

Homework Assignment-7

POM 500 Statistical Analysis

Note: Attempt all questions as per rubric. Problems including case study has a weightage of 10 marks each. The maximum you can score is 50. Use Excel function wherever possible.

Problem-1

According to the Hospital Care cost Institute, the annual expenditure for prescription drugs is \$838 per person in the Northeast region of the country. A sample of 60 individuals in the Midwest shows a per person annual expenditure for prescription drugs of \$745. Use a population standard deviation of \$300 to answer the following questions.

- Formulate hypotheses for a test to determine whether the sample data support the conclusion that the population annual expenditure for prescription drugs per person is lower in the Midwest than in the Northeast.
- What is the value of the test statistic?
- What is the p-value?
- At $\alpha = 0.01$, what is your conclusion?

Problem-2

The United States ranks ninth in the world in per capita chocolate consumption; Forbes reports that the average American eats 9.5 pounds of chocolate annually. Suppose you are curious whether chocolate consumption is higher in Hershey, Pennsylvania, the location of the Hershey Company's corporate headquarters. A sample of 36 individuals from the Hershey area showed a sample mean annual consumption of 10.05 pounds and a standard deviation of $s = 1.5$ pounds. Using $\alpha = .05$, do the sample results support the conclusion that mean annual consumption of chocolate is higher in Hershey than it is throughout the United States?

Problem-3

Last year, a soft drink manufacturer had 21% of the market. In order to increase their portion of the market, the manufacturer has introduced a new flavor in their soft drinks. A sample of 400 individuals participated in the taste test and 100 indicated that they like the taste. We are interested in determining if more than 21% of the population will like the new soft drink.

- Set up the null and the alternative hypotheses.
- Determine the test statistic.
- Determine the p-value.
- Using $\alpha = .05$, test to determine if more than 21% of the population will like the new soft drink.

Problem-4

Consider the following hypothesis test:

$$H_0: \mu \leq 38$$

$$H_a: \mu > 38$$

You are given the following information obtained from a random sample of six observations.

| | | | | | | |
|---|----|----|----|----|----|----|
| X | 38 | 40 | 42 | 32 | 46 | 42 |
|---|----|----|----|----|----|----|

- Using $\alpha = 0.05$, what is the rejection rule?
- Determine the standard error of the mean.
- Compute the value of the test statistic. What is your conclusion?

Case Study: Quality Associates, Inc.

Quality Associates, Inc. Quality Associates, Inc., a consulting firm, advises its clients about sampling and statistical procedures that can be used to control their manufacturing processes. In one particular application, a client gave Quality Associates a sample of 800 observations taken during a time in which that client's process was operating satisfactorily. The sample standard deviation for these data was 0.21; hence, with so much data, the population standard deviation was assumed to be 0.21. Quality Associates then suggested that random samples of size 30 be taken periodically to monitor the process on an ongoing basis. By analyzing the new samples, the client could quickly learn whether the process was operating satisfactorily. When the process was not operating satisfactorily, corrective action could be taken to eliminate the problem. The design specification indicated the mean for the process should be 12. The hypothesis test suggested by Quality Associates follows.

$$H_0: \mu = 12$$

$$H_a: \mu \neq 12$$

Corrective action will be taken any time H_0 is rejected.

The following samples were collected at hourly intervals during the first day of operation of the new statistical process control procedure. These data are available in the data set *Quality*.

Managerial Report

- Conduct a hypothesis test for each sample at the 0.01 level of significance and determine what action, if any, should be taken. Provide the test statistic and p-value for each test.
- Compute the standard deviation for each of the four samples. Does the assumption of 0.21 for the population standard deviation appear reasonable?

3. Compute limits for the sample mean \bar{x} around $\mu=12$ such that, as long as a new sample mean is within those limits, the process will be considered to be operating satisfactorily. If \bar{x} exceeds the upper limit or if \bar{x} is below the lower limit, corrective action will be taken. These limits are referred to as upper and lower control limits for quality control purposes.
4. Discuss the implications of changing the level of significance to a larger value. What mistake or error could increase if the level of significance is increased?

Data set *Quality*

| Sample 1 | Sample 2 | Sample 3 | Sample 4 |
|----------|----------|----------|----------|
| 11.55 | 11.62 | 11.91 | 12.02 |
| 11.62 | 11.69 | 11.36 | 12.02 |
| 11.52 | 11.59 | 11.75 | 12.05 |
| 11.75 | 11.82 | 11.95 | 12.18 |
| 11.90 | 11.97 | 12.14 | 12.11 |
| 11.64 | 11.71 | 11.72 | 12.07 |
| 11.80 | 11.87 | 11.61 | 12.05 |
| 12.03 | 12.10 | 11.85 | 11.64 |
| 11.94 | 12.01 | 12.16 | 12.39 |
| 11.92 | 11.99 | 11.91 | 11.65 |
| 12.13 | 12.20 | 12.12 | 12.11 |
| 12.09 | 12.16 | 11.61 | 11.90 |
| 11.93 | 12.00 | 12.21 | 12.22 |
| 12.21 | 12.28 | 11.56 | 11.88 |
| 12.32 | 12.39 | 11.95 | 12.03 |
| 11.93 | 12.00 | 12.01 | 12.35 |
| 11.85 | 11.92 | 12.06 | 12.09 |
| 11.76 | 11.83 | 11.76 | 11.77 |
| 12.16 | 12.23 | 11.82 | 12.20 |
| 11.77 | 11.84 | 12.12 | 11.79 |
| 12.00 | 12.07 | 11.60 | 12.30 |
| 12.04 | 12.11 | 11.95 | 12.27 |
| 11.98 | 12.05 | 11.96 | 12.29 |
| 12.30 | 12.37 | 12.22 | 12.47 |
| 12.18 | 12.25 | 11.75 | 12.03 |
| 11.97 | 12.04 | 11.96 | 12.17 |
| 12.17 | 12.24 | 11.95 | 11.94 |
| 11.85 | 11.92 | 11.89 | 11.97 |
| 12.30 | 12.37 | 11.88 | 12.23 |
| 12.15 | 12.22 | 11.93 | 12.25 |