PROBLEMS

1. Describe the distribution of sample means (shape, expected value, and standard error) for samples of $n = 100$ selected from a population with a mean of $\mu = 40$ and a standard deviation of $\sigma = 10$.
2. A sample is selected from a population with a mean of $\mu = 40$ and a standard deviation of $\sigma = 8$.
   a. If the sample has $n = 4$ scores, what is the expected value of M and the standard error of M?
   b. If the sample has $n = 16$ scores, what is the expected value of M and the standard error of M?
3. The distribution of sample means is not always a normal distribution. Under what circumstances is the distribution of sample means *not* normal?
4. A population has a standard deviation of $\sigma = 24$.
   a. On average, how much difference should exist between the population mean and the sample mean for $n = 4$ scores randomly selected from the population?
   b. On average, how much difference should exist for a sample of $n = 9$ scores?
   c. On average, how much difference should exist for a sample of $n = 16$ scores?
5. For a population with a mean of $\mu = 70$ and a standard deviation of $\sigma = 20$, how much error, on average, would you expect between the sample mean (M) and the population mean for each of the following sample sizes?
   a. $n = 4$ scores
   b. $n = 16$ scores
   c. $n = 25$ scores
6. For a population with a standard deviation of $\sigma = 20$, how large a sample is necessary to have a standard error that is:
   a. less than or equal to 5 points?
   b. less than or equal to 2 points?
   c. less than or equal to 1 point?
7. For a population with $\sigma = 12$, how large a sample is necessary to have a standard error that is:
   a. less than 4 points?
   b. less than 3 points?
   c. less than 2 point?
8. For a sample of $n = 25$ scores, what is the value of the population standard deviation (σ) necessary to produce each of the following a standard error values?
   a. $\sigma_M = 10$ points?
   b. $\sigma_M = 5$ points?
   c. $\sigma_M = 2$ points?
9. For a population with a mean of $\mu = 80$ and a standard deviation of $\sigma = 12$, find the z-score corresponding to each of the following samples.
   a. $M = 83$ for a sample of $n = 4$ scores
   b. $M = 83$ for a sample of $n = 16$ scores
   c. $M = 83$ for a sample of $n = 36$ scores
10. A sample of $n = 4$ scores has a mean of $M = 75$. Find the z-score for this sample:
    a. If it was obtained from a population with $\mu = 80$ and $\sigma = 10$.
    b. If it was obtained from a population with $\mu = 80$ and $\sigma = 20$.
    c. If it was obtained from a population with $\mu = 80$ and $\sigma = 40$.
11. A normal distribution has a mean of $\mu = 60$ and a standard deviation of $\sigma = 18$. For each of the following samples, compute the z-score for the sample mean and determine whether the sample mean is a typical, representative value or an extreme value for a sample of this size.
    a. $M = 67$ for $n = 4$ scores
    b. $M = 67$ for $n = 36$ scores
12. A random sample is obtained from a normal population with a mean of $\mu = 95$ and a standard deviation of $\sigma = 40$. The sample mean is $M = 86$.
    a. Is this a representative sample mean or an extreme value for a sample of $n = 16$ scores?
    b. Is this a representative sample mean or an extreme value for a sample of $n = 100$ scores?
13. The population of IQ scores forms a normal distribution with a mean of $\mu = 100$ and a standard deviation of $\sigma = 15$. What is the probability of obtaining a sample mean greater than $M = 97$,
    a. for a random sample of $n = 9$ people?
    b. for a random sample of $n = 25$ people?
14. The scores on a standardized mathematics test for 8th-grade children in New York State form a normal distribution with a mean of $\mu = 70$ and a standard deviation of $\sigma = 10$.
    a. What proportion of the students in the state have scores less than $X = 75$?
    b. If samples of $n = 4$ are selected from the population, what proportion of the samples will have means less than $M = 75$?
    c. If samples of $n = 25$ are selected from the population, what proportion of the samples will have means less than $M = 75$?
15. A normal distribution has a mean of $\mu = 54$ and a standard deviation of $\sigma = 6$.
    a. What is the probability of randomly selecting a score less than $X = 51$?
    b. What is the probability of selecting a sample of $n = 4$ scores with a mean less than $M = 51$?
    c. What is the probability of selecting a sample of $n = 36$ scores with a mean less than $M = 51$?
16. A population of scores forms a normal distribution with a mean of $\mu = 80$ and a standard deviation of $\sigma = 10$.
    a. What proportion of the scores have values between 75 and 85?
    b. For samples of $n = 4$, what proportion of the samples will have means between 75 and 85?