

# An Application of the Elo Rating System to College Football Rankings

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### **Abstract**

We will look into the use of the Elo Rating System to rank college football teams. The Elo system is a rating system used to rank player performance in zero-sum games such as chess. We will make use of how each team performed and apply their ratings to the Elo system. The teams that will be used are the 133 Football Bowl Subdivision (FBS) teams. After getting each team's final rating, we will then compare those ratings to the AP Top 25 Poll and to the Coaches Poll.

# 1 Introduction

College football rankings are a huge part of the sport and of the tradition of college football. The first Associated Press (AP) rankings were released in 1936. They featured 20 teams and they helped to determine a college football champion. At the end of the 1936 season, Minnesota sat atop of rankings, becoming the 1936 champions [7].

62 sportswriters and broadcasters throughout the country vote individually on the poll. Teams are given points based on what place they are voted for. For example, Number one would receive 25 points, two would receive 24 points and so on [8].

Here's a look of what the final AP poll from 1936 looked like:

**1936 Final AP Football Poll**

RANK	TEAM (FPV)	CONF	REC	PTS	LAST WEEK
1 < 1	<a href="#">Minnesota</a> (25)	Big Ten	7-1	332	DNP
2 < 2	<a href="#">LSU</a> (9)	SEC	9-0-1	309	
3 < 4	<a href="#">Pittsburgh</a>	Ind	7-1-1	227	
4 < 3	<a href="#">Alabama</a>	SEC	8-0-1	218	W 14-6 H Vanderbilt
5 < 6	<a href="#">Washington</a>	PCC	7-1-1	216	
6 < 5	<a href="#">Santa Clara</a> (1)	Ind	7-0	155	
7 < 7	<a href="#">Northwestern</a>	Big Ten	7-1	130	
8 < 9	<a href="#">Notre Dame</a>	Ind	6-2	107	
9 < 10	<a href="#">Nebraska</a>	Big 6	7-2	69	
10 < 13	<a href="#">Penn</a>	Ind	7-1	34	
11 < 11	<a href="#">Duke</a>	Southern	9-1	33	
12 < 16	<a href="#">Yale</a>	Ind	7-1	22	DNP
13 < 14	<a href="#">Dartmouth</a>	Ind	7-1-1	13	DNP
14 < 12	<a href="#">Duquesne</a>	Ind	7-2	12	DNP
15 < 8	<a href="#">Fordham</a>	Ind	5-1-2	11	
16 < 18	<a href="#">TCU</a>	Southwest	7-2-2	10	T 0-0 A SMU
17 < 17	<a href="#">Tennessee</a>	SEC	6-2-1	8	
18 < NR	<a href="#">Arkansas</a>	Southwest	6-3	6	
18 < NR	<a href="#">Navy</a>	Ind	6-3	6	
20 < 15	<a href="#">Marquette</a>	Ind	7-1	4	DNP
NR < 19	<a href="#">Tulane</a>	SEC		0	
NR < 20	<a href="#">Washington State</a>	PCC		0	

In 1950 The Coach's Poll began selecting the top 20 teams on a weekly Basis. A panel of Football Bowl Subdivision (FBS) coaches is chosen by a random draw of coaches who are willing to participate. Much like the AP Top 25 poll, Each coach submits a Top 25 with the first place vote being worth 25 points and so on [2].

Here's what the final Coach's Poll from 1950 looked like:

Ranking	Team	Conference	Bowl
1	Oklahoma	Big Seven	Lost Sugar, 7–13
2	Texas	Southwest	Lost Cotton, 14–20
3	Tennessee	SEC	Won Cotton, 20–14
4	California	Pacific Coast	Lost Rose, 6–14
5	Army	Independent	none
6	Michigan	Big Ten	Won Rose, 14–6
7	Kentucky	SEC	Won Sugar, 13–7
8	Princeton	Independent	none
9	Michigan State	Independent	
10	Ohio State	Big Ten	
11	Illinois	Big Ten	
12	Clemson	Southern	Won Orange, 15–14
13	Miami (FL)	Independent	Lost Orange, 14–15
14	Wyoming	Skyline	none
15	Baylor	Southwest	
	Washington	Pacific Coast	
17	Alabama	SEC	
18	Washington & Lee	Southern	
19	Navy	Independent	
20	Cornell	Independent	
	Nebraska	Big Seven	
	Wisconsin	Big Ten	

While these two polls are generally in accord with one another there have been instances where the polls disagree at the end of the season. There has been eleven different instances where the Coach's Poll has had a different number one team at the end of the season [Coaches Poll].

As these two polls are both voted on by humans, some bias may come into play. In 2012, The University of Southern California's coach Lane Kiffin resigned as a voter after just one vote. He voted USC as the number one team in the country and was met with backlash after saying he wouldn't vote for USC as the best team in the nation. It was later revealed he did vote for USC as the best team and later resigned [4].

With the possibility of human error or bias, a different way to rank teams may need to come into play. This paper will focus on the Elo Rating System. Using the Elo system and applying it to sports rankings will take all of the human error out of the equation. However, this paper will also look at if the Elo system would be a viable replacement to human polls.

## 1.1 Topics

This paper will look at the history of the Elo rating system, the math behind Elo, applying the Elo system to college rankings, and a comparison of our final Elo ratings to the AP Top 25 Poll and to the Coaches Poll.

## 2 History of The Elo Rating System

The Elo rating system was created by Arpad Elo who was a Hungarian-American physics professor. Elo attended the University of Chicago where he studied physics. He would later go on to become a professor of Physics at the University of Marquette. He was a master-level chess player and a part of the United States Chess Federation (USCF). In 1950's, on the organizations behalf, he devised a new system for rating players. He would base this system off of known ideas from statistics including expected value, random variables and probabilistic distributions [9].

In 1959, the USCF officially asked Elo to improve the Harkness rating system. Kenneth Harkness was originally from Glasgow, Scotland and was an integral part of United States chess for more than a third a of century. He was the creator of the Harkness rating system which was adopted by the International Chess Federation and was used in international competition until 1970 [6]. When players compete in a tournament, the average rating of their competition is calculated. If a player scores a 50

percent, they will receive the average competition rating as their new rating. If they score more than 50 percent, their new rating is the competition average plus 10 points per percentage point exceeding 50. If they score less than 50 percent, the new rating is the competition average minus 10 points per percentage point shy of 50 [3].

For example, A player rated 1600 plays in an eleven round tournament. They score 2.5 - 8.5(22.7 percent) against competition with an average rating of 1850. This would be 27.3 percent below 50 percent (50-22.7), so their new rating is  $1850 - (10 \times 27.3) = 1577$  [3].

The Elo system is a method for calculating the relative skills of players in zero-sum games such as chess. A zero-sum game is one in which no "wealth" is created or destroyed. In a two player zero-sum game, such as chess, when one player wins, the other player loses. So, the players share no common interests. There are two general types of zero-sum games: one's with perfect information and those without perfect information. Chess falls into the perfect information category because every player knows the result of the previous move [11].

