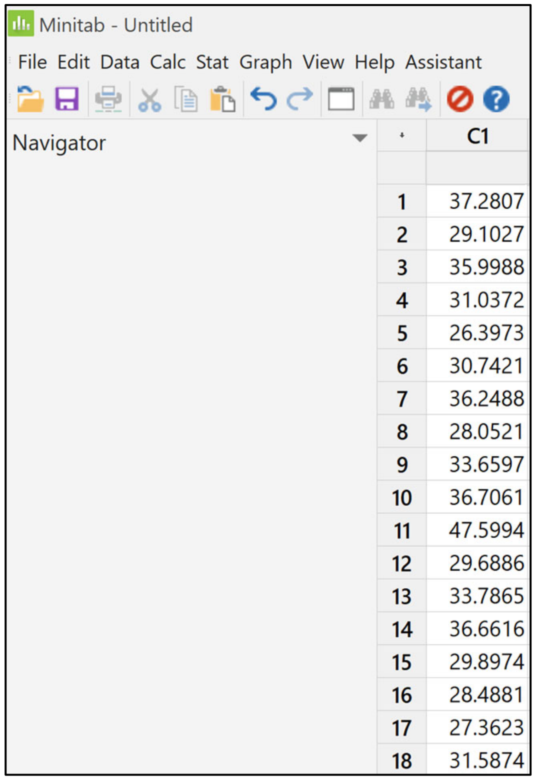


Figure 4 Minitab Data Pane

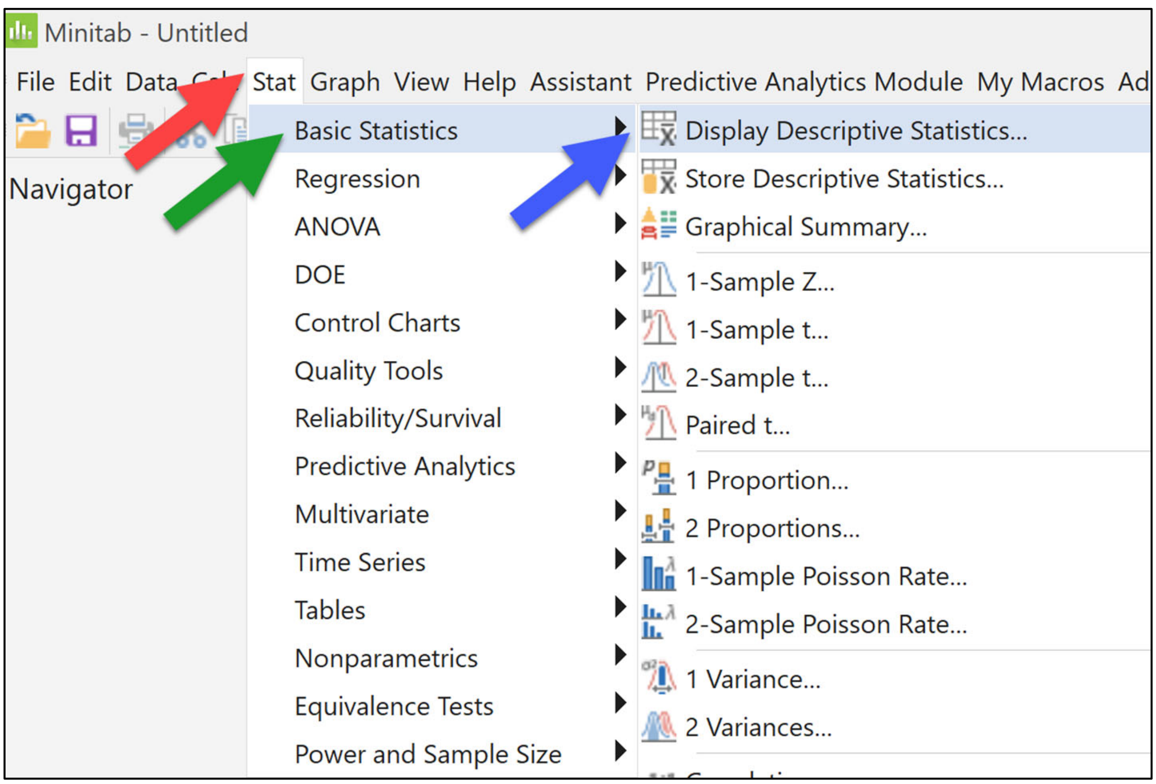


Figure 5 Run the Display Descriptive Statistics Command

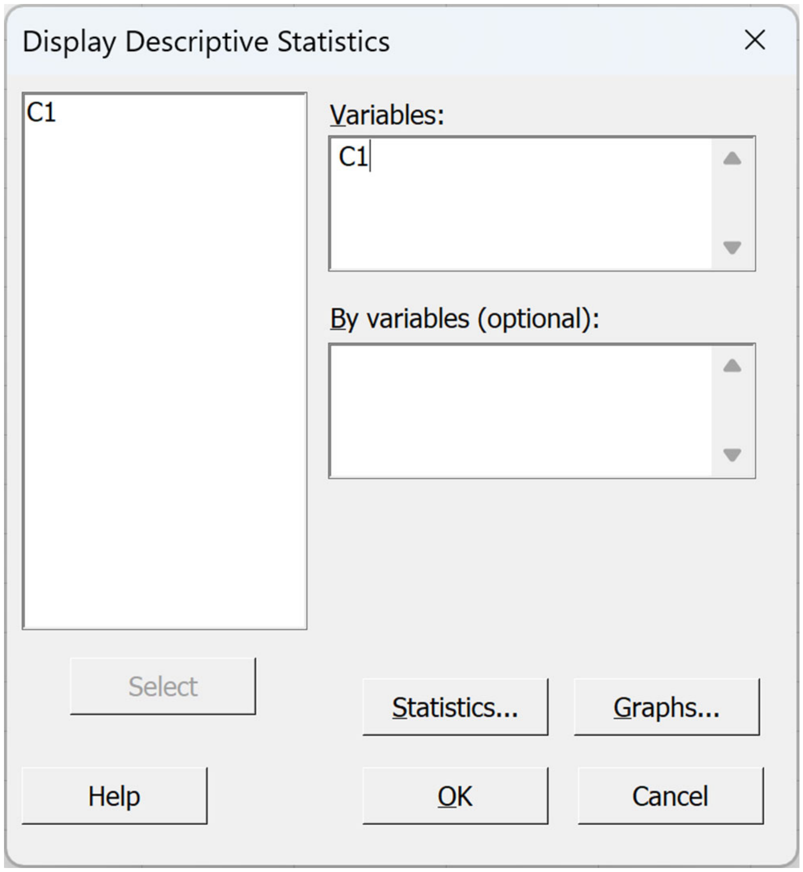


Figure 6 Display Descriptive Statistics Dialog

Statistics

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
C1	10000000	0	31.730	0.00122	3.846	21.368	29.018	31.098	33.736	85.164

