**Probability and Inferential Statistics**

Start Date & Time

Jun 5, 2023, 12:00 AM

Due Date & Time

Jun 11, 2023, 11:59 PM

Status

**Active**

Rubric

[View Rubric](https://halo.gcu.edu/courses/MAT-274-O500-20230508/rubrics/a3924fb9-97e6-4d5a-955a-1cc8201490f2)

Assessment Traits

Benchmark

Requires Lopeswrite

Assessment Description

**Refer to the attached MAT-274 Project Style Guide for further directions and assistance as you complete this assignment.**

1. A patient is classified as having gestational diabetes if their glucose level is above 140 milligrams per deciliter (mg/dl) one hour after a sugary drink is ingested. Rebecca's doctor is concerned that she may suffer from gestational diabetes. There is variation both in the actual glucose level and in the blood test that measures the level. Rebecca's measured glucose level one hour after ingesting the sugary drink varies according to the Normal distribution with μ= 140+X mg/dl and σ = X+1 mg/dl, where X is the last digit of your GCU student ID number. What is the probability of Rebecca being diagnosed with gestational diabetes if her glucose level is measured:

a. Once?  
b. X+1 times, where X is the last digit of your student ID?  
c. X+4 times, where X is the last digit of your student ID?

Comment on the relationship between the probabilities observed in (a), (b), and (c). Explain, using concepts from lecture, why this occurs and what it means in context.

2. Suppose next that we have even less knowledge of our patient, and we are only given the accuracy of the blood test and prevalence of the disease in our population. We are told that the blood test is 9X percent reliable, gestational diabetes affects X+1 percent of the population in our patient’s age group, and that our test has a false positive rate of X+4 percent. Compute the following quantities based on this new information:

a. If 100,000 people take the blood test, how many people that test positive will actually have gestational diabetes?  
b. What is the probability of having the disease given that you test positive?  
c. If 100,000 people take the blood test, how many people that test negative despite actually having gestational diabetes?  
d. What is the probability of having the disease given that you tested negative?

Comment on what you observe in the above computations. How does the prevalence of the disease affect whether the test can be trusted?

3. As we have seen in class, hypothesis testing and confidence intervals are the most common inferential tools used in statistics. Imagine that you have been tasked with designing an experiment to determine reliably if a patient should be diagnosed with diabetes based on their blood test results. Create a short outline of your experiment, including all of the following:

a. A detailed discussion of your experimental design.  
b. How is randomization used in your sampling or assignment strategy?  
c. The type of inferential test utilized in your experiment.  
d. A formal statement of the null and alternative hypothesis for your test.  
e. A confidence interval for estimating the parameter in your test.  
f. An interpretation of your p-value and confidence interval, including what they mean in context of your experimental design.

This assignment uses a rubric. Please review the rubric prior to beginning the assignment to become familiar with the expectations for successful completion.

APA style is not required, but solid academic writing is expected.

You are required to submit this assignment to LopesWrite. A link to the LopesWrite technical support articles is located in Class Resources if you need assistance.

**MAT 274 BENCHMARK FORMAT AND STYLE TEMPLATE**

**1.For each part, insert your sketch of the required area under the normal curve. In addition, include a screenshot of your Excel computation to find this area.**

1. **Insert screenshot and figure for part (a)**

**b. Insert screenshot and figure for part (b)**

**c. Insert screenshot and figure for part (c)**

**d. Comment on the relationship among the probabilities in parts (a),(b), and (c).**

**2.Insert a conditional probability table here, then answer the questions in each part below.**

**a. Answer part (a) here.**

**b. Answer part (b) here.**

**c. Answer part (c) here.**

**d. Answer part (d) here.**

**e. Comment on how prevalence of the disease affects your ability to trust the test. Discuss what factors would lead you to trust the blood test, or not trust the blood test.**

**3.Answer each part below.**

1. **Detailed experimental design should include the type of experiment, how you chose your sample size, what data is being collected, and how you would collect that data.**
2. **Remember to discuss how you would randomize for sampling and assignment, what type of randomization are you using?**
3. **Include type of test used, number of tails, and a justification for this choice.**
4. **Make sure to include correct statistical notation for the formal null and alternative, do not just state this in words.**
5. **State and discuss your chosen confidence level, why this is appropriate, and interpret the lower and upper limits.**
6. **State your significance level, interpret your p-value, and make a decision on the null.**