Total points are not the main point

Ed Pappanastos
Troy University

Bob Wheatley
Troy University

ABSTRACT

This case study provides students with the opportunity to use descriptive statistics tools to compare the "competitiveness" of the football series between several southern universities. In addition, more advanced topics such as hypothesis testing can be employed. Knowledge of football is not necessary; however, basic knowledge regarding how points are scored might prove beneficial.

Keywords: Descriptive Statistics, Correlation, Data Analysis, Hypothesis Testing, Graphical Analysis

INTRODUCTION

In the southern part of the United States, religion and college football are big. Which one is bigger is debatable, and often is. Sometimes it is said there are two seasons down south – the season of college football and the season of waiting for college football to start (e.g., Bragg, 2012).

Southerners love their college teams and follow them through in good times and in bad times. They know individual statistics and team statistics for the present season and those in the past. Every game offers the opportunity to demonstrate knowledge of the past and to analyze past results in hopes of gaining a glimpse of what might happen each Saturday.

The "oldest rivalry of the deep south" is the one between the University of Georgia and Auburn University. Since 1892, Georgia and Auburn have played 116 football games. Since 1900, they have played every year except for three years – 1917, 1918, and 1943 – where the series was interrupted by World War I and II ("Auburn-Georgia," 2005).

As with other games, this game invokes great debate and analysis on an annual basis. Several years ago, prior to the 2005 football game, it was noted that the combined total points for each team for the previous 108 games was only one point different – Auburn had scored a combined total of 1,619 points and Georgia had scored 1,618. Quotes like "… they are separated by one measly point" and "It's crazy how close and how tight it has been" insinuate that it can be concluded from this one statistic, cumulative total points, that the series had been extremely "competitive" (Russ Tanner, as cited in "Auburn-Georgia," 2005, para. 1, 3). While it is incredible that the total points were only one point different after the 2004 game, that fact alone does not justify the claim of the series being "competitive."

To see an example of how flawed this logic is, one only needs to look at the eight year period from 2001 to 2008 of the Alabama-Auburn series ("Iron Bowl," 2013). As indicated in Table 1 (Appendix), Auburn won six of those games and Alabama won only two games. However, the total points scored by the teams suggests a fairly competitive series as Alabama has only scored 13 more points than Auburn. Nevertheless, it would be difficult to describe this eight year period as competitive.

ASSIGNMENT

There are a variety of other methods of comparing how competitive the series has been. Students are to provide a written report supporting the argument of the series having been competitive or not competitive. Statistical analysis should be provided and explained. The students may use the scores for the entire 116-game series or the scores from just the 108 games prior to 2005. It is interesting to note that while the cumulative total points differed by only one point for the games prior to 2005, Auburn had won 52 games, Georgia had won 48 games, and 8 had ended in a tie ("Deep South's," 2013). Surprisingly, the cumulative total points are quite different for the entire 116-game series [Georgia has scored 1892 and Auburn has scored 1778 point – a difference of 114 point]; however, over the 116 games, there have been eight ties and each team has won EXACTLY 54 games!

POSSIBLE ANALYSES

In order to better compare the competitiveness of the series, the student may choose a variety of statistical methods. The following methods will be discussed:

1. Numerical and graphical analysis of the point difference for each game,
2. Scatter plot of the scores for each game,
3. Plot of the cumulative point total difference for each game,
4. Hypothesis test for a significant correlation between scores,
5. Hypothesis test for randomness of winning team,
6. Football-based comparison of descriptive measures of the point difference for each game.

Comparison of Summary Descriptive Measures of the Point Difference for Each Game

One very reasonable way to compare how competitive the series has been is to look point difference, or spread, of each game. One would expect that, if the series was competitive, the spread would be small regardless of who wins. As the original data set only provides the scores for each game, the spread needs to be calculated. Here the spread is calculated for each game as the Georgia score minus the Auburn score. The order of subtraction is irrelevant; however, it is important to know how the spread was calculated so that negative and positive differences can be interpreted. Here negative differences represent Auburn wins and positive differences represent Georgia wins.

The summary statistics of spread for the 116 games are provided in Table 2 (Appendix). The mean of 0.98 indicates that, on average, Georgia has scored almost one more point per game. As indicated by the minimum and maximum values, each team's biggest victory was by slightly more than 40 points. Based on the quartiles, the winning team won by at least 9 points 50% of the time. This doesn't suggest a series filled with extremely close games. Applying the Empirical Rule to the data suggests that the distribution of the spread closely approximates the normal distribution as the percentage of observations within 1, 2, and 3 standard deviations of the mean is close to the expected values of 68%, 95%, and 99.44%, respectively. The box plot, as indicated in Graph 1 (Appendix), supports these observations.

