Exercises Section 5.4 [page 218]

46. The inside diameter of a randomly selected piston ring is a random variable with mean value 12 cm and standard deviation .04 cm.

a. If $\overline{X}$ is the sample mean diameter for a random sample of $n = 16$ rings, where is the sampling distribution of $\overline{X}$ centered, and what is the standard deviation of the $\overline{X}$ distribution?

b. Answer the questions posed in part a for a sample size of $n = 64$ rings.

c. For which of the two random samples, the one of part a or the one of part b, is $\overline{X}$ more likely to be within .01 cm of 12 cm? Explain your reasoning.

47. Refer to Exercise 46. Suppose the distribution of the diameters is normal.

a. Calculate $P(11.99 \leq \overline{X} \leq 12.01)$ when $n = 16$.

b. How likely is it that the sample mean diameter exceeds 12.01 when $n = 25$?

48. Let $X_1, X_2, \ldots, X_{100}$ denote the actual net weights of 100 randomly selected 50-lb bags of fertilizer.

a. If the expected weight of each bag is 50 lb and the variance is 1, calculate $P(49.9 \leq \overline{X} \leq 50.1)$, approximately, using the CLT.

b. If the expected weight is 49.8 lb rather than 50 lb so that on average bags are underfilled, calculate $P(49.9 \leq \overline{X} \leq 50.1)$.

50. The breaking strength of a rivet has a mean value of $10,000$ psi and a standard deviation of 500 psi.
a. What is the probability that the sample mean breaking strength for a random sample of 40 rivets is between 9900 and $10,200$?

b. If the sample size had been 15 rather than 40, could the probability requested in part a be calculated from the given information?

51. The time taken by a randomly selected applicant for a mortgage to fill out a certain form has a normal distribution with mean value 10 min and standard deviation 2 min. If five individuals fill out a form on one day and six on another, what is the probability that the sample average amount of time taken on each day is at most 11 min?

52. The lifetime of a certain of battery is normally distributed with mean value 10 hours and standard deviation 1 hour. There are four batteries in a package. What lifetime value is such that the total lifetime of all batteries in a package exceeds that value for only 5% of all packages?

53. Rockwell hardness of pins of a certain type is known to have a mean value of 50 and a standard deviation of 1.2.
a. If the distribution is normal, what is the probability that the sample mean hardness for a random sample of 9 pins is at least 51?

b. What is the (approximate) probability that the sample mean hardness for a random sample of 40 pins is at least 51?