Unit 4 - Worksheet

1. A population consists of four numbers 152, 156, 160, 164. Consider all possible samples of size 2 which can be drawn from the population without replacement. Find the mean and standard deviation in the population and in the sampling distribution of means. Verify the formulas for $\mu_{\overline{x}}$ and $\sigma_{\overline{x}}$.

2. A population consists of four numbers 152, 156, 160, 164. Consider all possible samples of size 2 which can be drawn from the population with replacement. Find the mean and standard deviation in the population and in the sampling distribution of means. Verify the formulas for $\mu_{\overline{x}}$ and $\sigma_{\overline{x}}$.

3. The mean and standard deviation of the tax value of all vehicles registered in a certain state are $\mu = \$13{,}525$ and $\sigma = \$4180$. Suppose random samples of size 100 are drawn from the population of vehicles. Find the mean $\mu_{\overline{x}}$ and the standard deviation $\sigma_{\overline{x}}$ of the sample mean $\overline{x}$.

4. A population has mean 5.75 and standard deviation 1.02.
(a) Random sample of size 81 are taken. Find the mean and standard deviation of the sample mean.
(b) How would the answers to part (a) change if the size of the samples were 25 instead of 81?

5. A population has a mean 128 and standard deviation 22. Find the mean and standard deviation of $\overline{x}$ for samples of size 36. Find the probability that the mean of a sample of size 36 will be within 10 units of the population mean.

6. A population has a mean 48.4 and standard deviation 6.3. Find the mean and standard deviation of $\overline{x}$ for samples of size 64. Find the probability that the mean of a sample of size 64 will be less than 46.7.

7. Suppose speeds of vehicles on a particular stretch of roadway are normally distributed wih mean 36.6 mph and standard deviation 1.7 mph.
(a) Find the probability that the speed x of a randomly selected vehicle is between 35 and 40 mph.
(b) Find the probability that the mean speed $\overline{x}$ of 20 randomly selected vehicles is between 35 and 40 mph.

8. Suppose the mean length of time between submission of a state tax return requesting a refund and the issuance of the refund is 47 days, with standard deviation 6 days. Find the probability that in a sample of 50 returns requesting a refund, the mean such time will be more than 50 days.

9. ABC Poultry Farms supplies eggs. The company claims its eggs remain fresh for five days if refrigerated. An analyst samples 25 eggs to test this claim. The average freshness of eggs was 4.5 days, with a standard deviation of a day. Find the student's t.

10. The following values give the sensory rates to relieve pain for 15 subjects:
8.6, 9.4, 7.9, 6.8, 8.3, 9.2, 9.6, 8.7, 11.4, 10.3, 5.4, 8.1, 5.5, 6.9. Calculate the student's t.

11. You do a study of hypnotherapy to determine how effective it is in increasing the number of hours of sleep subjects get each night. You measure hours of sleep for 12 subjects with the following results: 8.2, 9.1, 7.7, 8.6, 6.9, 11.2, 10.1, 9.9, 8.9, 9.2, 7.5, 10.5. Calculate the student's t.

12. A random sample of statistics students were asked to estimate the total number of hours they spend watching television in an average week. The responses are recorded as follows:
0, 3, 1, 20, 9, 5, 10, 1, 10, 4, 14, 2, 4, 4, 5. Calculate the student's t.

13. A data sample is sorted into five categories with an assumed probability distribution.

Factor Levels	Assumed Distribution	Observed Distribution
1	0.1	10
2	0.4	35
3	0.4	45
4	0.1	10

Find the expected frequencies, if the sample population has a probability distribution as assumed. Find the chi-squared statistic χ^2.

14. The litter size of Bengal tigers is typically two or three cubs, but it can vary between one and four. Based on long-term observations, the litter size of Bengal tigers in the wild has the distribution given in the table provided. A zoologist believes that Bengal tigers in captivity tend to have different litter sizes from those in the wild. The zoologists searched all data sources and found 316 litter size records of Bengal tigers in captivity. The results are given in the table provided.

Litter Size	Wild Litter Distribution	Observed Frequency
1	0.11	41
2	0.69	243
3	0.18	27
4	0.02	5

Find the expected frequencies, if the sample population has a probability distribution as assumed. Find the chi-squared statistic χ^2.

15. Fit a binomial distribution to the following frequency distribution and hence find the expected frequencies, rounded to the nearest integer and hence find the chi-squared statistic χ^2.

x	0	1	2	3	4	5	6
f	13	25	52	68	32	16	4

16. Fit a Poisson distribution to the following frequency distribution and hence find the expected frequencies, rounded to the nearest integer and hence find the chi-squared statistic χ^2.

x	0	1	2	3	4	5	6
f	70	137	135	89	44	17	6