Jaden Stanford
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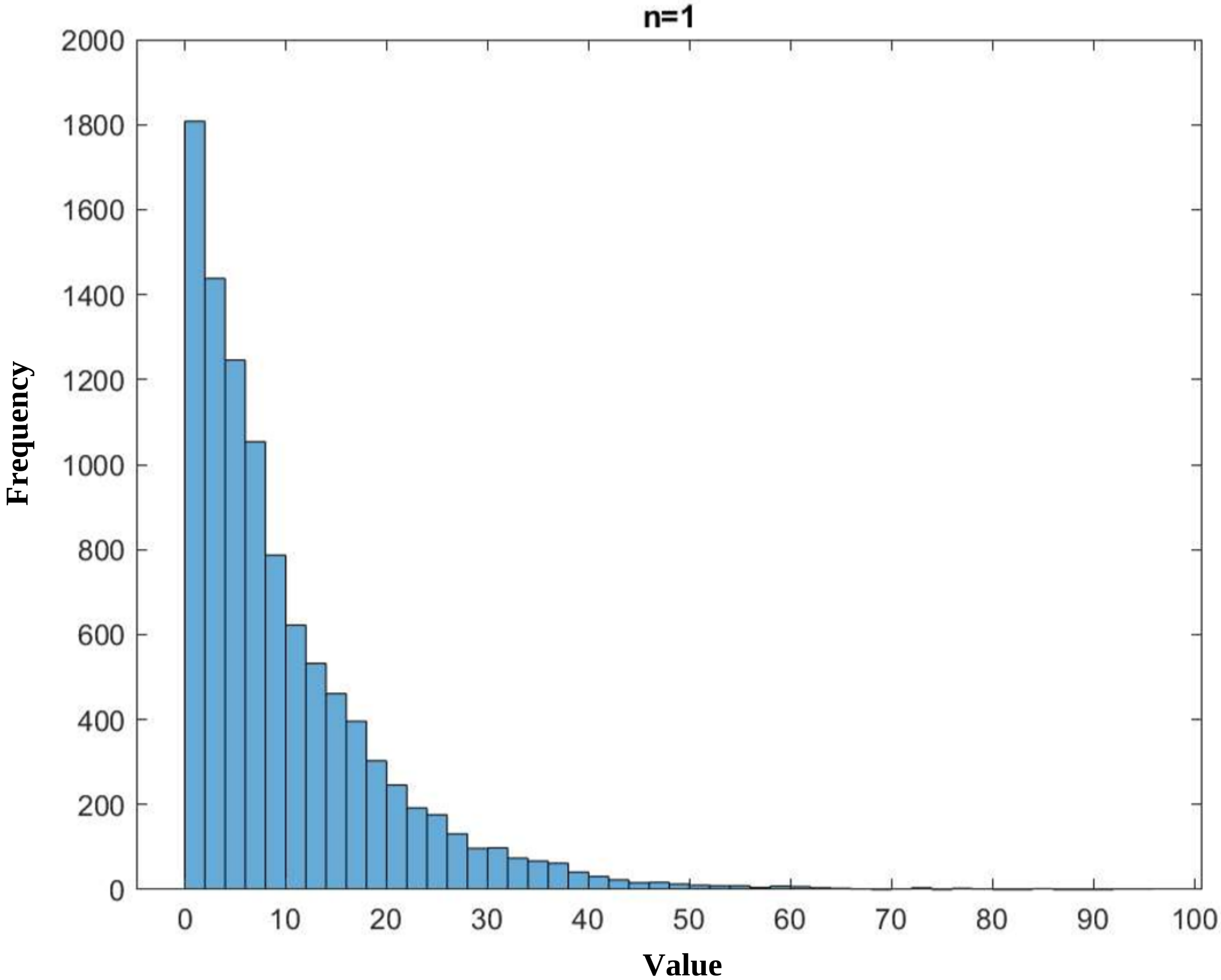
Project 03

Case 1



Mean = 10.0398

Standard deviation = 10.0338

This histogram shows 10000 random samples of size n = 1 from an exponential distribution with a mean of 10. The data is skewed to the right, showing the majority of the samples are a low value. The calculated mean and standard deviation are both close to the expected value of 10.

