Name: _____

Student ID: _____

- *Please avoid all unethical behaviors (e.g., looking at others' solutions, asking others), if you are caught, then I will take your script and the exam will be cancelled then and there, so no mercy policy!*

- *The exam is worth 45 points, and total duration of the exam is 90 minutes.*

Question:	1	2	3	4	5	6	7	8	Total
Points:	7	5	5	5	8	6	6	3	45
Score:									

Problems from Interval Estimation

1. (7 points) Suppose we have a dataset which has income of 20 persons from the city of Dhaka. We calculated the sample average of their income and we found 2551 taka. We also calculated the sample standard deviation, and it is 301.31 taka. Assume the population is normal and the target parameter is the population mean of the income for all the people living in the city of Dhaka. Now answer following questions,

    (a) (1 point) Provide a point estimate of the target parameter (here the target parameter is the population mean of the income for all the people living in the city of Dhaka).

    (b) (3 points) Develop a 95% confidence interval for the target parameter.

    (c) (3 points) If we set the target parameter as the population mean of the income for all the people living in Bangladesh, is our point estimate is a good estimate, briefly argue why or why not?

2. (5 points) Suppose that shopping times for customers at a local mall are normally distributed with known population standard deviation of 20 minutes. A random sample of 64 shoppers in the local grocery store had an average time of 75 minutes.

    (a) (1 point) Find the standard error of the sampling distribution of the means

    (b) (1 point) At 80% confidence find the margin of error.

    (c) (3 points) Find the 80% confidence interval for the population mean.

3. (5 points) Continuing from question 2., now suppose we don't know the population standard deviation 20, but know the sample standard deviation 25, in this case can we calculate standard error? What is possible to calculate? Will this have any effect on the interval estimate, how?

4. (5 points) A 90% confidence interval for a population mean was reported to be $(150, 160)$. If the population standard deviation is 15, what sample size was used in this study?

Problems from Testing

5. (8 points) TechGiant Bangladesh, a Bangladeshi tech enterprise receives a shipment of batteries from a battery manufacturer in Denmark named BestBatt. TechGiant is concerned that the true mean lifetime for all batteries in the shipment should be at least 50 hours. If it is less than that, then the batteries are not good enough for the purpose of TechGiant. From past experience it is safe to conclude that the population distribution of lifetimes is normal with a standard deviation of 3.6 hours.

    (a) (2 points) Form the hypotheses to test the concern of the company TechGiant.

    (b) (1 point) Suppose for one particular shipment the sample mean lifetime for a sample of 16 batteries was found to be 48.8 hours. Now if you want to do the test that you wrote in a), which test statistic that you can use? Write down the value of the test statistic

    (c) (1 point) Calculate and write down the p-value.

    (d) (2 points) Using p-value at 10% significance level, do the test and conclude whether based on this sample the company should be concerned or not.

    (e) (2 points) Write down the critical values, and do the same test as in d) using critical value approach.

6. (6 points) According to the National Automobile Dealers Association, the mean price for used cars is $\$10,192$. A manager of a Kansas City used car dealership reviewed a sample of 50 recent used car sales

at the dealership in an attempt to determine whether the population mean price for used cars at this particular dealership differed from the national mean. The prices for the sample of 50 cars are shown in the file `UsedCars.xlsx`

(a) (2 points) Formulate the hypotheses that can be used to determine whether a difference exists in the mean price for used cars at the dealership.

(b) (2 points) What is the p-value?

(c) (2 points) At $\alpha = .05$, what is your conclusion? Does the conclusion change if you test at $\alpha = .10$?a

7. (6 points) Suppose the population data is normal and we want to do following test

$$H_0 : \mu \leq 10 \quad \text{vs.} \quad H_a : \mu > 10$$

If we have a sample of size $n = 50$ with known $\sigma = 0.2$ then with the test statistic $\bar{X}_n$,

(a) (1 point) What is the distribution of the test statistic $\bar{X}_n$ under the Null?

(b) (1 point) Roughly draw the distribution of the test statistic under the null and show the mean and type - 1 error.

(c) (1 point) At $\alpha = 0.02$ do the test using the test statistic $\bar{X}_n$ (you can follow the critical value approach or p-value approach, whatever you feel comfortable with).

(d) (3 points) Shortly explain why critical value approach and p-value approach will give you the same conclusion of the test?

8. (3 points) Give two examples of estimators with their target parmaters. So clearly write down two estimators and their target parameters. With one of your example, explain why an estimator is a random variable.