1. Let X = the number of large bags of popcorn sold by a local movie theater in a day. Suppose that X is normally distributed with a mean of 230 bags and a standard deviation of 29 bags. Describe the distribution of $\overline{X}$, the **average** number of large bags of popcorn sold in a random sample of 7 days, by identifying the following.

   (a) **Mean** of the Distribution of $\overline{X}$ (Use the symbol and value on page 117 of the Lecture Guide.)

   (b) **Standard Deviation** of the Distribution of $\overline{X}$ (Use the symbol and formula on page 117.)

   (c) **Shape** of the Distribution of $\overline{X}$ (Use the flowchart on page 118 to determine whether $\overline{X}$ is normally distributed and how you know.)

2. Suppose that Y describes the number of tickets sold by the movie theater in a day, with a mean of 1040 tickets and a standard deviation of 212 tickets. Describe the distribution of $\overline{Y}$, the **average** number of tickets sold per day in a random sample of 55 days.

   (a) **Mean** of the Distribution of $\overline{Y}$

   (b) **Standard Deviation** of the Distribution of $\overline{Y}$

   (c) **Shape** of the Distribution of $\overline{Y}$ (i.e. whether it's normally distributed and how you know!)

3. Suppose that the number of Krabby Patties sold at the Krusty Krab on a randomly selected day, X, follows a normal distribution with a mean of 537 patties and a standard deviation of 38.6 patties.

   (a) Describe the distribution of $\overline{X}$, the mean number of Krabby Patties sold per day for a random sample of 27 days, by identifying the **mean** $\mu_{\overline{X}}$ and **standard error** $\sigma_{\overline{X}}$. Round standard error to four places.

   (b) What distribution does $\overline{X}$ follow? How can you tell?

   (c) Suppose that a random sample of 27 days is selected. What is the probability that the sample mean number of Krabby Patties differs from the population mean by **more than** 15 patties? Include a probability statement, your answer, and an appropriately labeled and shaded sketch.

4. A national survey estimated that of all U.S. citizens who had visited the hostpital within the last five years, approximately 69% were satisfied with the treatment received during their visit. In an evaluation of their patient care standards, the staff at Grey-Sloan Memorial Hospital are interested in seeing how their hospital compares to the national result. They plan to interview a sample of 235 randomly selected patients who stayed at Grey-Sloan in the past five years.

   (a) Describe the distribution of $\hat{p}$, the proportion of satisfied patients in a sample of 235, by describing the **mean** $\mu_{\hat{p}}$ and **standard error** $\sigma_{\hat{p}}$. Round standard error to four decimal places.

   (b) What distribution does $\hat{p}$ follow? How can you tell?

   (c) What is the probability that the proportion of satisfied hospital patients at Grey-Sloan Memorial Hospital differs from the national result by **less than** 5%? Include a probability statement, your answer, and an appropriately labeled and shaded sketch.

5. According to M&M's, each package of Milk Chocolate M&M's contains 24% blue M&M's. Suppose that you have a random sample of 200 Milk Chocolate M&M's. Let $\hat{p}$ represent the proportion of blue M&M's in your sample.

   (a) Which parameter is being estimated by $\hat{p}$?

      A. The true average number of Milk Chocolate M&M's that are blue.
      B. The proportion of blue candies in a sample of 200 Milk Chocolate M&M's.
      C. The standard deviation of the proportion of blue candies in a sample of 200 Milk Chocolate M&M's.
      D. The true proportion of Milk Chocolate M&M's that are blue.

   (b) What is the probability that the percentage of blue candies in your random sample of 200 M&M's is 20% or less?

      A. 0.000
      B. 0.093
      C. 0.186
      D. 0.200

6. The School of Mathematical and Statistical Sciences has found that for each exam, 3% of the scantrons are not correctly filled out and the scantron machine will not record a score for those students. Often this is because students forget to bubble in their test version. Suppose that we have a random sample of 300 scantrons from students taking exams in the month of November. Let $p =$ the true proportion of scantrons that are incorrectly completed for exams taken in the month of November, and let $\hat{p}$ be the proportion of incorrectly completed scantrons in our random sample. Use this information to answer the following about the shape of the distribution of $\hat{p}$.

   (a) Describe the center or mean of the sampling distribution of $\hat{p}$. (Include the correct symbol in your answer.)

   (b) Describe the spread or standard error of the sampling distribution of $\hat{p}$. Round your answer to four decimal places.