Elo's system would replace earlier systems of competitive rewards with a system based on statistical estimation. There are many rating systems that reward points based on the greatness of certain achievements. For example, winning an important golf tournament may result in more points than winning a lesser one [10]. By using a statistical system, the results will rely on underlying variables which represent the ability of each player.

One of Elo's main assumptions was that the chess performance of each player in each game is a normally distributed random variable. A player may perform significantly better or worse from game to game, however Elo assumed the mean value of the performances of any given player changes slowly over time. Elo considered the true skill of the player as the mean of that player's performance random variables [5].

Another assumption Elo had was that performance could not be based on what a player did in a game but would have to be based on whether that player won, lost, or drew. So, if a player wins a game, they are assumed to have performed at a higher level than their opponent for that game. On the other hand, if that player loses, then they are assumed to have performed at a lower level than their opponent. If the game ends in a draw, the two players are assumed to have performed at nearly the same level [5].

The difference between two players ratings serves as a predictor of the outcome of the match. If two players have an equal rating and play against each other, they are expected to score an equal number of wins. A player who has a rating of 100 more than their opponent is expected to score 64 percent. If the difference is 200 points, then the expected score for the higher rated player is 76 percent [9].

A player's Elo rating is based on head to head match-ups. After every game, the winning player takes "rating points" from the other player. The difference between the ratings of each player determine how many points are taken. If a player with a higher rating wins, then only a few points will be taken from the losing player. However if a player with a lower rating wins, more points will be taken from the losing player and given to the winner[5].

While Elo invented his system as an improvement over the previously used Harkness system, it is also used a rating system in association football, American football, baseball, basketball, pool, board games, and esports [10].

## 3 Math Behind Elo

### 3.1 Performance Ratings in Chess

In chess the performance rating is calculated using the algorithm of 400. So for each win, add your opponents rating plus 400. For each loss, add your opponents rating minus 400. Then divide this sum by the total number of games played. This gives us the formula:

$$\frac{\text{total of opponent's rankings} + 400 \times (\text{wins} - \text{losses})}{\text{games}}$$

For example if you beat 2 opponents each with ratings of 1000 we would get:

$$\frac{2000+400(2-0)}{2} = 1400 \text{ [10].}$$

While Elo does not directly use this formula, he does use the algorithm of 400 in his expected ratings as we will see in the next section.

### 3.2 Expected Rating

When two players are matched against each other there are two expected scores, the expected score of player A and of player B. The two formulas are:

- $E_A = \frac{1}{1+10^{(R_B-R_A)/400}}$
- $E_B = \frac{1}{1+10^{(R_A-R_B)/400}}$

Say player A has a rating of 1000 and player B has a rating of 900. Plugging in these numbers we get:

- $E_A = \frac{1}{1+10^{(900-1000)/400}} = 0.64$
- $E_B = \frac{1}{1+10^{(1000-900)/400}} = 0.36$  [5]

We get two expected ratings from these formulas which are 0.64 and 0.36 respectively. We can see by adding these two numbers we get that they are equal to 1. Since these formulas represent all possible outcomes of a match between two players, and in this context, there are only two outcomes: either player A wins or player B wins. Hence the sum of the probabilities of all possible outcomes must equal one.

*Proof.* Let  $E_A = \frac{1}{1+10^{(900-1000)/400}}$  and let  $E_B = \frac{1}{1+10^{(R_A-R_B)/400}}$ .

Notice that  $10^{(R_A-R_B)/400} = \frac{1}{10^{(R_B-R_A)/400}}$ . Using this we can write  $E_B$  as:

$$\frac{1}{1+10^{(R_A-R_B)/400}} = \frac{1}{1+\frac{1}{10^{(R_B-R_A)/400}}}$$

$$\text{Then, } E_B = \frac{1}{1+\frac{1}{10^{(R_B-R_A)/400}}} = \frac{10^{(R_B-R_A)/400}}{10^{(R_B-R_A)/400}+1}$$

$$\text{Since } E_A = \frac{1}{1+10^{(R_B-R_A)/400}} \text{ and } E_B = \frac{10^{(R_B-R_A)/400}}{10^{(R_B-R_A)/400}+1}$$

$$\text{Then, } E_A + E_B = \frac{1}{1+10^{(R_B-R_A)/400}} + \frac{10^{(R_B-R_A)/400}}{10^{(R_B-R_A)/400}+1}$$

Since both fractions have the same denominator we get:

$$E_A + E_B = \frac{1+10^{(R_B-R_A)/400}}{1+10^{(R_B-R_A)/400}} = 1$$

Hence  $E_A + E_B = 1$

■

These formulas come from the logistic curve function using base 10 [5]. The logistic curve in general form is as follows:

$$L(x) = \frac{1}{1+e^{-kx}}$$

In the context of Elo ratings, the difference between the ratings of two players A and B ( $R_A - R_B$ ) is the input to the logistic function. The difference is scaled to ensure the probabilities fit within the logistic model. The logistic function we use is:

$$E_A = \frac{1}{1+10^{(R_B-R_A)/400}}$$

The number 400 is a scaling factor determined empirically to fit the performance of chess players and to make the differences in ratings meaningful in terms of probabilities.

Let's derive the expected rating formula from the logistic curve.

*Proof.* Let  $L(x) = \frac{1}{1+e^{-kx}}$  and let  $x = (R_B - R_A)$

Then  $L(R_B - R_A) = \frac{1}{1+e^{-k(R_B - R_A)}}$

To fit the logistic model used in Elo ratings, convert the base of exponent from e to 10.

let  $e^x = 10^{x/\ln(10)}$  then,

$$e^{-k(R_A - R_B)} = 10^{-(k/\ln(10))(R_A - R_B)}$$

Through empirical data, it is determined that  $k/\ln(10) = 1/400$  which gives us:

$10^{-(R_B - R_A)/400}$ . Now replacing the exponent part in the logistic function we get:

$$E_A = \frac{1}{1+10^{(R_B - R_A)/400}}$$

Hence giving us the expected rating formula for Elo.

■

### 3.3 Actual Rating

The actual rating is a bit simpler. A player receives 1 point for a win, 0.5 point for a draw and 0 points for a loss.

### 3.4 K-Factor

The United States Chess Federation has a classification system that puts players into classes. The ratings start at 100-199, 200-399 and up to 2400+. The K-factor is arbitrary so it is chosen based on the association. The K-factor is chosen so more experienced players don't increase their rating as quickly as less experienced players and less experienced players have the opportunity to grow more quickly [3]. A K-factor may look like:

K = 32 for players under 2100

K = 24 for players between 2100 and 2400

K = 16 for players above 2400

### 3.5 Updating Player Rating

After each game or tournament, the players rating is updated. The formula for which is:

$$\bullet R'_A = R_A + K(S_A - E_A) \text{ [5]}$$

For example, say player A has a rating of 1613 and plays 5 opponents. They lose to a player with rating 1609, draw with a player rated 1477, defeat a player rated 1388, defeat a player rated 1586 and lose to player rated 1720.

