

- 1) Kicking the extra point will likely send the game into overtime. There is a chance that the kick will be missed or blocked especially after the line where the ball is kicked from has been moved in the last few years. Additionally, you have to factor in the fact that winning in overtime is likely less than 50% because of factors like fatigue, home field advantage, the chance of making the extra point, etc. I would tell my team to go for two based on the above factors and the fact that in the last few years, the chance of making a two point conversion has a greater than 50% chance.

- 2) To determine which of the outcomes was the most improbable to happen, I first found out the percent chance for each game that the Cavs would win. For game five, in order to “beat the spread,” the Warriors would have to lose by 9 points. For game six, they would have to lose by 3 points, and they would also have to lose by 6 points in game seven. Then, I converted these values to z-scores by dividing by the standard deviation of 12. This resulted in -0.75 for game four, -0.25 for game five, and -0.5 for game seven. Using a z-score table, these convert to 0.2266, 0.4013, and 0.3085, respectively. Lastly, since each game is dependent of each other because the Cavs needed to “win out” in order to win the series, the final probability they would win the series is: $0.2266 * 0.4013 * 0.3085 = 0.0281$. Since a 2.81% chance of winning is higher than 2.1%, the Patriots comeback victory in Super Bowl 51 was the most impressive of the two events.

- 3) The probability that Alice and Bob will arrive within 20 minutes of each other is around 0.31. I came to this conclusion by running a Monte Carlo simulation 100,000 times in the context of the given problem.

The code I developed to run the simulation can be understood with this pseudocode:
generate two random values that represented a time between 1 minutes to 2 hours arrival time, 100,000 times. Then, subtract these two values from each other and take the absolute value. If the subtracted value is less than or equal to 20 minutes, increment a counter by 1. After the loop is over, divided the counter by 100,000 and print the results. The outputs always ranged extremely close to 0.31, so I assumed that the probability would tend towards this value with an even larger sample size.

- 4) To answer this question, I first compared total career passer ratings for both players during the regular season and post season. I also compared their career win percentages for both the regular season and the post season. Lastly, I compared their career adjusted net yards per pass attempt for both the regular and post seasons.

I used passer rating as a benchmark because it is one of the most widely used statistical figures in the NFL to measure and rate quarterbacks. However, it does receive criticism that it only measures the quality of the passer, not the quality of the quarterback as a whole, nor the quality of his receivers. Profootball Reference created the statistic adjusted net yards per pass attempt to try to counterbalance the criticism. It takes into account passing yards, passing attempts, sacks, interceptions, and touchdowns to try to create a statistic that accurately measures the quarterback's performance as a whole.

Both players have essentially the same number of regular seasons and post seasons in

their respective careers as well, so the argument that one had more data than the other is basically irrelevant. The only argument I can think of is that they played in different eras, so it may be hard to compare some aspects of their careers. For example, for the years Ben Roethlisberger has been playing, the NFL has become more of a “pass first, rush second” type of league, whereas in Terry Bradshaw’s time, games were often fought with strong rushing attacks and physical defenses.

With this information in mind, here are my findings:

Statistic	Ben Roethlisberger	Terry Bradshaw
Regular season passer rate	94.0	70.9
Post season passer rate	86.5	83.0
Regular ANY/A	6.70	4.77
Post season ANY/A	6.09	7.16
Regular season win %	68.2	67.7
Post season win %	61.9	73.7

Based on this table, Ben Roethlisberger is a better quarterback than Terry Bradshaw.