Figure 7 First Iteration Results

Statistics

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
C1	10000000	0	29.513	0.000874	2.763	22.295	27.565	29.059	30.955	65.475

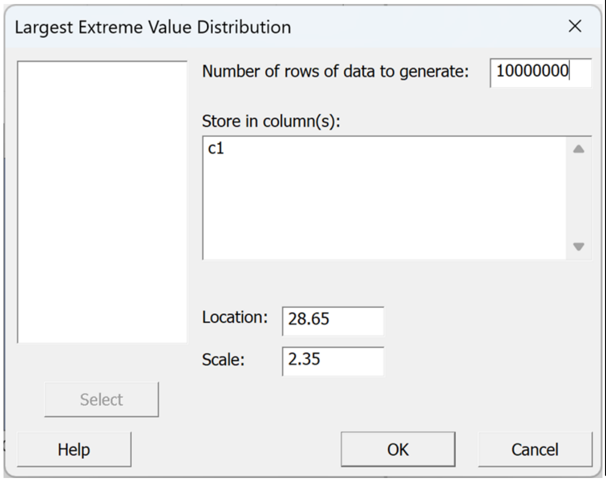
Figure 8 Second Iteration Results

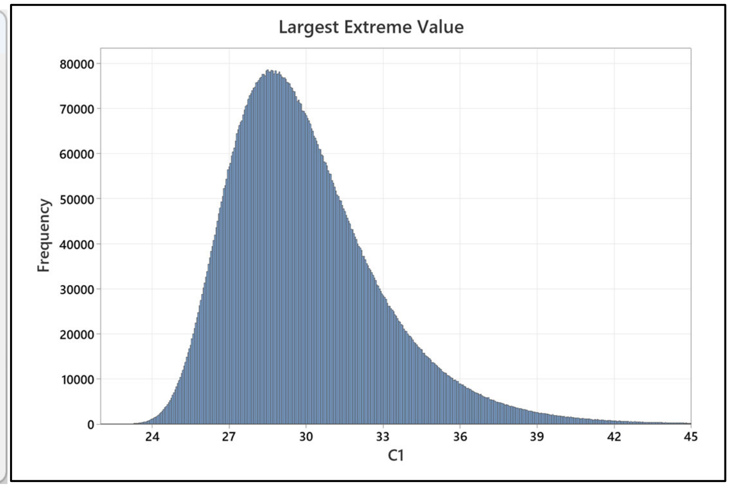
Statistics

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
C1	10000000	0	30.013	0.000957	3.027	21.864	27.879	29.515	31.590	69.553

