

## Going the Extra Yard

There are few things more certain in football than the “extra point.” After a team scores a touchdown, the ball is placed on the 2 yard line and teams have the option of kicking the ball through the goal posts for an “extra point” or attempting to run or pass the ball into the end zone for a “two-point conversion.” During the 2013 season, NFL kickers were 1,316/1,321 (99.6%) successful. In contrast, there were 69 two point conversion attempts, with only 33 being successful. As a result, many fans choose to not even watch extra point attempts, opting instead to take a bathroom break or to get more food or drink.

The NFL is considering a rule change in order to make the “point after touchdown” attempts more appealing to fans. During the 2014 NFL Preseason, the league experimented with a rule change that moved the extra point line from the 2 yard line to the 25 yard line. (The placement of the ball for the two-point conversion remained unchanged.) Of the 141 extra points attempted during the preseason, 133 were successful. Clearly, increasing the distance of the extra point attempt will make extra points more difficult, but will it make the game more exciting? More specifically, will it cause more teams to attempt the two-point conversion?

Create a mathematical model to predict the rate at which extra point attempts will be successful based on the spot of the kick. At what point does it become more desirable to attempt 2 point conversions instead?

## Pipe Dreams

In recent years Montana and other western states have experienced severe drought conditions. Currently large portions of the American Southwest are in extreme drought, and some climate models suggest that these droughts could last decades. As a result, many large cities in drought stricken regions are exploring alternative options for sources of their water. Among some of the more popular options for cities are desalination (for coastal cities), non-potable recycled water (through so-called “purple pipes” systems), and potable recycled water.

Billings is the largest city in Montana, and is one of the state’s largest industrial centers. In anticipation of worsening drought conditions and continued growth of the city, the City Council has asked your team to develop a water-recycling plan appropriate for Billings. In doing so, they have asked you to:

- Project the expected water needs of the city over the next 30 years;
- Compare the costs of water treatment under the non-potable versus potable recycling systems (including the building of new facilities and upgrading of existing infrastructure);
- Make a recommendation for how the city should proceed over the next 30 years.