

### Interpretation

If we assume that the overtime coin toss does not favor either team, then among 431 teams that won the overtime coin toss, there is a 0.0336 probability of at least 235 wins. This probability is low enough to suggest that the team winning the coin toss has an advantage over the team losing the coin toss. Given that winning the overtime coin toss provides an unfair advantage, it appears that overtime rules should be modified to reduce or eliminate that unfair advantage.

### Continuity Correction

The procedure for using a normal distribution to approximate a binomial distribution includes a *continuity correction*, defined as follows.

**DEFINITION** When we use the normal distribution (which is a *continuous* probability distribution) as an approximation to the binomial distribution (which is *discrete*), a **continuity correction** is made to a discrete whole number  $x$  in the binomial distribution by representing the discrete whole number  $x$  by the *interval* from  $x - 0.5$  to  $x + 0.5$  (that is, adding and subtracting 0.5).

In the preceding six-step procedure for using a normal distribution to approximate a binomial distribution, Steps 3 and 4 incorporate the continuity correction. (See Steps 3 and 4 in the solutions to Examples 1 and 2.)

To see examples of continuity corrections, examine the common cases illustrated in Figure 6-20. Those cases correspond to the statements in the following list:

Statement	Area
At least 235 (includes 235 and above)	To the <i>right</i> of 234.5
More than 235 (doesn't include 235)	To the <i>right</i> of 235.5
At most 235 (includes 235 and below)	To the <i>left</i> of 235.5
Fewer than 235 (doesn't include 235)	To the <i>left</i> of 234.5
Exactly 235	Between 234.5 and 235.5

#### Example 2 Exactly 235 Wins

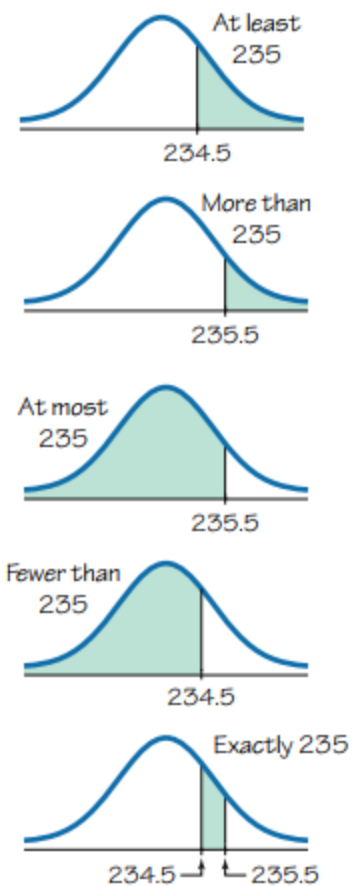
Using the same information from Example 1, find the probability of *exactly* 235 wins by the 431 teams that won the coin toss in overtime. That is, given  $n = 431$  and assuming that  $p = 0.5$ , find  $P(\text{exactly 235 wins})$ . Is this result useful for determining whether the overtime coin toss is fair?

#### Solution

Using the same six-step procedure given earlier, Steps 1, 2, and 3 are the same as in Example 1.

**Step 4:** See Figure 6-21, which shows the normal distribution with  $\mu = 215.5$  and  $\sigma = 10.380270$ . Also, the shaded area represents the probability of *exactly* 235 wins. That region is the vertical strip between 234.5 and 235.5, as shown.

**Step 5:** Because we want the probability of *exactly* 235 wins, we want only the shaded area shown in Figure 6-21.



**Figure 6-20**  
Using Continuity Corrections

*continued*