We know the actual score is  $(0 + 0.5 + 1 + 1 + 0) = 2.5$

From the formula above we can figure out the expected scores.

$$\text{For the first expected rating we get: } E_A = \frac{1}{1+10^{(1609-1613)/400}} = 0.51$$

For the next four we get: 0.69, 0.79, 0.54, 0.35. Adding them we get  $(0.51 + 0.69 + 0.79 + 0.54 + 0.35) = 2.88$

Now using the formula  $R'_A = R_A + K(S_A - E_A)$  we get:

$$R'_A = 1613 + 32(2.5 - 2.88) = 1601$$

This is our new player rating and the rating they will use going forward for future competitions. Now that we have the math behind Elo, we are ready to Apply the Elo system to college football.

## 4 Applying the Elo System to College Football

133 FBS teams played at least 12 games over the course of 21 weeks in the 2023 college football season. On August 26, 2023 at 2:30 pm, Notre Dame and Navy kicked off the season with Notre Dame defeating Navy 42 to 3. Nearly four and half months later the season would come to a close on January 8, 2024 with Michigan defeating Washington to win the National Championship. In between those two games there took place 1596 regular season games, 10 conference championship games, and 43 bowl games [1]. With so many games happening throughout the season, it was essential to find a way to efficiently rate each team. While it would be possible to go through each team and rate them by hand, this would take too much time. Finding each teams ratings after week one would be relatively easy. You would just have to look at their rating and their opponents rating and whether they won or lost. However, after this, things get a little more complicated. If you were to go through the season team by team, you would constantly have to jump from team to team to have the correct rating going forward. To be able to rate 133 teams and analyze over 1500 games, we will make use of a simple python program and Google Spreadsheets.

### 4.1 Python and Google Spreadsheets

Here is a look at the python program we wrote to make rating every team possible:

```
1 import pandas as pd
2
3 # Read initial ratings from CSV
4 initial_ratings = pd.read_csv('initial_ratings3 - initial_ratings.csv')
5 teams = dict(zip(initial_ratings['Team'], initial_ratings['Rating']))
6
7 # Read matchups from CSV
8 matchups = pd.read_csv('matchups - matchups.csv')
9
10 # Check if necessary columns exist in the matchups DataFrame
11 required_columns = ['Week', 'Team 1', 'Team 2', 'Team 1 Score', 'Team 2 Score']
12 for col in required_columns:
13     if col not in matchups.columns:
14         raise ValueError(f'column {col} is missing from the matchups CSV file.')
15
16 # Function to convert scores to integers, handling errors
17 def convert_scores(scores):
18     return pd.to_numeric(scores, errors='coerce')
19
20 matchups['Team 1 Score'] = convert_scores(matchups['Team 1 Score'])
21 matchups['Team 2 Score'] = convert_scores(matchups['Team 2 Score'])
22
23 # Check for rows with missing or invalid scores and remove them
24 matchups.dropna(subset=['Team 1 Score', 'Team 2 Score'], inplace=True)
25
26 # Convert scores to integers
27 matchups['Team 1 Score'] = matchups['Team 1 Score'].astype(int)
28 matchups['Team 2 Score'] = matchups['Team 2 Score'].astype(int)
29
30 # Convert week to integers
31 matchups['Week'] = matchups['Week'].astype(int)
32
33 # Elo rating calculation function
34 def calculate_elo_rating(R1, R2, score1, score2, week):
35     if 0 <= week <= 4:
36         K = 32
37     elif 5 <= week <= 8:
38         K = 24
39     else:
40         K = 16
```



```

22 E1 = 1 / (1 + 10 ** ((R2 - R1) / 400))
23 E2 = 1 / (1 + 10 ** ((R1 - R2) / 400))
24 W1 = 1 if score1 > score2 else 0
25 W2 = 1 if score2 > score1 else 0
26 new_R1 = R1 + K * (W1 - E1)
27 new_R2 = R2 + K * (W2 - E2)
28 return new_R1, new_R2
29
30 # DataFrame to store ratings week by week
31 rating_history = pd.DataFrame(columns=['Week', 'Team', 'Rating'])
32
33 # Update ratings based on matches
34 for index, match in matches.iterrows():
35     week = match['Week']
36     team1, team2 = match['Team 1'], match['Team 2']
37     score1, score2 = match['Team 1 Score'], match['Team 2 Score']
38
39     R1, R2 = teams[team1], teams[team2]
40     new_R1, new_R2 = calculate_elo_rating(R1, R2, score1, score2, week)
41
42     teams[team1], teams[team2] = new_R1, new_R2
43
44     rating_history = pd.concat([rating_history, pd.DataFrame([{'Week': week, 'Team': team1, 'Rating': new_R1}, {'Week': week,
45     'Team': team2, 'Rating': new_R2}]), ignore_index=True)
46
47 # Display final ratings
48 print("Final Ratings:")
49 final_ratings_df = pd.DataFrame(list(teams.items()), columns=['Team', 'Rating'])
50
51 # Set display options to show all rows
52 pd.set_option('display.max_rows', None)
53
54 print(final_ratings_df)
55
56 # Save rating history to CSV
57 rating_history.to_csv('rating_history.csv', index=False)
58
59 # Display all data
60 print("\nRating History:")
61 print(rating_history)
62

```

This program makes use of pandas library for data manipulation. We have two Google spreadsheets: one being the match-ups and results of every game played throughout the season. The other being a list of every team and their initial rating. It reads initial team ratings from a CSV file, then stores the ratings in a dictionary 'teams' where the key is the team name and the value is the rating. It reads match-ups from another CSV file where the necessary columns are checked in the match-ups DataFrame to ensure all required data is available. The program then takes the scores and converts them to integers while also removing an invalid or missing scores. It then makes use of the math behind Elo, calculating each teams rating week by week. Finally the program outputs every teams final rating along with every teams week to week rating.

## 4.2 The Initial Trial

Before we can begin rating teams we need to assign each team an initial rating and determine the k-factor. Initially we looked back on the previous season to determine both. Initial rating was determined by how many wins each team had the year prior. Here's what that looked like:

0-3 wins = 800 rating  
4-5 wins = 900 rating  
6-8 wins = 1000 rating  
9-11 wins = 1100 rating  
12+ wins = 1200 rating

The k-factor would also be based on the previous seasons performance:

0-5 wins = 32 k-factor  
6-8 wins = 24 k-factor  
9+ wins = 16 k-factor

After applying each rating and k-factor to each team and inputting them into our python program, we noticed that teams were not rising or falling much in terms of Elo rating. Firstly let's take a look at the two teams who played in the National Championship game: Michigan and Washington.