The margins of victory by the two teams, as indicated in Table 3 (Appendix), provide greater insight into the distribution of point differences. The majority of wins be each team result in a spread of 1 to 10 points – 21.6% of Auburn wins and 25. 0% of Georgia wins. The table also illustrate that Georgia has a much greater chance of winning by at least 21 points – 12.9% to 5.4%.

The point spread without consideration for which team is the victor, as indicated in Table 4 (Appendix), provides greater insight into the competitiveness of the series. Similar to what was observed by examining the summary statistics, this table shows that 46.6% of the games have a spread of 11 points or more and almost 20% have a spread of 21 points or more. Again, this doesn't suggest a series filled with an unusually percentage of close games.

Scatter plot of the scores for each game

Another method for examining the closeness of the games is to construct a scatter plot of the scores for each game as indicated in Graph 2 (Appendix). The blue line drawn at a 45 degree

angle represents where both teams scored the same points in a game. If the series consisted of very competitive games, one would expect there to be minimal scatter about the blue line. Instead, this does not appear to be the case.

A couple of observations are worth noting. First, values plotted on the x-axis indicate games where Auburn did not score and values plotted on the y-axis indicate games where Georgia did not score. The further the points are from the origin, the less competitive the game was. There are a significant number of points on the axes and many of them fall far from the origin. Second, note that of the eight games that resulted in a tie, five games were tied at 0 points, one game was tied at 20 points, one at 22 points, and one at 23 points. The five games with a 0-0 score are plotted as only one point on the origin. The other three ties – 20-20, 22-22, 23-23 –appear as the only other points falling directly on the blue line.

Plot of the difference in cumulative total points for each game

Given the original suggestion of comparing total points, another method of analysis might include examining the difference in cumulative total points after each game as indicated in Graph 3 (Appendix). The plot below does just that. Keep in mind that a positive difference indicates that Georgia has a greater point total and a negative difference indicates Auburn's point total is greater.

The plot illustrates that, even though each team has won exactly 54 games in the series, there are distinct periods where one team has scored more points and other periods where the totals remain close. The series start with Auburn maintaining a larger cumulative total points over the first 34 games. Then there is a period of about 15 games where the totals are approximately equal. This period is followed approximately 60 games where Georgia's cumulative total points is larger. Then the next 15 years result in cumulative total points that are very close. Georgia's wins over the last several games of the series have helped Georgia start to build a larger cumulative total points. Essentially, what this chart shows is that for the majority of the series, the cumulative total points are quite different with short periods of where they are close. This chart suggests that there is little significance in the fact that the total points were only one point off after the 105th game.

Hypothesis test for a significant correlation between scores

Previously, a scatter plot of the scores for each game was examined. The scatter plot exhibited a slight upward trend with a great deal of scatter. In addition to the scatter plot, more sophisticated analysis of the relationship between scores can be conducted by a hypothesis test for a significant correlation coefficient. The more competitive or close the games are, the closer Georgia's and Auburn's individual game scores will be to each other. And, as a result of this closeness, the correlation coefficient will approach 1.00. The correlation coefficient for the scores is 0.183. This indicates that there is a positive relationship. However, it doesn't appear to be very strong.

As this is population data, testing for a statistically significant relationship is not really appropriate. However, doing so provides a little insight in the strength of the relationship. The appropriate test for in this case is a one-tailed case because a positive correlation is expected. The hypotheses for the test would be Ho: $\rho \leq 0$ and H1: $\rho > 0$. At the 0.025 significance level, the critical value is 0.182. That is, any correlation coefficient of 0.182 or larger would lead to a

rejection of the null. As the correlation coefficient of the Georgia and Auburn game scores is 0.183, the null is rejected and correlation coefficient, while not very large, is statistically significant. One point of caution must be considered. Since there are 116 games, statistical significance can be concluded when little practical significance exists. This appears to be the case here.

Hypothesis test for randomness of winning team

Another inferential statistical method to analyze the competitiveness of the series is a test for randomness. In order to conduct the test, the eight games with ties were disregarded, leaving 108 games with each team winning 54. In a competitive series each team should win a reasonable share of the games and the number of runs of consecutive wins by the same team would be limited.

