game. Calculations with the binomial probability formula are not practical, because we would have to apply it 197 times, once for each value of x from 235 to 431 inclusive. Software and calculators can be used to find that the probability is 0.0335, but we will proceed to show how the normal approximation method can be used. We use the preceding six-step procedure.

Step 1: Requirement check: The 431 overtime NFL games are from recent years, but we will proceed under the assumption that we have a simple random sample. We must also verify that $np \geq 5$ and $nq \geq 5$. With $n = 431$ and $p = 0.5$ and $q = 0.5$, those requirements are both satisfied with $np = 215.5$ and $nq = 215.5$.

Step 2: We now proceed to find μ and σ needed for the normal distribution. We get the following:

$$\mu = np = 431 \cdot 0.5 = 215.5$$

$$\sigma = \sqrt{npq} = \sqrt{431 \cdot 0.5 \cdot 0.5} = 10.380270$$

Step 3: We want the probability of at least 235 wins, so the discrete whole number relevant to this example is $x = 235$.

Step 4: See Figure 6-19, which shows the normal distribution and the vertical strip from 234.5 to 235.5.

Step 5: We want to find the probability of getting *at least* 235 *wins,* so we want to shade the vertical strip representing 235 as well as the area to its right. The desired area is shaded in Figure 6-19.

Step 6: We want the area to the right of 234.5 in Figure 6-19. If using technology, we find that the shaded area in Figure 6-19 is 0.0336. If using Table A-2, we must first find the z score using $x = 234.5$, $\mu = 215.5$, and $\sigma = 10.380270$ as follows:

$$z = \frac{x - \mu}{\sigma} = \frac{234.5 - 215.5}{10.380270} = 1.83$$

Using Table A-2, we find that $z = 1.83$ corresponds to cumulative left area of 0.9664, so the shaded region in Figure 6-19 is $1 - 0.9664 = 0.0336$.

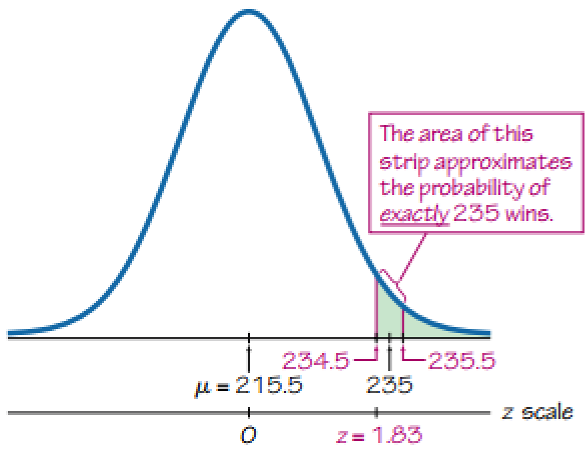

Figure 6-19 **Probability of 235 Wins**