	Initial Rating	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Game 7	Game 8	Game 9	Game 10	Game 11	Game 12	Game 13	Game 14	Game 15
Washington	1100	1100	1111.806618	1115.746665	1119.482546	1123.317155	1131.108535	1132.88863	1134.841858	1142.179967	1149.30078	1156.527691	1160.396106	1167.944441	1174.876158	1168.624823
Michigan	1200	1203.844049	1206.282502	1209.889032	1212.486841	1214.745665	1220.117538	1222.469705	1224.455355	1227.261159	1232.905266	1236.11917	1242.071091	1246.112543	1252.065091	1258.316427
Clemson	1100	1092	1093.516598	1097.464314	1089.888025	1096.637879	1102.509334	1090.658068	1080.330354	1089.227584	1093.589357	1102.159086	1107.67801	1113.642358		
Florida State	1100	1113.666427	1115.883098	1123.459387	1125.81269	1131.374175	1138.977846	1143.753961	1149.685416	1153.29358	1154.390187	1158.777335	1164.504533	1157.912385		

Michigan and Washington started with initial ratings of 1200 and 1100 respectively. As we look over the course of the season, we can see both teams had a slow but steady rise. They would go into the championship game both undefeated. Michigan would enter the game with a rating of 1252.07 while Washington would enter with a rating of 1174.88. Seeing such a large gap between what should be the best two teams in the country was a bit concerning. Throughout the season both teams made small

jumps in rating game after game, while this does reflex each team winning, it was not a good indicator of how good each team actually was.

We can also look at Clemson and Florida State. Clemson was up and down for the first part of the season but they ended up finishing strong and ending with a rating of 1113.64. This was only a 13.64 difference from where they started the season. Much like Michigan and Washington, Florida State went into their last game undefeated as well before finally losing. They had a steady climb throughout the season, however they would only go up about four rating points per game. After seeing how the initial trial went, it was time to make some changes to our initial ratings and to our k-factor.

### 4.3 Final Trial

Based on the initial trial, initial rating and k-factor will no longer be based on the previous season. Instead each team will receive an initial rating of 1500 and the k-factor will be based on the week of the season. For example, weeks 0-4 will have a k-factor of 32, weeks 5-8 will have a k-factor of 24, and weeks 9 and on will have a k-factor of 16. The idea behind k-factor being weekly was that teams are going to slowly progress through the season. Meaning that teams are going to find their identity throughout the season. For example, a mediocre team may win their first 4 or 5 games as a result of an easier early season schedule but then go on to lose 4 to 5 games to end the season. Having a k-factor that changes throughout the weeks of the season will give our ratings more balance.

Having each team start with a rating of 1500 will also help balance our ratings. Teams will still rise and fall but there should not be such a large discrepancy between top teams like we saw in the initial trial.

### 4.4 Final Trial Round One

To get more accurate final ratings, we will run the program through three rounds. The first round will use initial ratings of 1500 for each team. After running the program, we will get each teams final rating which will then be used as their initial ratings for round 2. Here is a look at each teams rating from round one:

Round 1											
1 Michigan	1642.652874	26 Air Force	1558.291968	51 Georgia State	1527.931025	76 Georgia Southern	1500.350385	101 Michigan State	1474.986318	126 Louisiana-Mon	1442.509081
2 Washington	1625.924159	27 Oklahoma Stat	1556.108938	52 Rutgers	1526.347227	77 South Florida	1500.047062	102 Arkansas	1469.276223	127 Texas-El Paso	1441.47621
3 Georgia	1620.439884	28 Kansas	1555.53894	53 Northwestern	1526.263772	78 Washington St	1499.736951	103 Hawaii	1467.65204	128 Charlotte	1441.170303
4 Florida State	1613.886108	29 Clemson	1555.517695	54 North Carolina S	1525.400156	79 Louisiana	1499.585281	104 Houston	1467.19995	129 Massachusetts	1434.930337
5 Liberty	1605.470852	30 Tennessee	1553.821877	55 Miami (FL)	1521.556521	80 San Jose State	1499.185853	105 San Diego Stat	1466.637977	130 Vanderbilt	1433.609105
6 Alabama	1597.749669	31 Fresno State	1552.884722	56 Utah	1521.270247	81 California	1498.354835	106 Purdue	1466.627328	131 Temple	1426.103557
7 Texas	1597.379445	32 Wyoming	1549.985524	57 Wisconsin	1518.978689	82 Minnesota	1498.061977	107 Connecticut	1466.307736	132 East Carolina	1421.73801
8 Oregon	1596.417482	33 Oregon State	1549.599916	58 Texas A&M	1517.359078	83 Old Dominion	1497.369224	108 Tulsa	1465.415762	133 Kent State	1411.478434
9 Missouri	1592.987915	34 Kansas State	1548.53563	59 Southern Illinois	1516.736307	84 Texas Christian	1495.492587	109 Florida Atlantic	1464.856451		
10 James Madison	1588.579006	35 Southern Califor	1548.011891	60 Sacramento St	1516	85 Eastern Michiga	1494.933393	110 Middle Tennessee	1461.107826		
11 Mississippi	1582.36734	36 North Carolina	1547.637101	61 Boise State	1515.550648	86 Rice	1494.171466	111 Western Michigan	1460.600553		
12 Oklahoma	1579.348665	37 West Virginia	1547.610184	62 Iowa State	1514.862163	87 Arkansas State	1489.609452	112 Alabama-Birmi	1460.11257		
13 Penn State	1576.718506	38 Iowa	1546.711094	63 South Alabama	1513.825668	88 Utah State	1487.834123	113 New Mexico	1459.415559		
14 Notre Dame	1576.297186	39 Duke	1543.869993	64 Georgia Tech	1512.686438	89 Mississippi State	1487.794465	114 Ball State	1456.451119		
15 Miami (OH)	1574.670491	40 Jacksonville St	1542.884351	65 Texas Tech	1510.42984	90 Central Michigi	1485.880774	115 Stanford	1455.974884		
16 Ohio State	1574.364781	41 Nevada-Las Ve	1540.759278	66 Virginia Tech	1509.048375	91 Nebraska	1485.09586	116 Pittsburgh	1455.466391		
17 Louisiana State	1572.366248	42 Maryland	1539.989639	67 Boston College	1506.931558	92 North Texas	1484.443639	117 Cincinnati	1454.785954		
18 Toledo	1570.435786	43 New Mexico Sta	1539.773253	68 Auburn	1504.381661	93 South Carolina	1484.057139	118 Arizona State	1451.391258		
19 Tulane	1568.502995	44 UCLA	1538.19887	69 Bowling Green	1503.005766	94 Illinois	1483.298314	119 Baylor	1449.570016		
20 Troy	1566.785786	45 Appalachian St	1537.148704	70 Florida	1502.773099	95 Navy	1482.912895	120 Akron	1446.122147		
21 Arizona	1565.67124	46 Texas-San Anti	1534.318223	71 Syracuse	1502.668123	96 Colorado State	1481.916262	121 Virginia	1444.488251		
22 Southern Metho	1565.623718	47 Texas State	1532.023171	72 Army	1502.506594	97 Marshall	1480.86646	122 Florida Internat	1444.403575		
23 Louisville	1563.481219	48 Coastal Carolina	1530.285996	73 Northern Illinois	1501.783415	98 Colorado	1480.313415	123 Buffalo	1444.382639		
24 Memphis	1562.398751	49 Western Kentuck	1528.805244	74 Brigham Young	1501.451203	99 Wake Forest	1478.789143	124 Louisiana Tech	1443.718852		
25 Ohio	1562.226434	50 Kentucky	1528.1966	75 Central Florida	1500.737948	100 Indiana	1476.157708	125 Southern Missis	1442.699501		

As we can see from our final ratings from round one, Michigan and Washington are much closer in rating points than the initial trial. Georgia, Florida State, and Liberty follow closely behind Washington to round out the top 5. We will now use these ratings as our initial ratings for round 2.