With 108 games and each team winning 54 games, the minimum number of runs would be two. This would occur if one team won 54 games in a row and the other team won the next 54. The maximum number of runs would be 108. This could occur only if each team won every other game – very unlikely, but extreme evidence of a non-competitive series. While providing evidence of very competitive series, this would be extremely odd and would probably be more indicative of an anomaly of some type.

The expected number of runs for this series is 54 games. The actual number of runs is 48. The fact that there are fewer runs than expected indicates that there have been more streaks of consecutive wins than expected. The p-value for a one-tailed test for randomness [which is being equated to competitiveness] is 0.088. This suggests that there is some evidence of a non-competitive series, but not enough to conclusively state so.

Football-based comparison of descriptive measures of the point difference for each game

Previously, the spread of points for each game was analyzed. The analysis is conducted again here as indicated in Table 5 (Appendix), but there is emphasis placed on football implications of the different point spreads. That is, some point spreads can be overcome by the losing team with just one single play. Sometimes that single play is a field goal and other times it is a touchdown.

The table examines various groupings of point spreads where emphasis is placed on the number of scores the losing team needs. For simplicity, the table ignores the use of the two-point conversion. The table indicates that outcome of 43.1% of the games could have been changed by a single – thus, suggesting a competitive series. However, for almost a third (31.9%) of the games, the losing team lost by three or more scores. As there is no benchmark to define what constitutes a competitive series, these numbers don't suggest an unusually competitive series.

ADDITIONAL EXERCISE: EXAMINING HOW THE GAME HAS CHANGED IN TERMS OF SCORING

Over the years, there have many changes in the game of football. Not only are the players much bigger, stronger, and faster, but the rules of the game and the strategy have also changed. The offenses of the early days of football were more run-oriented than they are today. In fact, the

last two decades have witnessed much greater emphasis on passing offenses and, as a result, there has been a significant increase in scoring.

One way students can examine the change in scoring is by plotting the total points scored in each game over time as indicated in Graph 4 (Appendix). As can be seen by the time-series plot below, there has been a definite upward trend in total scoring. In addition, the total score the last twenty years has centered around 50 points while the scores of the first twenty years have centered around 20 points.

As indicated in Table 6 (Appendix), the summary measures for the total points scored during the first and last twenty years of Auburn-Georgia football games lead to several noteworthy observations. First, there is a tremendous difference in the typical total points for the two time periods. For the first twenty years, both the mean and the median are less than 20 points. Meanwhile, the mean and the median for the last twenty years are around 55. Second, the lowest total points for the last twenty years was 30, near the upper end of the scores of the first twenty years. Third, the maximum number of points scored in the last twenty years was 105, almost two-and-a-half times larger than the highest point total of the first twenty years.

Below are box plots for the two different time periods, as indicated in Graphs 5 and 6 (Appendix), clearly highlight the difference in scoring. From the plots, we see that the lowest score of the last twenty years is larger than over 75% of the scores of the first twenty years. Additionally, 75% of the games in the last twenty years resulted in at least 44 total points, the maximum amount for the first twenty years.

The bottom box plot indicates that the game where the teams combined for 105 points is an outlier. In fact, that game was the first overtime game in Southeastern Conference football. During the game's four overtimes, 49 of the games 105 total points were scored.

REFERENCES

Auburn-Georgia: 1 Point Apart After 113 Years. (2005, November 11). Retrieved from: http://nbcsports.msnbc.com/id/9972712/ns/sports-college_football/

Bragg, R. (2012, August 8). Down here: To understand football's place in the South, you first have to see it from the inside. ESPN The Magazine, updated online. Retrieved from: http://espn.go.com/college-football/story/_/id/8240383/rick-bragg-explains-history-traditions-south-obsession-football-espn-magazine

Deep South's Oldest Rivalry. (2013, February 11). Wikipedia, The Free Encyclopedia. Retrieved from: http://en.wikipedia.org/wiki/Deep_South's_Oldest_Rivalry

Iron Bowl. (2013, April 8). Wikipedia, The Free Encyclopedia. Retrieved from: http://en.wikipedia.org/wiki/Iron_Bowl

APPENDIX

Table 1

Year	Alabama	Auburn
2001	31	7
2002	7	17
2003	23	28
2004	13	21
2005	18	28
2006	15	22
2007	10	17
2008	36	0
Total	153	140

