1. The distribution of waiting time (in minutes) is represented by the random variable $X$ with PDF

$$f(x) = \frac{x}{8}, \qquad 0 \leq x \leq 4.$$

What is the probability that the waiting time is within two standard deviations of its expected mean value?

(a) 0.9618
(b) 0.8889
(c) 0.8427
(d) 0.9545
(e) 1.2571

2. The monthly water bill for households in a city follows a normal distribution with mean SAR 210 and standard deviation SAR 35. If the city contains 50,000 households, what is the expected number of households with monthly water bills between SAR 182 and SAR 238?

(a) 28814
(b) 50000
(c) 39407
(d) 25000
(e) 21718

3. Customers arrive at a coffee shop's drive-thru at a rate of 12 per hour. If a customer has just arrived, what is the probability that the next customer will arrive within 10 minutes?

   (a) 0.8647
   (b) 0.1353
   (c) 0.5000
   (d) 0.3935
   (e) 0.6065

4. A university registrar divides the student population into four groups by college (Engineering, Business, Sciences, Arts) and then selects a simple random sample of students from within each college, in proportion to the size of each college. This is an example of

   (a) Stratified sampling
   (b) Systematic sampling
   (c) Simple random sampling
   (d) Cluster sampling
   (e) Convenience sampling

5. According to the Central Limit Theorem, as the sample size $n$ increases, the sampling distribution of the sample mean $\bar{X}$ will

   (a) Approach a normal distribution, regardless of the shape of the population distribution.

   (b) Become more skewed, regardless of the shape of the population distribution.

   (c) Approach the same shape as the population distribution.

   (d) Have increasing variance.

   (e) Only approach normality if the population itself is already normally distributed.

6. Boxes of cereal from a filling machine have weights that are normally distributed with a mean of 368 grams and a standard deviation of 15 grams. A quality inspector randomly selects a sample of 25 boxes. What is the probability that the sample mean weight is between 362 and 374 grams?

   (a) 0.9545

   (b) 0.6826

   (c) 0.9974

   (d) 0.8664

   (e) 0.4772

7. A quality-control manager wants to estimate the average weight of a product manufactured at a factory. A random sample of 49 products is selected. The sample mean weight is 150 grams, and the population standard deviation is known to be 14 grams. Construct a 95% confidence interval estimate for the population mean weight.

   (a) (146.08, 153.92)
   (b) (148.00, 152.00)
   (c) (147.06, 152.94)
   (d) (144.12, 155.88)
   (e) (146.71, 153.29)

8. A market researcher is studying the average amount spent by customers at a retail store. A random sample of 16 customers yields a sample mean expenditure of SAR 82 and a sample standard deviation of SAR 12. Assuming the population is normally distributed, construct a 95% confidence interval estimate for the population mean expenditure.

   (a) (75.61, 88.39)
   (b) (76.12, 87.88)
   (c) (78.68, 85.32)
   (d) (70.00, 94.00)
   (e) (79.06, 84.94)

9. A customer-service company wants to estimate the proportion of customers who are satisfied with its services. A random sample of 250 customers is selected, and 175 indicate that they are satisfied. Construct a 95% confidence interval estimate for the population proportion of satisfied customers.

   (a) (0.6432, 0.7568)
   (b) (0.6500, 0.7500)
   (c) (0.6608, 0.7392)
   (d) (0.6206, 0.7794)
   (e) (0.6800, 0.7200)

10. A researcher wishes to estimate a population mean using a 95% confidence interval. Previous studies indicate that the population standard deviation is approximately 20. Determine the minimum sample size required so that the resulting 95% confidence interval has a length of at most 10 units.

    (a) 62
    (b) 16
    (c) 8
    (d) 49
    (e) 100

11. A company that manufactures chocolate bars is concerned that the mean weight of its chocolate bars may exceed 60 grams. The company wishes to test this claim. What is the correct set of hypotheses?

    (a) $H_0 : \mu \leq 60$ vs. $H_1 : \mu > 60$

    (b) $H_0 : \mu \geq 60$ vs. $H_1 : \mu < 60$

    (c) $H_0 : \mu = 60$ vs. $H_1 : \mu = 60$

    (d) $H_0 : \mu > 60$ vs. $H_1 : \mu \leq 60$

    (e) $H_0 : \mu \neq 60$ vs. $H_1 : \mu = 60$

12. A stationery store wants to test whether the population mean retail value of greeting cards in its inventory differs from \$2.50. Assume that the population retail values are normally distributed with a standard deviation of \$0.44. A random sample of 100 cards has a sample mean of \$2.55. At the 3% significance level, the test statistic and the critical value(s), respectively, are

    (a) 1.14 and $\pm 2.17$

    (b) $-1.14$ and $\pm 1.96$

    (c) 1.14 and $\pm 1.645$

    (d) $-1.14$ and $\pm 2.33$

    (e) 1.14 and $\pm 1.88$

13. A company claims that the mean lifetime of its batteries is at least 500 hours. Assume battery lifetimes are normally distributed. A consumer group tests a random sample of $n = 25$ batteries and finds a sample mean of 490 hours with a sample standard deviation of 25 hours. At the $\alpha = 0.05$ significance level, what is the correct conclusion?

    (a) Reject $H_0$; there is sufficient evidence that the mean lifetime is less than 500 hours.

    (b) Do not reject $H_0$; there is insufficient evidence that the mean lifetime is less than 500 hours.

    (c) Reject $H_0$; there is sufficient evidence that the mean lifetime is greater than 500 hours.

    (d) Do not reject $H_0$; the sample mean equals the hypothesized mean.

    (e) Do not reject $H_0$; because the sample mean is only 10 hours below 500 hours, the observed difference is likely due to random sampling variability.

14. A company claims that at least 80% of its customers are satisfied with its product. In a random sample of 150 customers, 108 reported being satisfied. The probability of getting a test statistic equal to or more extreme than the sample result, given that $H_0$ is true, is

    (a) 0.0071

    (b) 0.0142

    (c) 0.0214

    (d) 0.9929

    (e) 0.0958