### 4.5 Final Trial Round Two

Similarly to round one, we will take our final ratings from round one and use them as our initial ratings for the second round. Here is a look at each teams final rating once again:

[illegible]

#### 4.6 Final Trial Round Three

Round 3											
1 Michigan	1816.858916	26 Oklahoma State	1629.117345	51 North Carolina S	1564.328277	76 Army	1508.043478	101 North Texas	1457.103601	126 Louisiana Tech	1376.555486
2 Washington	1786.65935	27 Kansas	1626.809998	52 Georgia State	1563.63358	77 Brigham Young	1506.327482	102 Purdue	1444.419391	127 Akron	1375.206551
3 Georgia	1767.981903	28 Air Force	1625.58317	53 Northwestern	1563.726629	78 Central Florida	1505.354572	103 Arkansas	1441.929926	128 Charlotte	1374.332924
4 Florida State	1758.73075	29 Tennessee	1625.013104	54 Miami (FL)	1560.773232	79 Georgia Southern	1504.894698	104 San Diego State	1438.303674	129 Massachusetts	1373.018499
5 Texas	1731.845172	30 Kansas State	1623.762463	55 Texas State	1558.854062	80 Florida State	1501.369816	105 Houston	1435.987844	130 Vanderbilt	1371.749459
6 Alabama	1729.959761	31 Ohio	1619.564641	56 Utah	1557.157133	81 Texas Christian	1500.045389	106 Connecticut	1430.941398	131 Temple	1338.406066
7 Liberty	1727.460647	32 Wyoming	1618.77632	57 Iowa State	1551.055546	82 Old Dominion	1499.398172	107 Tulsa	1430.451456	132 East Carolina	1338.630804
8 Oregon	1718.991926	33 Oregon State	1617.684013	58 Southern Illinois	1548.096886	83 Northern Illinois	1499.107869	108 Hawaii	1429.650667	133 Kent State	1306.412805
9 Missouri	1715.10114	34 Southern Califor	1611.776192	59 Boise State	1547.359683	84 Louisiana	1495.255188	109 Florida Atlantic	1426.764402		
10 Mississippi	1701.655143	35 Duke	1610.87048	60 Texas A&M	1546.09679	85 Mississippi State	1488.494387	110 Middle Tennessee	1423.702118		
11 James Madison	1697.214701	36 North Carolina	1609.216791	61 Wisconsin	1545.389334	86 Rice	1486.683964	111 Western Michigan	1422.458042		
12 Oklahoma	1686.956861	37 Iowa	1606.586221	62 Georgia Tech	1534.593108	87 North Carolina	1485.679654	112 Stanford	1422.477991		
13 Penn State	1676.877194	38 West Virginia	1605.337359	63 Sacramento State	1541.409355	88 Arkansas State	1485.249548	113 Alabama-Birmi	1420.474938		
14 Ohio State	1676.077919	39 Fresno State	1604.568261	64 Texas Tech	1538.724166	89 Illinois	1484.324366	114 New Mexico	1415.051002		
15 Louisiana State	1675.101038	40 Nevada-Las Veg	1599.907372	65 South Alabama	1536.934392	90 Utah State	1480.282574	115 Pittsburgh	1414.845425		
16 Notre Dame	1672.773394	41 Maryland	1588.483429	66 Virginia Tech	1524.797593	91 Eastern Michigan	1475.603706	116 Ball State	1411.960306		
17 Troy	1652.409218	42 Jacksonville St	1587.204388	67 Boston College	1523.951643	92 Nebraska	1473.599194	117 Arizona State	1410.973118		
18 Miami (OH)	1648.71783	43 UCLA	1586.580599	68 Auburn	1521.904992	93 Central Michig	1467.520791	118 Cincinnati	1410.106488		
19 Tulane	1648.14976	44 Appalachian S	1582.477252	69 Bowling Green	1521.464269	94 Michigan State	1467.521468	119 Baylor	1399.948994		
20 Arizona	1646.686874	45 New Mexico S	1575.865568	70 Florida	1518.639308	95 Colorado	1465.649393	120 Virginia	1395.92939		
21 Louisville	1644.563568	46 Coastal Carolina	1574.193574	71 San Jose State	1513.138136	96 Indiana	1464.572312	121 Southern Missi	1389.789668		
22 Toledo	1643.946411	47 Kentucky	1569.173047	72 Washington St	1511.734851	97 Navy	1464.468052	122 Buffalo	1387.117503		
23 Memphis	1638.005233	48 Mississippi St	1568.262323	73 Arkansas	1511.623285	98 Texas Forest	1461.603289	123 Texas-El Paso	1382.477498		
24 Southern Metho	1633.474409	49 Texas-San Anto	1567.006248	74 Marshall	1510.489796	99 Marshall	1461.363042	124 Louisiana-Monr	1378.633319		
25 Clemson	1631.227279	50 Western Kentuc	1565.399346	75 California	1509.451856	100 Colorado S	1458.076248	125 Florida Internat	137.099528		