Note: Scores extracted from "Iron Bowl," April 8, 2013, Wikipedia, The Free Encyclopedia.
Retrieved from: http://en.wikipedia.org/wiki/Iron_Bowl

Table 2

Descriptive Statistics

Measure	Spread
Mean	0.98
Population Standard Deviation	16.13
Miniumum	-44.00
Maximum	41.00
1st Quartile	-10.25
3rd Quartile	9.00

Empirical Rule	
Percent within 1 Standard Deviation	71.6%
Percent within 2 Standard Deviations	93.1%
Percent within 3 Standard Deviations	100.0%

Note: Statistics based on data from "Deep South's Oldest Rivalry," February 11, 2013, Wikipedia, The Free Encyclopedia. Retrieved from: http://en.wikipedia.org/wiki/Deep_South's_Oldest_Rivalry

Graph 1

BoxPlot

(BoxPlot with horizontal axis labeled "Spread" ranging from -80 to 80 in increments of 20)
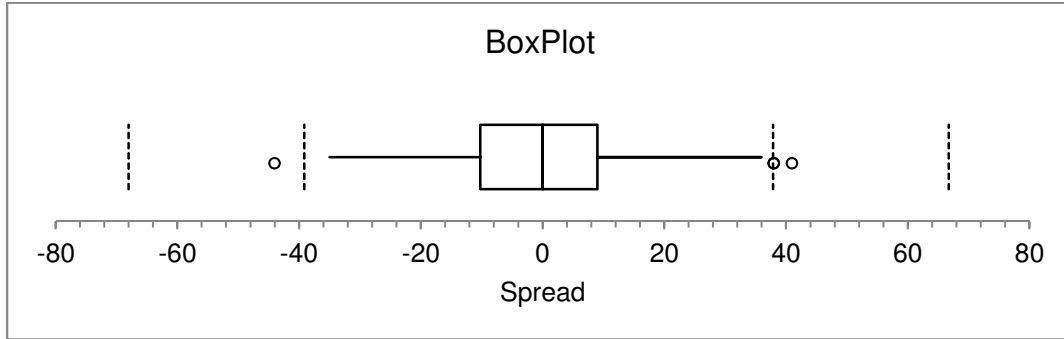
Table 3

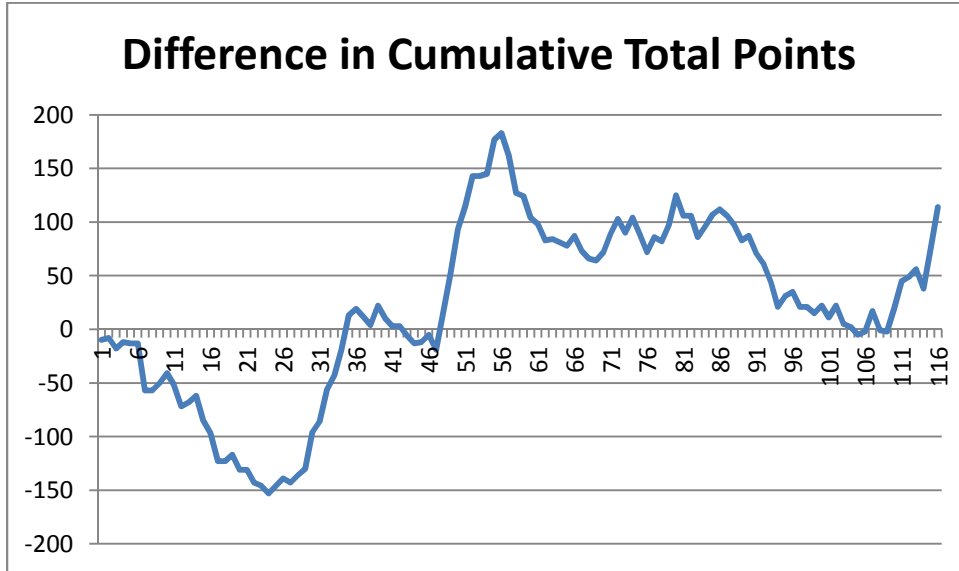|	Spread	Frequency	Percent
Auburn Wins	-41 to -50	1	0.9
	-31 to -40	1	0.9
	-21 to -30	4	3.4
	-11 to -20	23	19.8
	-1 to -10	25	21.6
Ties	0	8	6.9
Georgia Wins	1 to 10	29	25.0
	11 to 20	10	8.6
	21 to 30	7	6.0
	31 to 40	7	6.0
	41 to 50	1	0.9
		116	100.0

