ECON 0150 | Fall 2024 | Homework 5

Due: Friday, November 8

Homework is designed to both test your knowlege and challenge you to apply familiar concepts in new applications. Answer clearly and completely. You are welcomed and encouraged to work in groups so long as your work is your own. Use the datafiles to answer the following questions. Then submit your answers to Gradescope.

Hint: This homework covers the normal distribution, the sample mean, and confidence intervals. Start each qustion by defining the question in mathematical notation. Then sketch out the probability distribution and the question at hand.

Q1. Major league baseball salaries averaged $3.26 million with a standard deviation of $1.2 million in a certain year in the past. Suppose a sample of 100 major league players was taken. Use the 1-2-3 Rule to find the approximate probability that the mean salary of the 100 players did not exceed $3.5 million.

A) Approximately 0

B) 0.025

C) 0.975

D) Approximately 1

Q2. At a computer manufacturing company, the actual size of a computer chip is normally distributed with a mean of 1 centimeter and a standard deviation of 0.1 centimeter. A random sample of 25 computer chips is taken. Use the 1-2-3 Rule to find the value above which 16% of the sample means fall.

A) 1.02 centimeter

B) 1.04 centimeter

C) 1.10 centimeter

D) 1.20 centimeter

Q3. According to a survey, only 36% of customers who visited the website of a major retail store made a purchase. If a random sample of size 64 is selected, what is the probability that between 30% and 48% customers in the sample will make a purchase after visiting the website? Use the 1-2-3 Rule to answer this question.

A) 0.8385

B) 0.9735

C) 0.8150

D) There is not enough information to obtain the answer

Q4. Daily observations for a period of 144 days have been conducted about the number of candy bars sold from a vending machine. Using these observations, the sample mean is calculated to be 258 and the sample standard deviation is calculated to be 60. Use the 1-2-3 Rule to answer the following questions.

a) What is the probability that the sample mean number of candy bars sold for the 144-day period is less than 273?

b) What is the probability that the total number of candy bars sold for the 144-day period is greater than 34,992 but less than 37,872?

c) If the profit per candy bar is 5 cents, what is the probability that the average profit per day over the 144-day period is at least $12.65?

Q5. Taylor's Econ 0150 students collected the number of green M&Ms in 76 fun-sized bags. The data is presented in the data file "HW_5_Q5.csv". Use python to answer the following questions.

a) With a sample size of 76, how is the sample mean of the number of green M&Ms per bag distributed?

A) It follows a normal distribution with $\mu = 4.803$ and $\sigma = 1.819$.

B) It follows a normal distribution with $\mu = 4.803$ and $\sigma = 0.209$.

C) It follows a non-normal distribution with $\mu = 4.803$ and $\sigma = 1.819$.

D) It follows a non-normal distribution with $\mu = 4.803$ and $\sigma = 0.209$.

b) Based on your answer in a), consider the probability that the average number of green M&Ms per bag for a sample of 76 bags is more than 5.

A) Between 10% and 12%

B) Between 18% and 20%

C) Between 45% and 47%

D) Between 54% and 56%

Q6. The head librarian at the Library of Congress has asked her assistant for an interval estimate of the mean number of books checked out each day. After tracking the daily record for 100 days, the assistant provides the 95% confidence interval as follows: (740 books, 920 books). To interpret this confidence interval, consider the following statements:

I. On 95% of the 100 days, the number of books checked out falls in the interval of 740 to 920 books.

II. We are 95% confident that the true mean number of books checked out each day across all days lies in the interval of 740 to 920 books.

III. We are 95% confident that the mean number of books checked out on a randomly selected day from the 100 days falls in the interval of 740 to 920 books.

A) Only statement I is correct

B) Only statement II is correct

C) Only statement III is correct

D) There are more than one correct statements

Q7. An economist is interested in studying the incomes of consumers in a particular country. The population standard deviation is known to be $1,500. A random sample of 200 individuals resulted in a mean income of $30,000. What is the width of the 68% confidence interval? (*Round to the nearest integer.*)

A) $424

B) $318

C) $212

D) $106

Q8. A survey asked 1000 individuals whether they would be willing to pay $5 per month for access to the local newspaper. 30% responded "Yes", "45%" responded "No", and "25%" responded "I'm not sure". Use python or the 1-2-3 Rule to find which of the following best describes the 68% confidence interval for the proportion of the population that would respond "No". (*Numbers in each option are rounded to three decimal places.*)

A) Between 25.7% and 34.3%

B) Between 40.3% and 49.7%

C) Between 41.9% and 48.1%

D) Between 43.4% and 46.6%

Q9. Pain Reliever A has just been invented. Data has been collected from a random sample of 256 patients on how quickly it releives pain. The mean time to relief for the sample is 25.25 minutes and the standard deviation for the sample is 10 minutes. Use python to answer the following questions.

a) What is the 95% confidence interval for the average relief time of Pain Reliever A?

b) To determine whether it is worthwhile to launch Pain Reliever A, you need to compare its effectiveness with Pain Reliever B, the pain reliever that is currently used in hospitals. Pain Reliever B is known to relieve pains in a mean time of 26.75 minutes. Would you conclude that A is more effective than B in reducing the mean time till relief? Briefly explain why or why not.