Review Questions for the Third Exam

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1. Suppose the mean weight of school children's bookbags is 17.4 pounds, with standard deviation 2.2 pounds. Find the probability that the mean weight of a sample of 30 bookbags will exceed 17 pounds.

2. Suppose that 2% of all cell phone connections by a certain provider are dropped. Find the probability that in a random sample of $1,500$ calls at most 40 will be dropped. First verify that the sample is sufficiently large to use the normal distribution.

3. Let x be a random variable that represents the length of time a student studies before an exam. It was found that x has approximately normal distribution with mean $\mu = 6.8$ hours and standard deviation $\sigma = 2.1$ hours.
   (a) What is the probability that a randomly selected student studies for at least 4 hours?
   (b) Suppose 40 students are selected at random. What is the probability that the mean time $\bar{x}$ that these students studying for the exam is more than 7 hours?

4. In 2005, the distribution of the score in the math portion of the SAT test was approximately normal with a mean $\mu 520$ and a standard deviation $\sigma = 115$.
   (a) What percentage of students scored more than 720 in the math portion of the SAT test in 2005?
   (b) Suppose that sample of 64 students that took the SAT in 2005 is randomly selected. What is the probability that the average score $\bar{x}$ in the math portion of the SAT for these 64 students is between 491 and 549?

5. Jose conducts a random sample of 41 people regarding their television viewing habits. He found that the sample mean was $\bar{x} = 4.615$ hours per week with a sample standard deviation of $s = 2.277$ hours per week. Find a 90% confidence interval for the population mean.

6. In a sample of 500 randomly selected patients, the percentage of those reporting improvement after given a placebo is 35%.
   (a) Construct a 95% confidence interval for the proportion of patients in the whole population that exhibit the placebo effect.
   (b) Construct a 99% confidence interval for the proportion of patients in the whole population that exhibit the placebo effect.

7. Nicole decides to run for political office. In order for her name to appear on the ballot, she must collect $7,500$ valid signatures from registered voters. After she collects $10,000$ signatures, she decides to check what proportion of the ones she collected are valid. She takes a random sample of 150 of the signatures she collected and brings them to the Board of Elections to verify them. It turns out that of the sample of 150, only 87 are valid.
   (a) Construct a 95% confidence interval for the proportion of valid signatures she has collected.
   (b) If Nicole wants to be sure her name appears on the ballot, should she continue to collect signatures?

8. An economist wishes to estimate, to within 2 minutes, the mean time that employed persons spend commuting each day, with 95% confidence. On the assumption that the standard deviation of commuting times is 8 minutes, estimate the minimum size sample required.

9. It is commonly reported that the mean normal body temperature is $\mu = 98.6$ °F . A sample of 36 healthy people was taken and their body temperatures were recorded. The sample mean was found to be $\bar{x} = 98.3°$ and the sample standard deviation was found to be $s = 0.62°$. Does it appear that the mean is less than $98.6°$? Use a level of significance of $\alpha = 0.05$. Be sure to state the null and alternate hypotheses.

10. Ever since Andrew took MTH 23, he has been obsessed with looking up statistics. One day, he comes across a study that claims that the amount of money a household spends on bottled water every year can be represented by a normally distributed variable x with population mean $\mu = 195$ dollars and population standard deviation $\sigma = 25$ dollars. He can't believe it. He checks his records and sees that last year he spent way more than that on bottled water. He decides to conduct a random sample of 13 people in his building and finds out that the average amount spent by the sample group was $\bar{x} = 210$ dollars. Aha!

    Test the claim that the mean amount spent on bottled water is more than 195 dollars with a level of significance of $\alpha = 0.01$. Identify the null and alternate hypotheses.

11. Researchers studying the effect of diet on growth would like to know if a vegetarian diet affects the height of a child. The researchers randomly select 12 vegetarian children that are six years old, and their average height turns out to be 42.5 inches with a standard deviation of 3.8 inches. The average height for all six year old children is 45.7 inches.

    Conduct a hypothesis test to determine whether there is overwhelming evidence, at $\alpha = 0.01$ that six year old vegetarian children are not the same height as other six year old children.

12. The National Center for Drug Abuse is conducting a study to determine if heroin usage among teenagers have changed. Historically, about 1.3% of teenagers between the ages of 15 and 19 have used heroin one or more times. In a recent survey of 1824 teenagers, 37 indicated they had used heroin one or more times.

    Is there overwhelming evidence of a change in heroin usage among teenagers? Test at the 0.05 level of significance.