Note: Statistics based on scores from "Deep South's Oldest Rivalry," February 11, 2013, Wikipedia, The Free Encyclopedia. Retrieved from: http://en.wikipedia.org/wiki/Deep_South's_Oldest_Rivalry

Table 4

Spread	Frequency	Percent	Cumulative Percent
0	8	6.9	6.9
1 to 10	54	46.6	53.4
11 to 20	33	28.4	81.9
21 to 30	11	9.5	91.4
31 to 40	8	6.9	98.3
41 to 50	2	1.7	100.0
	116	100.0	

Note: Statistics based on scores from "Deep South's Oldest Rivalry," February 11, 2013, Wikipedia, The Free Encyclopedia. Retrieved from: http://en.wikipedia.org/wiki/Deep_South's_Oldest_Rivalry

Graph 2
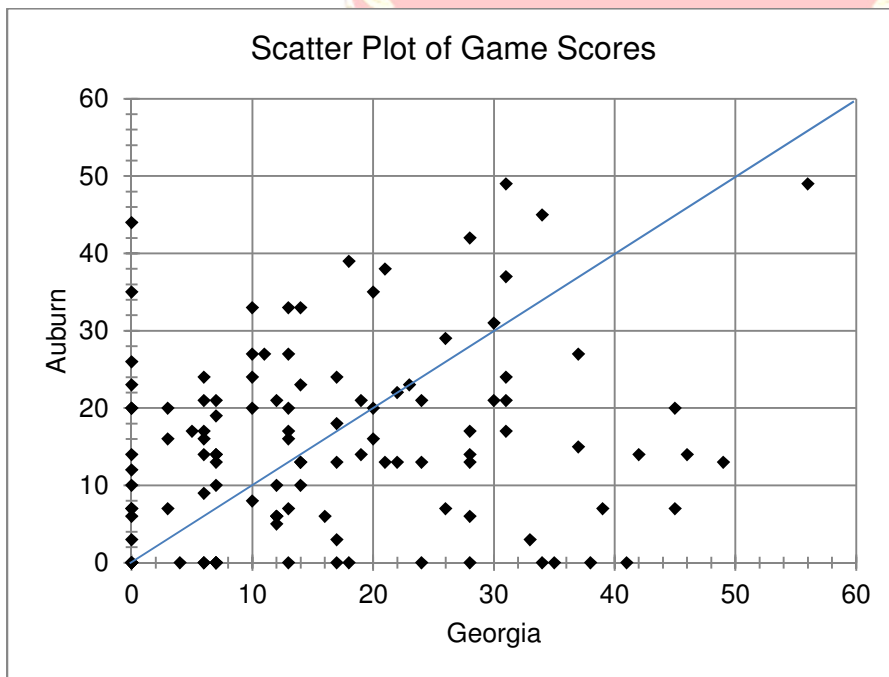
Note: Game scores extracted from "Deep South's Oldest Rivalry," February 11, 2013, Wikipedia, The Free Encyclopedia. Retrieved from: http://en.wikipedia.org/wiki/Deep_South's_Oldest_Rivalry

