

## 7.6: Central Limit Theorem - Cookie Recipes (Worksheet)

Name: \_\_\_\_\_

Section: \_\_\_\_\_

Student ID#: \_\_\_\_\_

*Work in groups on these problems. You should try to answer the questions without referring to your textbook. If you get stuck, try asking another group for help.*

### Student Learning Outcomes

- The student will demonstrate and compare properties of the central limit theorem.

### Q1

$X$  = length of time (in days) that a cookie recipe lasted at the Olmstead Homestead. (Assume that each of the different recipes makes the same quantity of cookies.)

Recipe #	$X$	Recipe #	$X$	Recipe #	$X$	Recipe #	$X$
1	1	16	2	31	3	46	2
2	5	17	2	32	4	47	2
3	2	18	4	33	5	48	11
4	5	19	6	34	6	49	5
5	6	20	1	35	6	50	5
6	1	21	6	36	1	51	4
7	2	22	5	37	1	52	6
8	6	23	2	38	2	53	5
9	5	24	5	39	1	54	1
10	2	25	1	40	6	55	1
11	5	26	6	41	1	56	2
12	1	27	4	42	6	57	4
13	1	28	1	43	2	58	3
14	3	29	6	44	6	59	6
15	2	30	2	45	2	60	5

Calculate the following:

a.  $\mu_x =$  \_\_\_\_\_

b.  $\sigma_x =$  \_\_\_\_\_

### Collect the Data

Use a random number generator to randomly select four samples of size  $n = 5$  from the given population. Record your samples in [Table](#). Then, for each sample, calculate the mean to the nearest tenth. Record them in the spaces provided. Record the sample means for the rest of the class.

## Q2

Complete the table:

	Sample 1	Sample 2	Sample 3	Sample 4	Sample means from other groups:
Means:	$\bar{x} = \underline{\hspace{1cm}}$	$\bar{x} = \underline{\hspace{1cm}}$	$\bar{x} = \underline{\hspace{1cm}}$	$\bar{x} = \underline{\hspace{1cm}}$	

## Q3

Calculate the following:

1.  $\bar{x} = \underline{\hspace{1cm}}$
2.  $s_{\bar{x}} = \underline{\hspace{1cm}}$

## Q4

Again, use a random number generator to randomly select four samples from the population. This time, make the samples of size  $n = 10$ . Record the samples in [Table](#). As before, for each sample, calculate the mean to the nearest tenth. Record them in the spaces provided. Record the sample means for the rest of the class.

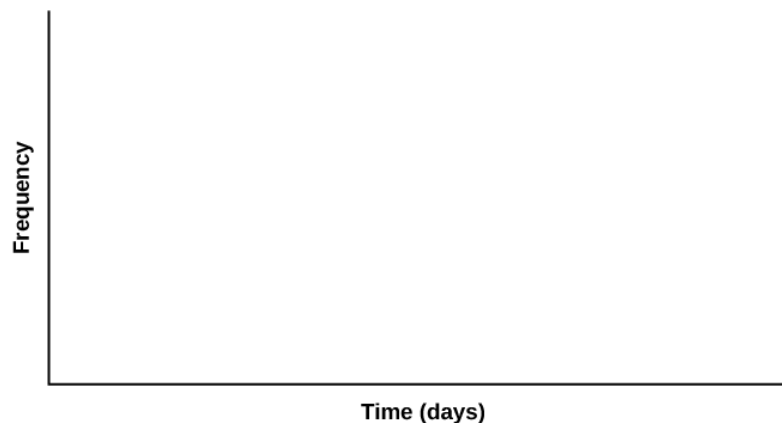
	Sample 1	Sample 2	Sample 3	Sample 4	Sample means from other groups
Means:	$\bar{x} = \underline{\hspace{1cm}}$	$\bar{x} = \underline{\hspace{1cm}}$	$\bar{x} = \underline{\hspace{1cm}}$	$\bar{x} = \underline{\hspace{1cm}}$	

Calculate the following:

1.  $\bar{x} = \underline{\hspace{1cm}}$
2.  $s_{\bar{x}} = \underline{\hspace{1cm}}$

## Q4

For the original population, construct a histogram. Make intervals with a bar width of one day. Sketch the graph using a ruler and pencil. Scale the axes.

