

Suppose that in a population of American adult coffee drinkers, the change in measured heart rate ten minutes after drinking 6 ounces of coffee is normally distributed with a mean increase of 7.3 beats per minute and a standard deviation of 11.1 beats per minute. *A negative change would indicate a decrease in heart rate.* In answering the following questions, ignore the reality that heart rate measurements are discrete (number of beats in a fixed time interval) and imagine that we used instead a more sophisticated form of measurement that gives continuous values.

- (a) What proportion of individuals in the population would have a measured decrease in heart rate?
- (b) The middle 90 percent of individuals have measured changes between what two values?
- (c) In a random sample of eight adult American coffee drinkers, what is the probability that the sample mean change in heart rate would be below zero?
- (d) In a random sample of eight individuals from the population, what is the probability that exactly seven of eight individuals in the sample have *increases* in their measured heart rates?
- (e) Use the normal approximation to the binomial distribution to estimate the probability that there would be 160 or more individuals whose heart rate increased in a random sample of 200 individuals from the population.