STAT 3010: Assignment 6

Spring 2024: Due Apr. 14, 2024

Please answer each question as completely as possible. Solutions must be typed and submitted to Canvas by 11:59pm CST on the due date.

1. After assembly and wiring of the individual keys, computer keyboards are tested by an automated test station that pushes each key several times. Daily records are kept of the number of keyboards inspected and the number that fail the inspection. Data from 25 successive manufacturing days is in the file hw6q1.csv.

    keys <- read.csv("hw5q1.csv", header = TRUE)

    (a) Calculate the centerline and the control limits for a p chart for this data.

    (b) Are there any signs of out-of-control conditions in this data?

2. When installing a bath faucet, it is important to properly fasten the threaded end of the faucet stem to the water-supply line. The threaded stem dimensions must meet product specifications, otherwise malfunction and leakage may occur. Researchers investigated the production process of a particular bath faucet manufactured in India. They reported the threaded stem diameter (target value being 13 mm) of each faucet in 25 samples of size 4 as given in the dataset hw6q2.csv.

    faucet <- read.csv("hw6q2.csv", header = TRUE)

    (a) Construct an R chart for this data. Are there any out-of-control signals present?

(b) Construct an $\bar{X}$ chart for this data. Are there any out-of-control signals present?

(c) If there are any out-of-control conditions found in parts (a) or (b), recalculate and interpret the revised $\bar{X}$ and R charts after eliminating these subgroups.

3. Random samples of size n are taken from a normal population whose standard deviation is known to be 5.

(a) For random samples of size $n = 10$, calculate the area under the sampling distribution curve for $\bar{X}$ between the values $\mu - 1$ and $\mu + 1$. That is, find the probability that the sample mean lies within ± 1 unit of the population mean.

(b) Repeat the probability calculation in part (a) for samples of size $n = 50, n = 100$, and $n = 1000$.

(c) Graph the probabilities you found in parts (a) and (b) versus their corresponding sample sizes, n. What can you conclude from this graph?