

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 sample datasets collected at hourly intervals during the first day of operation of the new statistical process control procedure are provided in the accompanying data file BAN_602_Case_3.csv.

Report

Prepare a case report that addresses the following.

1. Provide summary statistics (mean, median, standard deviation) of each of the four sample datasets separately in one table. (3x4 = 12 points)
2. Conduct a hypothesis test for each sample at $\alpha = 0.05$. Discuss your findings and determine what action, if any, should be taken. Provide the test statistic and p -value for each test. (4x4 = 16 points)
3. Does the assumption of 0.21 for the population standard deviation appear reasonable? (2 points)
4. 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. (6 points)
5. Discuss the implications of changing the level of significance to a larger value or a smaller value. What type of mistakes or errors could go up if the level of significance is increased? What could happen if the level of significance is decreased? (4 + 4 = 8 points)
6. Plot the sample means of the four sample datasets in a chart, with the population mean, upper control limit and lower control limit displayed as parallel horizontal lines. This chart, aka process control chart, helps us understand if a process is in statistical control. (6 points)

Format of the deliverables:

1. The typed report must be in Microsoft Word or PDF format and uploaded on Canvas by the due date. Each group must upload only one report.
2. The typed case report must **not** contain any R code.
3. Please do not copy the questions from the case to your report. You should just answer the questions without typing the questions in your report. The report must answer all the questions separately and sequentially.
4. You must include graphs and/or tables as asked in the question, followed by a written analysis and interpretation.
5. **All** computations must be done in R and the *executable* R script file must be uploaded on Canvas as well.
6. No part of the associated dataset can be changed manually. Any changes in the dataset, if necessary, must be made using R code and documented in the submitted R script.
7. The report must be in Times New Roman font with font size 12 and single-line space.
8. The number of pages in the report must not exceed five (5) excluding any cover page.
9. The names of all the participating group-members must be on the first page of the report.