Figure 9 Final Iteration

Largest Extreme Value Distribution





Variable	Mean	StDev	Minimum	Maximum	Skewness	Kurtosis
C1	30.013	3.027	21.864	69.553	1.14	2.40

$$\text{Location} \approx \text{Peak} \approx< \mu$$
$$\text{Scale} \approx \sigma$$

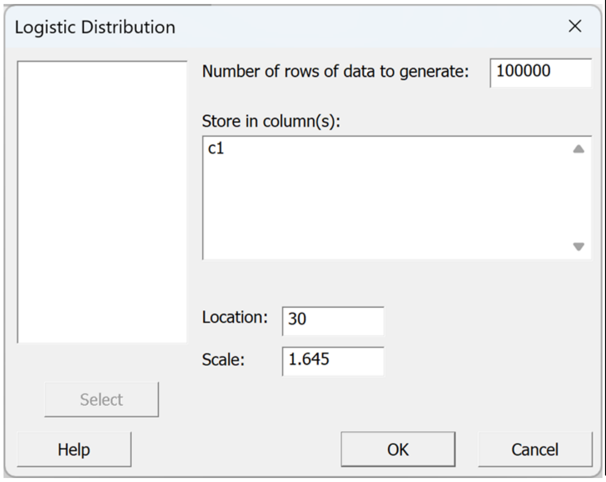
Start with known μ and σ and iterate to better estimates.

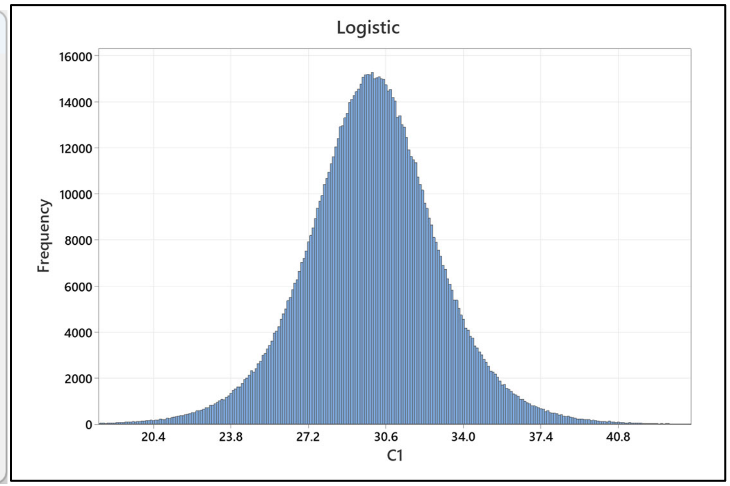
For example for μ=30 and σ=3

Location ≈ 28.65

Scale ≈ 2.35

Logistic Distribution





Variable	Mean	StDev	Minimum	Maximum	Skewness	Kurtosis
C1	30.003	2.983	7.038	55.657	-0.01	1.19

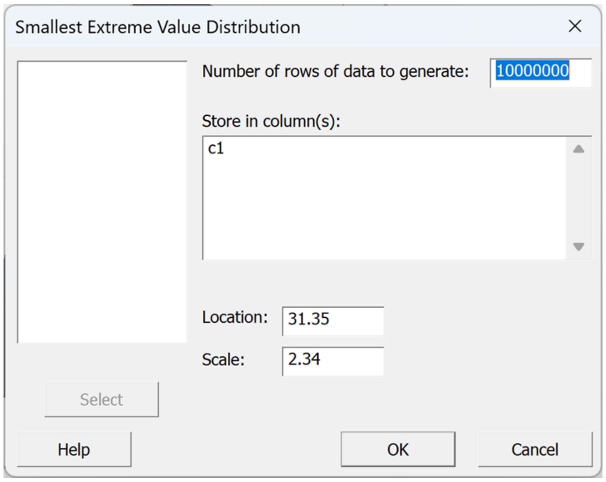
$$\text{Location} \approx \text{Peak} \approx \mu$$
$$\text{Scale} \approx \sigma$$

