Lesson #38 · Topic 4D · Practice

Name ______________________

1. SAT scores for High School A are approximately normally distributed with mean 1240 and standard deviation 105. SAT scores for High School B are approximately normally distributed with mean 1200 and standard deviation 125. A random sample of 15 SAT scores from High School A is selected and the sample mean $\bar{x}_A$ is calculated. A separate random sample of 12 SAT scores from High School B is selected and the sample mean $\bar{x}_B$ is calculated.

   a. Describe the shape of the sampling distribution of $\bar{x}_A - \bar{x}_B$. Justify.

   b. What is the mean of the sampling distribution of $\bar{x}_A - \bar{x}_B$? Interpret.

   c. What is the standard deviation of the sampling distribution of $\bar{x}_A - \bar{x}_B$? Be sure to check the 10% condition.

   d. What is the probability that the sample mean of High School A is greater than the sample mean from High School B?

2. Wordle is a popular online game in the New York Times. To win, you must correctly guess a 5-letter word in 6 attempts or less. The hardest word to date was JAZZY. For all people that correctly solved JAZZY, the mean was 5.82 attempts with a standard deviation of 0.56 attempts.

a. Can we assume the population shape for number of attempts to correctly solve JAZZY is approximately normal? Why or why not?

b. Separate random samples of 32 AP Statistics students and 45 AP Calculus students who correctly solved JAZZY will be selected, and the average number of attempts to solve will be calculated for each sample ($\bar{x}_S \text{ and } \bar{x}_C$). Assuming both groups have a mean of 5.82 attempts and a standard deviation of 0.56 attempts, describe the sampling distribution of $\bar{x}_S - \bar{x}_C$.

c. Find $P(\bar{x}_S - \bar{x}_C \leq -0.3)$.

d. Suppose the sample mean for the AP Statistics students is 5.1 attempts and the sample mean for the AP Calculus students is 5.4 attempts. Does this result provide convincing statistical evidence that AP Statistics students can correctly guess the word JAZZY in fewer attempts than AP Calculus students, on average?

3. Pratham and Raghav play a puzzle game on their computer every day during class. After many, many games, it has been determined that Pratham's mean time to solve the puzzle is 82.5 seconds with a standard deviation of 15.2 seconds and Raghav's mean time to solve the puzzle is 85.8 seconds with a standard deviation of 17.3 seconds. Suppose a random sample of 30 games from each player is selected and the sample means ($\bar{x}_P$) and ($\bar{x}_R$) are calculated.

a. Suppose that $\bar{x}_P - \bar{x}_R = 2.1$ seconds. Give a possible sample mean for each player.

b. Raghav found the standard deviation of the sampling distribution for $\bar{x}_P - \bar{x}_R$ by calculating $\sqrt{\frac{15.2^2}{30} - \frac{17.3^2}{30}}$ and Pratham found the standard deviation of the sampling distribution for $\bar{x}_P - \bar{x}_R$ by calculating $\sqrt{\frac{15.2}{30} + \frac{17.3}{30}}$. Explain each of their mistakes and find the correct standard deviation.

c. $P(\bar{x}_P - \bar{x}_R \geq 2.1) \approx 0.0995$. Interpet this probability.

4. According to a recent study, drinking coffee is becoming more popular among younger Americans. American adults aged 35 and older report drinking their first coffee at an average age of 19 years. American adults aged 18 to 24 report drinking their first coffee at an average age of 15 years. A small community with 500 adults aged 35 and older and 350 adults aged 18 to 24 wonders if this is true for their community, so they plan to select random samples of adults from each age group and ask at what age they drank their first coffee.

a. What sample sizes are required for each group so that the shape of the sampling distribution for $\bar{x}_1 - \bar{x}_2$ is approximately normal? Explain.

b. What is the sample size restriction for each group to use the formula for calculating standard deviation of the sampling distribution for $\bar{x}_1 - \bar{x}_2$? Explain.

c. A community member suggests sampling 40 from each group. Which condition would this violate?

5. The ideal climbing season for Mount Everest is April through June. During the month of April over many years, a clean-up team collects a mean of 115.7 pounds of trash per day with a standard deviation of 9.5 pounds per day. During the month of June over many years, the team collects a mean of 127.1 pounds of trash per day with a standard deviation of 8.7 pounds per day. Let $\bar{x}_A$ represent the sample mean pounds collected over 5 randomly selected days in April and let $\bar{x}_J$ represent the sample mean pounds collected over 5 randomly selected days in June.

What are the mean and standard deviation of the sampling distribution of the difference in sample means $\bar{x}_A - \bar{x}_J$?

A) The mean is 121.4, and the standard deviation is $\sqrt{\frac{115.7}{5} + \frac{127.1}{5}}$

B) The mean is 121.4, and the standard deviation is $\sqrt{\frac{115.7^2}{5} + \frac{127.1^2}{5}}$

C) The mean is -11.4, and the standard deviation is $\sqrt{\frac{9.5}{5} + \frac{8.7}{5}}$

D) The mean is -11.4, and the standard deviation is $\sqrt{\frac{9.5^2}{5} + \frac{8.7^2}{5}}$

6. Emily is going on a road trip and made a playlist with over 500 songs. Suppose the average length of a song is 3.75 minutes and the playlist is set to shuffle the songs randomly (with replacement). Let $\bar{x}_F$ represent the average length of the first twenty songs and let $\bar{x}_N$ represent the average length of the next ten songs.

What is the mean of the sampling distribution of the difference in sample means $\bar{x}_F - \bar{x}_N$?

A) $3.75 - 3.75 = 0$

B) $\frac{3.75}{20} - \frac{3.75}{10} = 0.5625$

C) $\frac{3.75 + 3.75}{2} = 3.75$

D) $20 - 10 = 10$