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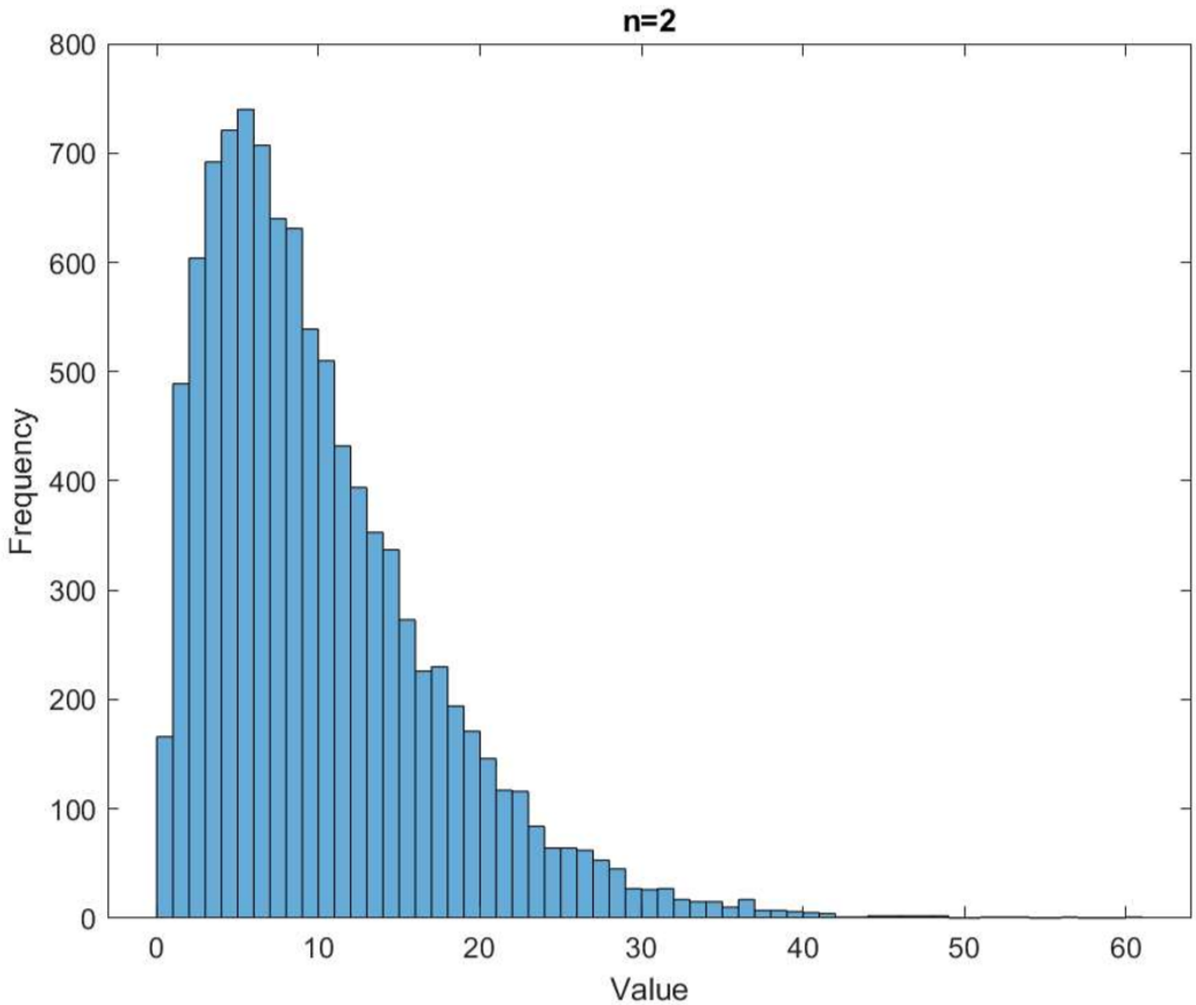
Case 2



