10.20. (a) The distribution on the right (for samples of size \( n = 100 \)) is more symmetric, and therefore closer to a Normal curve. (Because the same scale was used for both histograms, students might judge that this histogram looks too “rough,” but we are more concerned with skewness than smoothness.) The central limit theorem says that the distribution should be more normal for larger samples. (b) The mean appears to be between $38,000 and $40,000.

10.23. Mean \( \mu = 40.125 \) mm and standard deviation \( \sigma/\sqrt{4} = 0.001 \) mm.

10.26. (a) \( \bar{x} \) is approximately Normal with mean 0.9 g/mi and standard deviation \( 0.15/\sqrt{125} = 0.01342 \) g/mi. (b) \( P(Z > 2.326) = 0.01 \) if \( Z \) is \( N(0, 1) \), so \( L = 0.9 + (2.326)(0.01342) = 0.9312 \) g/mi. (If 2.33 is used instead of 2.326, the result rounds to 0.9313 g/mi.)

10.27. (a) \( \bar{x} \) is approximately \( N(2.2, 1.4/\sqrt{52}) = N(2.2 \) accidents, 0.1941 accidents).
(b) \( P(\bar{x} < 2) = P(Z < -1.03) = 0.1515 \). (c) Let \( A \) be the number of accidents in a year. \( P(A < 100) = P(\bar{x} < \frac{100}{52}) = P(Z < -1.43) = 0.0764 \). [Alternatively, we might use the continuity correction (which adjusts for the fact that counts must be whole numbers) and find \( P(A < 99.5) = P(\bar{x} < \frac{99.5}{52}) = P(Z < -1.48) = 0.0694 \).]

10.28. (a) No: A count assumes only whole-number values, so it cannot be normally distributed. (b) \( \bar{x} \) is approximately \( N(1.5, 0.75/\sqrt{700}) = N(1.5, 0.02835) \). (c) \( P(\text{more than 1075 in 700 cars}) = P(\bar{x} > \frac{1075}{700}) = P(Z > 1.26) = 0.1038 \). [Alternatively, we might use the continuity correction (which adjusts for the fact that counts must be whole numbers) and find \( P(\bar{x} > \frac{1075.5}{700}) = P(Z > 1.29) = 0.0985 \).]

Chapter 12 Solutions

12.17. Let \( X \) be the number of universal donors among the 20. Then \( X \) has a binomial distribution with \( n = 20 \) and \( p = 0.072 \), so \( P(X = 0 \text{ or } X = 1) = \binom{20}{0}(0.072)^0(0.928)^{20} + \binom{20}{1}(0.072)^1(0.928)^{19} \approx 0.5725 \), and \( P(X \geq 2) = 1 - P(X = 0 \text{ or } X = 1) = 0.4275 \).

12.18. (a) \( n = 20 \) and \( p = 0.25 \). (b) \( \mu = np = 5 \) correct guesses. (c) \( P(X = 5) = \binom{5}{5}(0.25)^5(0.75)^{15} \approx 0.2023 \).

12.20. Let \( N \) be the number of households with 3 or more cars. Then \( N \) has a binomial distribution with \( n = 12 \) and \( p = 0.2 \). (a) \( P(N = 0) = \binom{12}{0}(0.2)^0(0.8)^{12} = 0.81^2 \approx 0.0687 \). \( P(N \geq 1) = 1 - P(N = 0) = 0.9313 \). (b) \( \mu = np = 2.4 \) and \( \sigma = \sqrt{np(1-p)} \approx 1.3856 \) households. (c) \( P(N > 2.4) = 1 - P(N \leq 2) \approx 0.4417 \).