   (c) Describe the shape of the sampling distribution of $\hat{p}$. Justify your reasoning.

7. The wait time at a particular coffee shop is normally distributed. Records indicate that the mean wait time is 4.5 minutes with a standard deviation of 2 minutes. Let $\overline{X}$ represent the mean wait time for a random sample of 25 customers. Describe the sampling distribution of $\overline{X}$.

   A. The sampling distribution is normally distributed with a mean of 4.5 minutes and a standard deviation of 2 minutes.
   B. The sampling distribution has a mean of 4.5 minutes and a standard deviation of $\frac{2}{\sqrt{25}}$ minutes, but may not be normally distributed.
   C. The sampling distribution is normally distributed with a mean of 4.5 minutes and a standard deviation of $\frac{2}{\sqrt{25}}$ minutes.
   D. There is not enough information to determine the sampling distribution of $\overline{X}$.

8. Thompson and Thompson is a steel bolts manufacturing company. One of their steel bolts products has a mean diameter of 130 mm and a standard deviation of 6 mm. If a random sample of 33 of these steel bolts is selected, what is the probability that the sample mean would be greater than 130.6 mm?

   A. 0.28
   B. 0.72
   C. 0.46
   D. 0.53

9. Steve and Tony are two tenured college professors in Georgia. Rather than spend their Friday evenings complaining about the heat, Steve and Tony sit down to play a game of poker. The winnings for each game have an unknown probability distribution with a mean of \$4 and a standard deviation of \$20. Let X represent the winnings from a game and let $\overline{X}$ represent the average winnings for a random sample of 35 games.

   (a) Explain why $\overline{X}$ has a normal distribution.

   (b) Give the mean and standard deviation of $\overline{X}$. Label each value with the appropriate symbol. Round your answer to two decimal places if appropriate.

   (c) What is the probability that the average winnings for a random sample of 35 games will be greater than \$0.00? Label your answer with the appropriate probability notation. Round the final answer to four decimal places. To show your work, you may do one of the following: provide a well-labeled sketch with the appropriate area shaded, calculate the z-score and use the standard normal table, or write the correct integral for this problem.

10. Suppose it is known that approximately 2.5% of people in the United States have red hair. Tim the Stats Man decided to take a random sample of 250 U.S. citizens and records their hair color. What is the probability that Tim finds that more than 6 people in that sample have red hair?

    A. 0.54
    B. 0.46
    C. 0.10
    D. 0.90

11. According to a report published by *U.S. News and World Report*, 41% of Clemson students live on campus. Is the proportion of Clemson students who live on campus in a sample of 60 students normally distributed?

    A. No, because the sample size is larger than 30.
    B. Yes, because the sample size is larger than 30.
    C. Yes, because $60(0.41) \geq 5$ and $60(1 - 0.41) \geq 5$.
    D. No, because $60(0.41) \geq 5$ and $60(1 - 0.41) \geq 5$.

12. A survey asks a random sample of 1200 adults in South Carolina if they support an increase in the state sales tax with the additional revenue going to education. Let $\hat{p}$ denote the proportion in the sample that say that they support an increase. Suppose that 40% of all adults in South Carolina truly support an increase. What are the mean and standard deviation of the sampling distribution for $\hat{p}$?

    A. $\mu_{\hat{p}} = 0.60$, $\sigma_{\hat{p}} = 0.0115$
    B. $\mu_{\hat{p}} = 480$, $\sigma_{\hat{p}} = 288$
    C. $\mu_{\hat{p}} = 0.40$, $\sigma_{\hat{p}} = 0.0141$
    D. $\mu_{\hat{p}} = 0.40$, $\sigma_{\hat{p}} = 0.0115$

13. It has been determined that 80% of apartments listed as "apartment for rent" on Craigslist have been rented within two weeks of the initial listing. We selected a random sample of 100 "apartment for rent" ads on Craigslist and tracked down the rental result for each. We define $\hat{p}$ as the proportion of apartments in our sample of size 100 that rent within two weeks of listing the ad.

    (a) Is the proportion of apartments that will rent within two weeks in our sample of size 100 normally distributed? Support your response with the appropriate calculation(s).

    (b) Find the mean and standard error of the sampling distribution for $\hat{p}$ in this situation.

    (c) Find the probability that more than 75 out of 100 "apartment for rent" ads will result in renting the unit within two weeks. Give a probability statement, show a z-score calculation, and round your final answer to four places.