

## Case Problems #2, Due 7/29(30)/2024

1. Solve one of the following two case studies:

**CASE PROBLEM 1: 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 .21; hence, with so much data, the population standard deviation was assumed to be .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.

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

### Managerial Report

1. Conduct a hypothesis test for each sample at the .01 level of significance and determine what action, if any, should be taken. Provide the test statistic and  $p$ -value for each test.
2. Compute the standard deviation for each of the four samples. Does the assumption of .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?

### CASE PROBLEM 2: ETHICAL BEHAVIOR OF BUSINESS STUDENTS AT BAYVIEW UNIVERSITY

During the global recession of 2008 and 2009, there were many accusations of unethical behavior by Wall Street executives, financial managers, and other corporate officers. At that time, an article appeared that suggested that part of the reason for such unethical business behavior may stem from the fact that cheating has become more prevalent among business students (*Chronicle of Higher Education*, February 10, 2009). The article reported that 56% of business students admitted to cheating at some time during their academic career as compared to 47% of nonbusiness students.

Cheating has been a concern of the dean of the College of Business at Bayview University for several years. Some faculty members in the college believe that cheating is more widespread at Bayview than at other universities, while other faculty members think that cheating is not a major problem in the college. To resolve some of these issues, the dean commissioned a study to assess the current ethical behavior of business students at Bayview. As part of this study, an anonymous exit survey was administered to a sample of 90 business students from this year's graduating class. Responses to the following questions were used to obtain data regarding three types of cheating.

During your time at Bayview, did you ever present work copied off the Internet as your own?

Yes \_\_\_\_\_ No \_\_\_\_\_

During your time at Bayview, did you ever copy answers off another student's exam?

Yes \_\_\_\_\_ No \_\_\_\_\_

During your time at Bayview, did you ever collaborate with other students on projects that were supposed to be completed individually?

Yes \_\_\_\_\_ No \_\_\_\_\_

Any student who answered Yes to one or more of these questions was considered to have been involved in some type of cheating. A portion of the data collected follows. The complete data set is in the file *Bayview*.

Student	Copied from Internet	Copied on Exam	Collaborated on Individual Project	Gender
1	No	No	No	Female
2	No	No	No	Male
3	Yes	No	Yes	Male
4	Yes	Yes	No	Male
5	No	No	Yes	Male
6	Yes	No	No	Female
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
88	No	No	No	Male
89	No	Yes	Yes	Male
90	No	No	No	Female

### Managerial Report

Prepare a report for the dean of the college that summarizes your assessment of the nature of cheating by business students at Bayview University. Be sure to include the following items in your report.

1. Use descriptive statistics to summarize the data and comment on your findings.
  2. Develop 95% confidence intervals for the proportion of all students, the proportion of male students, and the proportion of female students who were involved in some type of cheating.
  3. Conduct a hypothesis test to determine if the proportion of business students at Bayview University who were involved in some type of cheating is less than that of business students at other institutions as reported by the *Chronicle of Higher Education*.
  4. Conduct a hypothesis test to determine if the proportion of business students at Bayview University who were involved in some form of cheating is less than that of nonbusiness students at other institutions as reported by the *Chronicle of Higher Education*.
  5. What advice would you give to the dean based upon your analysis of the data?
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2. Twelve homemakers were asked to estimate the retail selling price of two models of refrigerators. Their estimates of selling price are shown in the following table. Use these data and determine whether there is a difference between the two models in terms of home-makers' perceptions of selling price. ( $\alpha = .05$ )
    - (a) Use two sample t-test and paired sample t-test.
    - (b) Use nonparametric test.

Homemaker	Model 1	Model 2	Homemaker	Model 1	Model 2
1	\$850	\$1100	7	\$900	\$1090
2	960	920	8	890	1120
3	940	890	9	1100	1200
4	900	1050	10	700	890
5	790	1120	11	810	900
6	820	1000	12	920	900