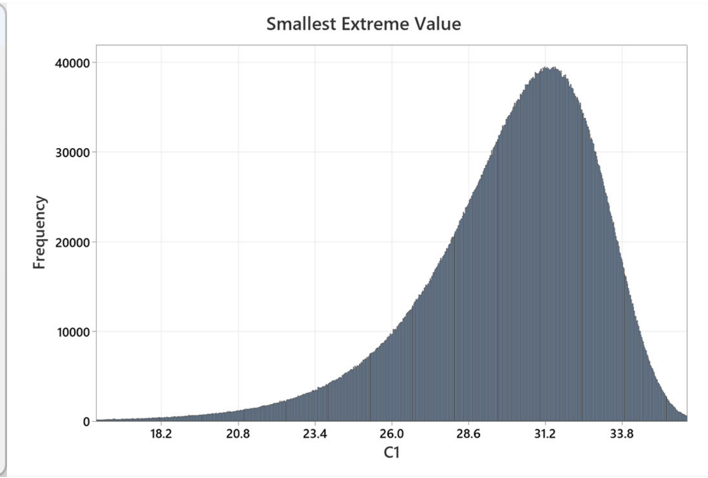
Start with known μ and σ and iterate to better estimates.

For example for μ=30 and σ=3

$$\text{Location} \approx 30$$
$$\text{Scale} \approx 1.645$$

Smallest Extreme Value





Variable	Mean	StDev	Minimum	Maximum	Skewness	Kurtosis
C1	30.000	2.999	-6.761	37.689	-1.14	2.39

$$\text{Location} \approx \text{Peak} \approx> \mu$$

$$\text{Scale} \approx \sigma$$

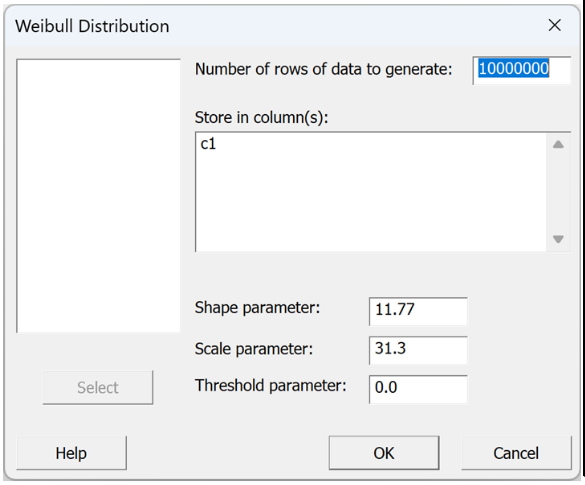
Start with known μ and σ and iterate to better estimates.

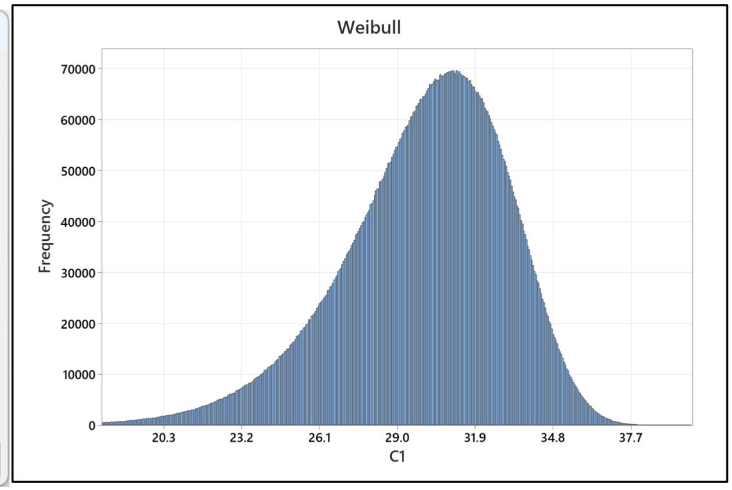
For example, for μ=30 and σ=3

Location ≈ 31.35

Scale ≈ 2.34

Weibull





Variable	Mean	StDev	Minimum	Maximum	Skewness	Kurtosis
C1	29.972	3.091	7.269	39.883	-0.70	0.75

$$\text{Shape} \approx \sigma$$
$$\text{as Shape}\uparrow \mu \downarrow$$
$$\text{Scale Parameter} \approx \mu$$

Start with known μ and σ and iterate to better estimates.

For example for μ=30 and σ=3

$$\text{Shape} \approx 11.77$$
$$\text{Scale} \approx 31.3$$