#### 4.7 A Week to Week look at Each Teams Rating

Team	Initial Ratings	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Game 7	Game 8	Game 9	Game 10	Game 11	Game 12	Game 13	Game 14
Air Force	1597.512553	1607.945946	1614.020696	1625.08955	1632.501405	1638.01674	1650.445484	1654.794792	1658.776957	1646.843184	1634.133766	1625.549165	1615.510873	1625.50317	
Akron	1405.800093	1420.473526	1438.633016	1428.45884	1418.660747	1405.210885	1395.203404	1386.029102	1380.873893	1387.621372	1384.001786	1378.538495	1375.206551		
Alabama	1671.483787	1678.112927	1662.217692	1671.319515	1683.645545	1689.739624	1697.519602	1702.260622	1708.210355	1715.098537	1720.154243	1723.506187	1727.506625	1736.452379	1729.959761
Alabama-Birmi	1436.086902	1453.502265	1440.383311	1426.795358	1423.097824	1417.412824	1432.734952	1423.991965	1420.105314	1428.936205	1421.740644	1428.051696	1420.547209		
Appalachian St	1563.225033	1573.926867	1558.842402	1566.437943	1555.539847	1563.406457	1550.712339	1541.371519	1545.982285	1552.063022	1560.387722	1572.044646	1578.79521	1572.533743	1582.477255
Arizona	1611.528801	1621.799989	1600.382743	1608.199534	1614.473728	1606.703564	1595.386658	1605.91006	1614.595026	1622.256311	1627.230827	1633.834786	1637.363258	1646.686874	
Arizona State	1425.234642	1441.889265	1432.993738	1424.311511	1418.23056	1409.399817	1400.490994	1398.701324	1409.729117	1405.087509	1417.022902	1414.501519	1410.973118		
Arkansas	1451.794462	1468.509072	1478.885862	1465.067887	1458.570602	1449.763821	1444.715932	1440.175272	1433.555051	1443.968665	1437.995709	1444.858742	1441.929926		
Arkansas State	1467.115551	1476.35661	1466.433119	1482.4055	1492.103943	1482.772285	1485.630132	1491.731923	1500.358822	1492.900118	1502.310507	1493.301234	1485.24954		
Army	1505.316442	1484.795525	1499.155585	1517.528191	1506.531507	1494.501905	1486.815907	1482.41576	1471.742509	1483.676282	1490.640585	1500.707473	1508.043478		
Auburn	1512.343831	1524.200791	1539.871152	1552.772238	1540.362121	1534.235267	1525.997941	1521.16297	1529.087401	1533.962082	1539.935039	1532.694629	1528.639991	1521.904992	
Ball State	1429.782465	1419.131365	1414.102311	1430.510148	1421.330584	1409.473283	1399.719756	1394.708414	1404.801089	1399.368262	1409.405797	1415.295629	1411.960306		
Baylor	1418.909045	1408.663957	1397.740129	1415.070376	1411.327399	1427.336195	1418.362622	1426.572598	1421.203434	1413.830004	1409.995559	1403.985642	1399.948994		
Boise State	1532.061332	1552.837134	1507.290008	1521.438417	1531.460455	1522.604515	1533.053385	1518.347164	1528.547581	1522.718308	1528.311109	1535.367839	1545.386931	1554.800041	1547.359683
Boston College	1515.417301	1498.751487	1512.625739	1504.981378	1497.436146	1507.674463	1517.704064	1526.011453	1531.780653	1539.580741	1530.815805	1520.106508	1513.064564	1523.951643	
Bowling Green	1511.677768	1502.722674	1517.112852	1510.590619	1501.897699	1514.84695	1506.618741	1515.219058	1520.374268	1525.807094	1529.542468	1524.246705	1530.113681	1521.464269	
Brigham Young	1503.578748	1514.701081	1526.565006	1540.382961	1531.192724	1540.201679	1526.971771	1534.728667	1530.474674	1523.780612	1515.253985	1511.896155	1506.367372		
Buffalo	1410.019146	1399.489284	1389.111807	1384.418017	1376.478689	1389.526731	1405.419625	1398.619508	1403.356601	1400.157975	1396.337371	1393.236635	1387.117503		
California	1502.536934	1517.041757	1501.371396	1517.502865	1512.217416	1521.048158	1512.240268	1501.549548	1496.11152	1492.304778	1500.845042	1507.284199	1517.131661	1509.451856	
Central Florida	1502.561378	1511.96921	1528.515536	1541.907343	1532.025985	1516.017189	1507.604964	1503.568336	1497.332556	1503.479559	1514.255945	1506.555886	1513.096053	1505.625482	
Central Michigi	1475.455973	1459.071159	1475.418954	1467.191098	1481.87977	1494.073356	1478.580262	1487.754563	1477.661889	1486.13709	1476.787961	1471.620639	1467.527011		
Charlotte	1401.835396	1419.4481	1410.329435	1401.293149	1393.55936	1387.829692	1378.617994	1385.98462	1379.4371	1388.93108	1385.804202	1379.940221	1374.332924		
Cincinnati	1427.251954	1443.874078	1460.042371	1450.473032	1445.195082	1436.106126	1427.483864	1419.273888	1415.370589	1409.223586	1418.290671	1413.921015	1410.106488		
Clemson	1597.953534	1593.988974	1592.127569	1601.876628	1593.854656	1604.608418	1613.137949	1604.093984	1594.405276	1604.075633	1610.578956	1619.158988	1624.331986	1631.227779	
Coastal Carolina	1554.684447	1539.200658	1557.5155	1567.979098	1556.441946	1543.287214	1555.981333	1562.528486	1568.378892	1574.767602	1562.485644	1572.418757	1567.274131	1574.193574	
Colorado	1469.560011	1487.169343	1502.029154	1515.821444	1509.320585	1500.969002	1509.689726	1494.74845	1488.975795	1483.997555	1479.023039	1471.671875	1465.649393		
Colorado State	1468.117593	1453.790441	1439.99775	1452.050409	1464.829166	1453.329907	1468.036127	1462.912012	1458.929847	1454.132064	1461.819736	1467.141888	1468.076248		
Connecticut	1444.769165	1465.322755	1453.605051	1435.107885	1428.966771	1418.333224	1433.270126	1426.493847	1420.724647	1416.891117	1414.404515	1423.928672	1430.941398		
Duke	1580.255731	1597.067367	1607.5511	1620.550731	1626.691846	1615.658344	1625.053385	1619.615978	1612.289314	1617.470196	1609.7139	1597.274561	1601.496074	1610.87048	
East Carolina	1371.73111	1368.327175	1356.078222	1348.482681	1363.344566	1355.762123	1351.053195	1343.686569	1339.853523	1337.588145	1348.037575	1342.760113	1336.603804		
Eastern Michiga	1485.790028	1499.9404	1484.756699	1496.948814	1487.485153	1475.291567	1485.020497	1492.302272	1484.255646	1474.736308	1470.415446	1476.478737	1482.597869	1475.683064	
Florida	1509.730251	1495.1313	1509.859883	1530.450777	1538.184567	1527.888076	1535.622741	1545.850182	1541.956166	1531.538002	1526.220458	1521.925995	1488.653908		
Florida Atlantic	1442.051357	1459.203779	1478.73284	1439.024225	1428.456676	1441.896489	1455.913454	1449.773561	1456.32105	1447.490159	1473.040729	1433.54916	1426.764402		
Florida Internat	1405.476691	1389.452165	1379.480631	1398.932956	1417.430122	1413.481331	1405.577575	1392.649099	1399.715481	1395.747424	1388.281309	1381.418277	1377.099528		
Florida State	1695.635301	1708.614125	1713.929074	1721.573435	1729.595408	1734.541115	1740.380507	1745.822882	1748.770306	1750.825062	1755.035658	1757.889842	1761.710129	1766.893626	1758.73075
Fresno State	1583.335911	1593.968974	1604.606203	1613.288791	1617.660184	1621.705124	1609.503366	1617.55698	1625.242644	1631.071917	1620.034681	1607.701772	1595.870171		
Georgia	1704.176369	1710.895324	1715.924378	1722.649977	1726.347512	1732.474366	1740.053926	1742.891134	1746.78515	1753.735322	1760.430011	1765.337232	1768.764582	1769.519027	1767.981903
Georgia Souther	1502.292815	1516.753003	1529.871957	1513.725694	1522.905259	1536.059599	1529.904191	1534.390674	1543.8003	1536.052797	1526.217273	1517.33457	1510.584006	1504.894698	
Georgia State	1548.172488	1560.632598	1572.350301	1581.386587	1592.923739	1581.360433	1589.916344	1596.255611	1586.845984	1581.478394	1572.802693	1566.726884	1557.133916	1563.53358	
Georgia Tech	1527.976022	1515.652768	1527.332859	1517.596999	1529.438888	1516.489637	1531.060394	1532.753005	1533.219904	1538.301087	1531.797764	1539.549888	1536.122538	1543.593108	
Hawaii	1445.40151	1427.139456	1411.42676	1427.852042	1421.830202	1438.16829	1431.021464	1419.583497	1411.619818	1405.304636	1412.10196	1424.813179	1420.586026	1429.650667	
Houston	1447.495885	1468.278594	1452.896688	1438.76908	1448.630389	1438.623812	1456.006799	1452.970057	1448.470878	1455.844308	1447.772223	1442.838074	1435.897744		
Illinois	1478.338642	1500.78741	1489.50214	1480.696618	1491.264167	1477.479744	1465.305039	1481.613636	1475.450853	1484.758606	1492.879386	1487.4423	1480.834636		
Indiana	1466.72139	1489.786886	1503.353193	1492.940879	1502.738972	1494.171862	1490.198929	1484.267464	1480.318755	1490.004424	1481.883644	1473.441341	1464.572312		
Iowa	1580.462683	1560.061824	1575.451473	1585.550271	1576.298604	1585.127165	1582.812627	1603.851446	1593.875043	1600.675123	1608.246388	1613.683474	1618.721603	1614.527666	1606.586201
Iowa State	1532.910664	1546.018587	1530.665108	1517.632254	1532.311327	1525.000721	1536.614221	1545.236883	1550.606047	1544.363005	1551.889632	1547.572123	1551.055546		
Jacksonville St	1569.653587	1578.506311	1589.822017	1571.507174	1580.970834	1586.375528	1593.072718	1584.859327	1592.41866	1596.386717	1585.476164	1589.234089	1581.027584	1587.204388	
James Madison	1650.804826	1659.252125	1665.304435	1678.694303	1684.351772	1691.394071	1698.360048	1701.750978	1705.586904	1710.954494	1713.441096	1702.135172	1707.279797	1697.214701	

