Middle East Technical University Department of Computer Engineering

CENG 222

Statistical Methods for Computer Engineering

Spring 2020-2021

Homework 3

Due date: 06/06/2021, Sunday, 23:55

Introduction

In this assignment, there are 3 questions related to the 9^{th} chapter of your text book. While answering the questions, please **show your work** and the steps of your calculations. Give an explanation about what numbers mean in those steps. In your calculations please use at most three decimal points. For brief explanations, two or three sentences is enough.

Questions

Q1. (**50 pts.**)
A company wants to evaluate their customer service's success and increase their salaries if they are successful. For this purpose they call their customers, and ask them to grade the customer service with a value from 1 to 10. The company would call the customer service successful if they get an average grade that is **significantly higher than 7** from the customers.
17 customer replied the calls and the mean is 7.8. The standard deviation of any customer's response is 1.4. Assume the population is normally distributed where the standard deviation of any customer's response is 1.4 and each customer answered the question independently.

a) With 95% confidence, can the customer service be regarded as successful? Please state null and alternate hypotheses (H_0 and H_A). *(20 pts)*
b) What if one customer who gave 10 mistakenly gives 1? Can the customer service still be regarded as successful with 95% confidence? *(10 pts)*
c) For part b, what if there were 45 customers in the survey? Does the mistake still affect the customer service's success with 95% confidence? Briefly explain the results. *(15 pts)*
d) What if the threshold for success is set to 8 for 95% confidence. Briefly explain why we don't need to make any calculations to evaluate success in this case. *(5 pts)*

NOTE: For simplicity, assume that the standard deviation does not change in parts b and c.

Q2. (**20 pts.**)
A new COVID-19 vaccine is developed and the developer company claims that the vaccine's protection lasts longer than their competitors. In an experiment with 55 subjects, the company showed that their vaccine protects for 6.2 months with a standard deviation of 1.5 months. Note that, when tested on an independent set of 55 patients, the old vaccine developed by their competitors protect for 5.8 months with a standard deviation of 1.1 months. With 5% level of significance, can we state that the new vaccine really protects for a longer duration? (Please state H_0 and H_A)

Q3. (**30 pts.**)
A survey is done by a news agency for presidential elections. The agency reported that the Reds are leading Blues by 11%, because 48% of the participants supported Red Party's candidate while 37% supported Blue Party's candidate. Note that 400 people participated in the survey and the population size is significantly larger than 400.

a) What margin of error should be reported for each candidate's estimated vote rate? *(10 pts)*
b) What margin of error should be reported for the estimated lead? *(5 pts)*
c) Which candidate's margin of error is larger than the other? Explain the reason. *(10 pts)*
d) How would margin of errors change if there were 1800 participants in the survey? Briefly explain. *(5 pts)*

NOTE: Use 95% confidence interval for calculating margin of errors.

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 3 late days for this homework. For each day you have submitted late, you will lose 20 points. The homeworks you submit after 3 late days will not be graded.
- Cheating is forbidden. The violators will be punished according to the department regulations.
- Follow the course page on COW for any updates and clarifications. Please ask your questions on COW instead of e-mailing if they do not contain some part of the solution. If they contain, you can send an email to "mduymus@ceng.metu.edu.tr".

Submission

Submissions will be done via ODTUCLASS. If you do not have access to ODTUCLASS for some reason, please send an email to assistants about that. You are expected to submit a **PDF** file named "hw3.pdf".