CENG 222

Statistical Methods for Computer Engineering

Spring 2023-2024

Homework III

Due date: 15/05/2024, Wednesday, 23:59

Questions

Q1. (**25 pts**)

You have a sample of measurements:

$$6.4,\ 9.5,\ 8.2,\ 10.2,\ 7.6,\ 11.1,\ 8.7,\ 7.3,\ 9.1$$

Assuming that measurement errors follow a normal distribution and the measurement device has a guaranteed standard deviation of $= 2.7$;

a) Construct a 95% confidence interval for the population mean. *(15 pts)*
b) What sample size is required to estimate the population mean with a margin of maximum 1.25 units with same confidence level? *(10 pts)*

Q2. (**40 pts**)

Two business partners, Leyla and Mecnun, are debating whether there has been a change in the average monthly revenue of their store compared to last year. Leyla argues that the revenue has increased, while Mecnun claims that it has remained the same. To settle their debate, they decide to conduct a statistical analysis.

Last year, the average monthly revenue of their store was 20,000 TL, with a standard deviation of 3,000 TL. This year, they collect data from a random sample of 50 customers and find that the average monthly revenue is 22,000 TL, with the standard deviation remaining the same.

a) What are the null and alternative hypotheses for this study. Whose claim should be considered as the null hypothesis? *(5 pts)*
b) Mecnun wants to statistically test his claim at a %5 level of significance. Can he claim that the average monthly revenue has remained the same compared to last year? *(10 pts)*
c) Calculate the p-value for Mecnun's test in **part b** and provide brief explanation. *(5 pts)*
d) In addition to comparing the changes in revenue, they want to compare the current average monthly revenue of their store to that of a competitor's store. They collect data from a random sample of 40 customers and find that the average monthly revenue is 24,000 TL, with a standard deviation of 4,000 TL.

At a %1 level of significance, can they claim that the average monthly revenue of their store is higher than that of the competitor's store? *(20 pts)*

Q3. (35 pts)

A researcher wants to investigate whether there is a relationship between gender and preference for coffee type. They survey 200 individuals, 100 males and 100 females, and ask them whether they prefer black coffee, coffee with milk or coffee with sugar. The results are summarized in the following table:

	Black Coffee	Coffee with Milk	Coffee with Sugar
Male Respondents	52	16	32
Female Respondents	17	63	20
Column Total	69	79	52

Use Chi-square test to determine if there is a significant association between gender and coffee preference.

Specifications

- You are expected to write your answers in LaTeX format. You can use the given template.

- Please do not skip the calculation steps. Show every step of your work.

- You have a total of 2 late days for this homework. For each day you have submitted late, you will lose 25 points. If you submit your homework at least 2 days later than the deadline, you will get zero.

- Cheating is forbidden. The violators will be punished according to the department regulations.

- Follow the course page on ODTUClass for any updates and clarifications. Please ask your questions on ODTUClass instead of e-mailing if they do not contain some part of the solution. If they contain, you can send an email to "haktans@ceng.metu.edu.tr".

Submission

Submissions will be done via ODTUClass. You are expected to submit a **single** PDF file named "hw3.pdf".