Mean (of the array of means) = 10.0374

Standard deviation (of the array of means) = 7.1364

This histogram is of an array of averages for 10000 random samples of size n=2. The 10000 data points are each the average of the 2 values in each random sample. This data is still skewed to the right, but less so than the data for size n = 1, and this data has a larger spread as well. The mean 10.0374 is close to the expected mean of 10. For a sample of size n = 2, the expected standard deviation would be $10/\sqrt{2}$. This yields 7.071, which is close to the calculated standard deviation of 7.14.

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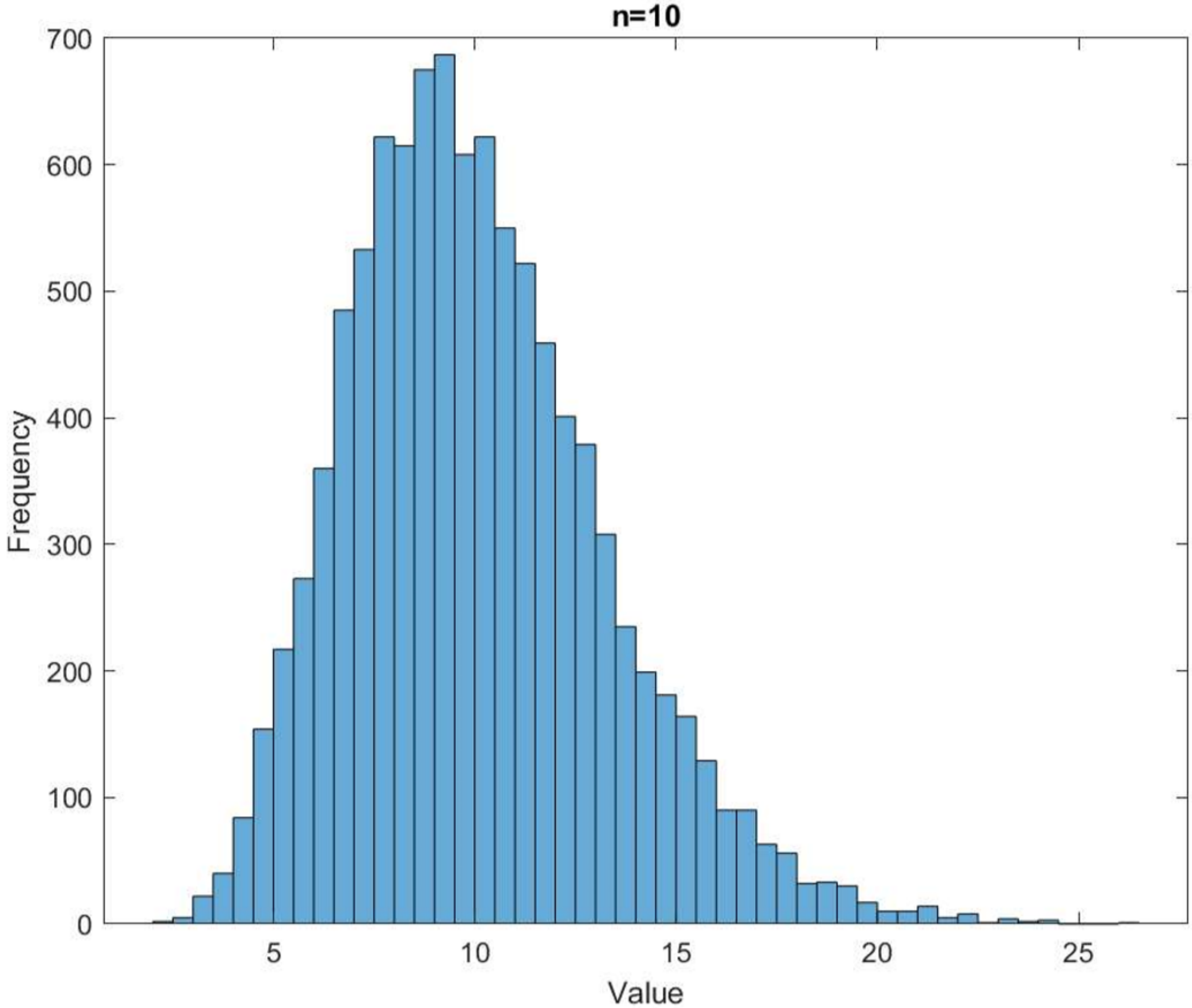
Case 3