Team	Initial Ratings	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Game 7	Game 8	Game 9	Game 10	Game 11	Game 12	Game 13	Game 14	Game 15
Kansas	1595.796297	1606.294351	1617.57962	1623.270942	1632.461198	1623.166502	1631.578726	1618.318237	1628.173312	1634.416354	1623.804519	1615.88171	1619.496237	1626.989898		
Kansas State	1589.303544	1600.054252	1617.213656	1603.897861	1613.779219	1600.679483	1610.134724	1616.009317	1620.507495	1614.640148	1618.470594	1626.593402	1616.804609	1623.762463		
Kent State	1530.374041	1430.966209	1380.590419	1382.380948	1348.009555	1343.93623	1339.820753	1332.563575	1326.026481	1319.279002	1315.543628	1309.653796	1305.412805			
Kentucky	1550.574885	1561.225985	1571.221592	1581.395767	1587.882972	1598.178062	1590.598022	1581.901838	1574.640084	1580.356196	1575.88045	1565.742379	1567.068841	1569.173047		
Liberty	1575.881956	1684.836962	1696.009632	1699.700722	1703.649129	1706.579253	1714.792644	1701.350124	1721.921159	1723.997244	1727.314792	1729.250147	1731.162497	1736.049953	1727.460467	
Louisiana	1497.147153	1504.143219	1493.162782	1506.750474	1514.691892	1502.481224	1516.719526	1510.376929	1519.013731	1510.386832	1499.680559	1494.898732	1500.431992	1504.251888		
Louisiana State	1629.234493	1616.255669	1625.917658	1627.712478	1634.714663	1632.566951	1646.972727	1655.210069	1659.610199	1652.722017	1658.039956	1664.115339	1669.748032	1675.103136		
Louisiana Tech	1404.90269	1420.929162	1412.740308	1425.685761	1431.595523	1440.392306	1441.937228	1440.62841	1398.875684	1391.374426	1398.208634	1390.331432	1376.555466			
Louisiana-Mon	1397.431596	1418.239496	1436.49692	1424.69178	1416.955377	1405.557225	1401.295964	1396.110733	1390.12631	1381.884243	1378.997373	1376.764982	1371.371971			
Louisiana-Lafayette	1641.921355	1641.921355	1641.921355	1641.921355	1641.921355	1641.921355	1641.921355	1641.921355	1641.921355	1641.921355	1641.921355	1641.921355	1641.921355	1653.723339	1644.563568	
Marshall	1468.87343	1451.323626	1463.67258	1467.787906	1469.412152	1478.770553	1470.214352	1466.82422	1469.970162	1454.892279	1464.727803	1458.243566	1467.252838	1461.363042		
Maryland	1567.625365	1579.267865	1588.36584	1596.831371	1604.984128	1613.551239	1602.65586	1586.144534	1596.973016	1571.269379	1567.455919	1573.808293	1581.69443	1588.438429		
Massachusetts	1397.200302	1420.283162	1406.426202	1404.459303	1388.260949	1377.622395	1369.439299	1364.992108	1361.681949	1372.355201	1362.76758	1380.82225	1373.819499			
Memphis	1606.129282	1615.262963	1625.196456	1634.793091	1624.663529	1633.519466	1621.46745	1625.354101	1629.743709	1634.76031	1637.887178	1629.35516	1632.089183	1638.394553		
Miami (FL)	1542.019873	1561.532875	1576.724367	1586.330031	1592.091768	1577.521011	1567.53014	1576.583014	1580.918952	1571.965734	1567.755138	1561.951006	1568.958946	1566.773322		
Miami (OH)	1619.566293	1600.053291	1608.62481	1607.659601	1623.803891	1627.877215	1636.105425	1641.683533	1633.521694	1640.957084	1643.973739	1647.07812	1650.41345	1656.661632	1648.71783	
Michigan	1741.461414	1744.865079	1753.818854	1760.341808	1766.774902	1770.568878	1775.174316	1779.147249	1781.471249	1783.315411	1789.136931	1792.816427	1798.514882	1802.708819	1809.241347	1816.858916
Michigan State	1667.098224	1483.483038	1498.875826	1492.143906	1483.643994	1474.769533	1468.088723	1463.823215	1457.243826	1466.238324	1462.65507	1471.093733	1467.514867			
Midle Tennessee	1438.3326	1441.70346	1425.21562	1441.522394	1429.469735	1421.809748	1414.788737	1426.541643	1422.983782	1418.96828	1426.434394	1433.587008	1423.782118			
Minnesota	1502.861682	1517.681524	1532.865225	1520.325366	1508.59935	1520.489527	1516.204212	1526.180615	1532.760004	1523.525211	1531.376644	1509.048531	1501.840204	1510.489796		
Mississippi	1654.645197	1662.958092	1667.301732	1680.80012	1674.272406	1685.225232	1690.170848	1694.651456	1696.991534	1701.802235	1694.991145	1697.224	1700.990638	1706.765542		
Mississippi State	1485.457164	1499.334037	1520.751282	1509.451688	1496.01411	1490.316031	1500.496667	1507.124437	1499.453374	1493.180862	1486.35748	1482.381772	1488.494837			
Missouri	1661.492221	1669.569036	1676.056676	1689.37247	1699.502744	1703.177671	1688.711996	1697.486559	1700.927252	1693.970779	1700.414351	1704.707914	1707.63673	1715.101114		
Navy	1471.998797	1462.856393	1478.165065	1468.578259	1477.848769	1470.061155	1479.272853	1474.923545	1463.991044	1471.185665	1467.464627	1471.804058	1464.480552			