Graph 3

Difference in Cumulative Total Points

Note: Total points based on scores from "Deep South's Oldest Rivalry," February 11, 2013, Wikipedia, The Free Encyclopedia. Retrieved from: http://en.wikipedia.org/wiki/Deep_South's_Oldest_Rivalry
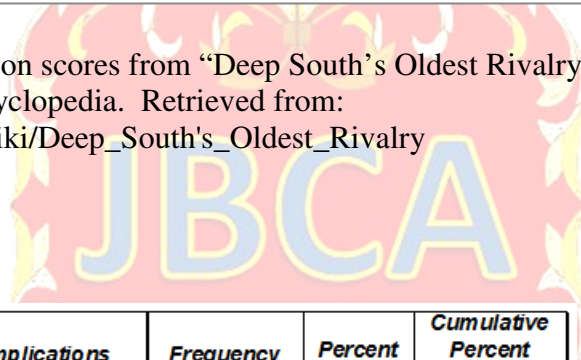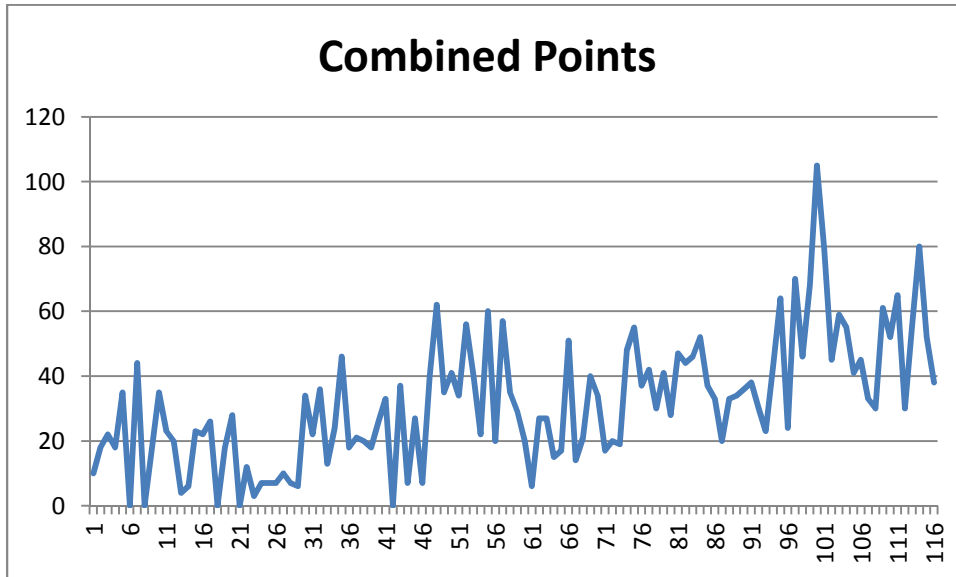
Table 5

Spread	Footbal Implications	Frequency	Percent	Cumulative Percent
0,1,2	Field Goal Wins	15	12.9	12.9
3	Field Goal Ties	6	5.2	18.1
4,5,6	Touchdown Wins	16	13.8	31.9
7	Touchdown Ties	13	11.2	43.1
8,9,10	Two Scores - TD & FG	12	10.3	53.4
11,12,13,14	Two Scores - 2 TDs	17	14.7	68.1
15-21	Three Scores	17	14.7	82.8
22+	Four Scores	20	17.2	100.0
		116	100	

Note: Spread based on game scores from "Deep South's Oldest Rivalry," February 11, 2013, Wikipedia, The Free Encyclopedia. Retrieved from: http://en.wikipedia.org/wiki/Deep_South's_Oldest_Rivalry

Graph 4

Combined Points

Note: Combined points based on scores from "Deep South's Oldest Rivalry," February 11, 2013, Wikipedia, The Free Encyclopedia. Retrieved from: http://en.wikipedia.org/wiki/Deep_South's_Oldest_Rivalry
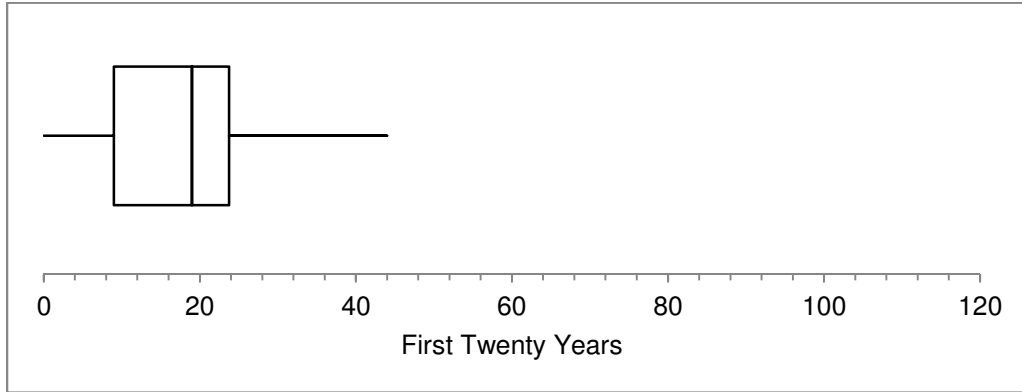
Table 6

Summary Measure	First Twenty	Last Twenty
Mean	18.5	55.5
Median	19.0	53.5
Standard Deviation	12.3	18.9
Range	44	75
Minimum	0	30
Maximum	44	105

Note: Statistics based on data from "Deep South's Oldest Rivalry," February 11, 2013, Wikipedia, The Free Encyclopedia. Retrieved from: http://en.wikipedia.org/wiki/Deep_South's_Oldest_Rivalry

Graph 5

First Twenty Years

Graph 6

Last Twenty Years