Mean (of the array of means) = 10.0598

Standard deviation (of the array of means) = 3.1935

This histogram shows the data from 10,000 generated random samples of size n = 10. Each data point is the average of each random sample. The calculated average of all the data points was 10.0598, which is close to the expected value of 10. The expected standard deviation for 10,000 samples of size n = 10 would be $10/\sqrt{10}$ = 3.162, which is close to the calculated value of 3.1935. The shape of the graph, although skewed right, is more of a bell curve than before (it's spread is wider).

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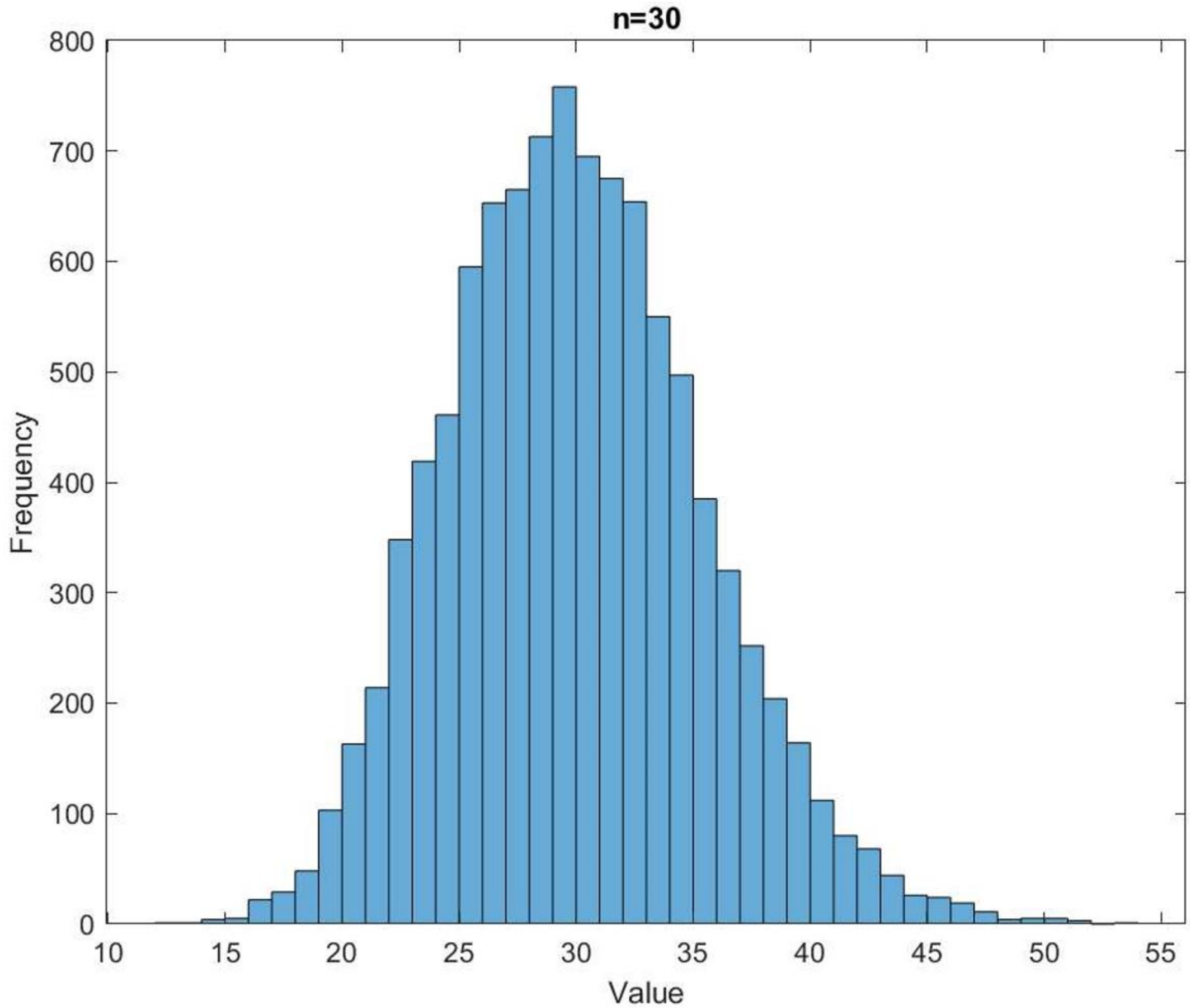
Case 4