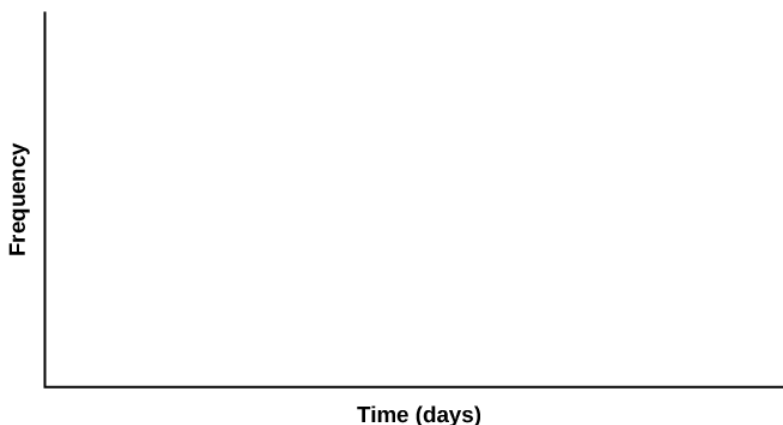


## Q5

Draw a smooth curve through the tops of the bars of the histogram. Use one to two complete sentences to describe the general shape of the curve.

### Repeat the Procedure for $n = 5$

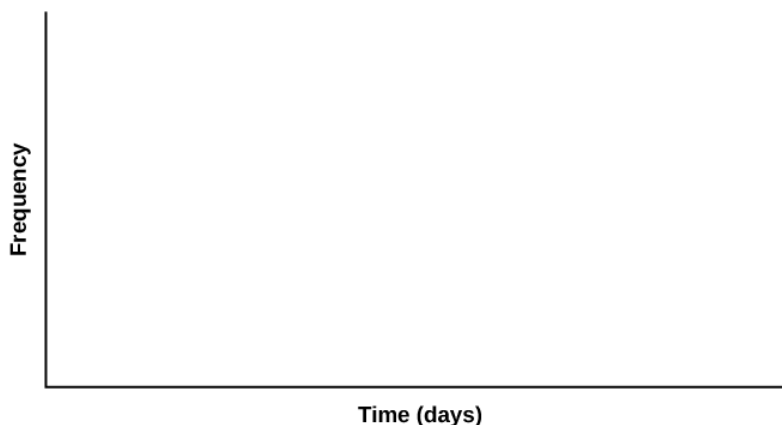
For the sample of  $n = 5$  days averaged together, construct a histogram of the averages (your means together with the means of the other groups). Make intervals with bar widths of  $\frac{1}{2}$  a day. Sketch the graph using a ruler and pencil. Scale the axes.



Draw a smooth curve through the tops of the bars of the histogram. Use one to two complete sentences to describe the general shape of the curve.

### Repeat the Procedure for $n = 10$

- For the sample of  $n = 10$  days averaged together, construct a histogram of the averages (your means together with the means of the other groups). Make intervals with bar widths of  $\frac{1}{2}$  a day. Sketch the graph using a ruler and pencil. Scale the axes.



- Draw a smooth curve through the tops of the bars of the histogram. Use one to two complete sentences to describe the general shape of the curve.

### Discussion Questions

- Compare the three histograms you have made, the one for the population and the two for the sample means. In three to five sentences, describe the similarities and differences.
- State the theoretical (according to the clt) distributions for the sample means.
  - $n = 5$ :  $\bar{x}$  \_\_\_\_\_ (\_\_\_\_\_, \_\_\_\_\_)
  - $n = 10$ :  $\bar{x}$  \_\_\_\_\_ (\_\_\_\_\_, \_\_\_\_\_)
- Are the sample means for  $n = 5$  and  $n = 10$  “close” to the theoretical mean,  $\mu_x$ ? Explain why or why not.
- Which of the two distributions of sample means has the smaller standard deviation? Why?

5. As  $n$  changed, why did the shape of the distribution of the data change? Use one to two complete sentences to explain what happened.

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