Math 113: Classroom Activity 4 Name : _____
10 pts

Materials Needed:

Dice

Instructions:

Two random variables will be studied. These are *x*, the number that is obtained when a single die is rolled, and $\overline{x}$, the average value that is obtained when a single die is rolled 40 times.

1. Complete this table for the theoretical distribution of a single roll of the die.

x	1	2	3	4	5	6	Total
$p(x)$	$\frac{1}{6}$		$\frac{1}{6}$		$\frac{1}{6}$		1
$x \cdot p(x)$	$\frac{1}{6}$		$\frac{3}{6}$	$\frac{4}{6}$		$\frac{6}{6}$	
$x^2 p(x)$	$\frac{1}{6}$	$\frac{4}{6}$		$\frac{16}{6}$	$\frac{25}{6}$		

2. Use the formulas from section 4.2 to find the mean, variance, and standard deviation for the random variable *x*. Record your answers in the first row of the table in question 12.

3. Use these formulas from the Central Limit Theorem with the theoretical values for the population *x* that were found in question 2 to find the theoretical values for the sample mean, $\overline{x}$, when the sample size is $n = 40$. Record your answers in the middle row of question 12.

The theoretical mean of the sample means is $Mean(\overline{x}) = \mu_{\overline{x}} = \mu$

The theoretical variance of the sample means $Var(\overline{x}) = \sigma_{\overline{x}}^2 = \frac{\sigma^2}{n}$

The theoretical standard deviation of the sample means is $SD(\overline{x}) = \sigma_{\overline{x}} = \frac{\sigma}{\sqrt{n}}$

4. Do you expect to get the same average each time you roll 40 dice? Why or why not?

5. Roll the die 40 times and record the rolled values in the table.

6. Average the results of the 40 rolls. This is one observation of the random variable $\overline{x}$.

   Record your average here: _____

Record the 40 rolls here

7. Roll the die another 40 times and obtain the value of $\overline{x}$ for this sample.

   Record your average here: _____

Record the 40 rolls here

8. Collect the $\overline{x}$ values from each person in the class and record in the table.

9. Enter the sample means into the computer. Find the mean, variance, and standard deviation and record the information in the bottom row of question 12.

10. Generate a histogram. Does the data appear normal?

11. Generate a normal probability plot. Does the data appear normal? How can you tell?

12. Record the theoretical values for the roll of a single die (found in question 10), the theoretical values for the mean of forty rolls of the die (found in question 12), and the observed values for our sample means (found in question 6). Your numbers will be easier to compare if you will write them as decimals, but don't round too much.

	Mean	Variance	St. Dev.
Theoretical Values for *x*.	$\mu =$	$\sigma^2 =$	$\sigma =$
Theoretical Values for $\overline{x}$, n=40	$\mu_{\overline{x}} =$	$\sigma^2_{\overline{x}} =$	$\sigma_{\overline{x}} =$
Observed Values for $\overline{x}$, n=40	$\overline{x} =$	$s^2 =$	$s =$

13. Use Minitab to perform a one sample t-test with a hypothesized mean equal to $Mean(\overline{x}) = \mu_{\overline{x}}$ that is in question 12. What is the p-value (labeled as P in Minitab)?

14. The p-value is the chance of getting the results we did if the true value for the mean is the value claimed. A small p-value, say less than 0.05, indicates that our results are too unusual to obtain by chance alone and that the claim must be wrong. Are our results close enough to what we expected to get to go on believing the Central Limit Theorem?