Mean (of the array of means) = 10.0060

Standard deviation (of the array of means) = 1.8321

This histogram shows the data from 10,000 generated random samples of size n = 30. Each data point is the average of each random sample. The shape of this histogram appears to be approximately normal – it follows a bell curve and is relatively symmetric. This makes sense due to the large sample size of n = 30 compared to the previous cases. The calculated mean 10.006 is close to the expected mean of 10. For a sample size of n = 30, the expected standard deviation would be $10/\sqrt{30}$ = 1.8257, which is very close to the calculated value of 1.8321.

Confidence Intervals:

Using MATLAB, it was determined that the number of confidence intervals including the mean was 9.624. So, the percent of 95% confidence intervals covering the mean is 96.24%.

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Matlab Code Used

1.
```
data = exprnd(10, 1, 10000);
histogram(data)
title('n=1')
total = sum(data);
mean = total/10000
standarddev = std(data)
```

2.
```
data = exprnd(10, 2, 10000);
matrix = zeros(10000);
means = matrix(1,:);
for i = 1:10000
  val1 = data(1, i);
  val2 = data(2, i);
  mean = (val1 + val2)/2;
  means(i) = mean;
end
histogram(means)
title('n=2')
xlabel('Value')
ylabel('Frequency')
meanval = sum(means)/10000
standarddev = std(means)
```

3.
```
data = exprnd(10, 10, 10000);
matrix = zeros(10000);
means = matrix(1,:);
for i = 1:10000
 values = data(:, i);
 average = sum(values)/10;
 means(i) = average;
end
histogram(means)
title('n=10')
xlabel('Value')
ylabel('Frequency')
meanval = sum(means)/10000
standarddev = std(means)
```

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4.
```
data = exprnd(10, 30, 10000);
matrix = zeros(10000);
means = matrix(1,:);
for i = 1:10000
 values = data(:, i);
 average = sum(values)/10;
 means(i) = average;
end
histogram(means)
title('n=30')
xlabel('Value')
ylabel('Frequency')
meanval = sum(means)/10000
standarddev = std(means)
```

```
data2 = exprnd(10,10000,30);
samples = mean(data2, 2);
margin = 1.96*10/sqrt(30);
L = samples - margin;
H = samples + margin;

count = 0;
for i = 1:10000
    if L(i) <= 10 %% 10 <= H(i)
        count = count + 1;
    end
end
percent = 100 * (count/10000);
```