12. In a recent Sports Illustrated article, author Michael Rosenberg addresses “America’s Wait Problem.” That is, he discusses how fans of some teams have to wait many, many years for their team to win a championship. In Major League Baseball, fans should expect to wait an average of 30 years for a championship—assuming all 30 teams are equally likely to win a championship each season.

But is it reasonable to believe that all teams are equally likely to win a championship? In the last 19 seasons, only 10 different teams won a championship. Does this provide convincing evidence that some teams are more likely than others to win a championship? We can find out by testing the following hypotheses:

 *H*0: All 30 teams are equally likely to win a championship

 *Ha:* Some teams are more likely to win a championship than others.

(a) Describe how to use slips of paper to simulate the number of different teams to win a championship in 19 seasons, assuming that each team is equally likely to win the championship each season.

**Write the name of each team on a slip of paper. Shuffle slips in a hat. Select one team, record, and replace slip. Repeat for a total of 19 champions. Record number of different champions. Repeat many times.**

*Comments on student performance*: Many students were able to describe how to prepare the slips. Most of these correctly selected 19 slips *with* replacement, although some left this out. However, many students did *not* discuss what they would do after the 19 selections (e.g., record the number of different champs).



One hundred trials of a simulation were conducted, assuming that each team is equally likely to win the championship each season. The number of different teams to win a championship in 19 seasons was recorded for each trial on graphed on the dotplot.

(b) There is one dot at 10. Explain what this dot represents.

**In one simulated 19-year stretch, there were only 10 different champions.**

*Comments*: Most students did well on this part.

Number of different champions

(c) Based on the simulation and the data from the previous 19 seasons, is there convincing evidence that some teams are more likely to win a championship than others? Explain.

**Because it is very unlikely to get 10 or fewer different winners by chance alone (*p*-value  1/100), we reject *H*0. There is convincing evidence that some teams are more likely to win a championship than others.**

*Comments*: As expected, this was the hardest part for students. About 10-15% had no idea what to do or tried a traditional *z* or *t* test. About 50% focused on the wrong part of the sampling distribution (e.g., said the evidence was convincing because there were no dots at 19, said the evidence was convincing because the distribution was centered at 14-15, which was less than 19 or 30). The remaining students focused on the small probability that there would be 10 or fewer different champions by chance alone. Some even called this a *p*-value! A few argued that 10 different winners did not provide convincing evidence of Ha because 10 could happen by chance, even though it is would be fairly unusual.