Nevada-Las Vegas	1477.188256	1462.368414	1471.508063	1466.011188	1476.215034	1472.421157	1484.595862	1493.892976	1500.65889	1491.664392	1488.465753	1478.637324	1473.599194			
Nevada-Las Vegas	1569.44003	1560.62765	1571.673874	1581.033991	1567.195642	1568.154429	1568.774406	1568.225887	1560.125889	1560.466892	1560.899635	1617.284135	1606.882243	1597.481133	1589.987372	
New Mexico	1432.752902	1441.221264	1439.251695	1427.849289	1436.487828	1431.954828	1421.160923	1429.124602	1419.175192	1414.931982	1409.337181	1421.67009	1415.001002			
New Mexico State	1562.429514	1539.34364	1552.140099	1545.734519	1533.378652	1537.077347	1534.941493	1541.042936	1555.890186	1560.170474	1565.185577	1573.023299	1580.263709	1588.470214	1583.582758	1575.865568
North Carolina	1607.233879	1607.233879	1607.233879	1607.233879	1607.233879	1607.233879	1607.233879	1607.233879	1607.233879	1607.233879	1607.233879	1607.233879	1607.233879	1607.233879	1607.233879	
North Carolina State	1546.46615	1525.90928	1515.353280	1529.14939	1536.651059	1538.366644	1539.303262	1529.634403	1539.323242	1548.673812	1546.708757	1547.285137	1547.285137	1609.262797		
North Texas	1569.97478	1545.489755	1536.42551	1551.719568	1548.053984	1545.820967	1541.820967	1546.512953	1546.385637	1541.99603	1546.15738	1541.826762	1499.599114	1507.103601		
Northern Illinois	1500.95975	1517.616789	1502.315348	1483.812137	1470.580367	1463.499342	1474.486022	1490.273311	1498.323937	1489.847366	1478.811201	1486.815186	1491.056176	1499.107669		
Northwestern	1546.6412	1530.758071	1541.610808	1528.819607	1540.332222	1532.787921	1541.3004	1532.13288	1541.367018	1543.568939	1542.806939	1555.142956	1555.142956	1573.376269		
Notre Dame	1631.186586	1640.329262	1649.182006	1659.731634	1667.559494	1664.735855	1665.792607	1653.440589	1664.901418	1668.030628	1658.39022	1662.451463	1665.712661	1672.773694		
Ohio	1597.986495	1575.94162	1585.417068	1595.843363	1608.881728	1618.571427	1621.689964	1604.859206	1608.991572	1601.555462	1605.370666	1610.543399	1613.875333	1619.566441		
Ohio State	1631.478317	1608.428214	1616.824218	1632.400148	1645.420928	1656.519471	1662.008277	1670.57552	1676.115796	1682.130392	1685.713646	1690.041759	1684.31503	1676.870794		
Oklahoma	1639.183573	1648.542514	1662.982826	1670.428271	1675.626291	1683.618827	1696.338921	1700.375549	1690.520475	1680.913544	1686.959461	1691.317291	1695.380476	1686.056586		
Oklahoma State	1597.259283	1607.699035	1616.954562	1596.528057	1581.848995	1584.748201	1598.20921	1615.767944	1619.671243	1629.280364	1618.503978	1622.843191	1628.371479	1622.72136	1629.17345	
Old Dominion	1497.679994	1482.575467	1499.856075	1493.711971	1495.432559	1482.799213	1491.926261	1501.267441	1497.431515	1491.042805	1487.725257	1496.60796	1506.209399	1499.398172		
Oregon	1665.480889	1672.751877	1681.803714	1687.825564	1694.326813	1698.458357	1688.232269	1693.048765	1698.308	1702.14472	1708.231371	1710.752682	1716.945652	1710.402441	1718.991926	
Oregon State	1687.509699	1599.214671	1608.639561	1619.829656	1605.275492	1615.746644	1624.554534	1635.730788	1627.048522	1632.04262	1635.96889	1639.928327	1624.745047	1617.680443		
Penn State	1635.734359	1649.220171	1657.330928	1668.55945	1675.811137	1681.355445	1686.665579	1678.098975	1682.647495	1687.991797	1681.845557	1687.448896	1691.024791	1683.081079		
Penn State	1429.837916	1447.520632	1431.36034	1421.72716	1415.954508	1406.330449	1425.966683	1419.233226	1416.104046	1418.492919	1408.316741	1419.026039	1414.004525			
Purdue	1540.71852	1440.565457	1460.692325	1448.017748	1439.213897	1452.99832	1445.355258	1439.866003	1433.100089	1431.201308	1441.276915	1435.550361	1444.41919			
Rice	1490.014146	1481.707014	1497.08882	1510.117147	1497.544336	1505.126778	1490.189876	1497.425811	1492.694668	1487.307686	1480.874184	1486.718127	1493.522884	1488.883984		
Rutgers	1549.192756	1565.072555	1572.61459	1585.957518	1579.423703	1586.464	1583.439662	1582.126668	1588.052133	1582.037537	1574.466272	1586.862943	1560.978606	1568.160523		
San Houston	1395.716808	1383.061975	1376.179223	1366.319794	1360.913221	1357.963481	1351.882781	1344.818567	1337.783733	1331.783733	1357.801905	1359.829516	1336.634406			
San Diego State	1468.376277	1470.86961	1485.3851	1473.883048	1463.632777	1453.62124	1447.305044	1446.743871	1447.946946	1440.560969	1432.873926	1426.472073	1438.303674			
San Jose State	1504.96501	1502.527059	1488.789332	1496.129659	1484.844878	1477.442023	1466.993154	1477.787059	1486.902045	1492.721227	1503.254463	1509.655687	1502.057579	1513.38136		



Team	Initial Ratings	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	Game 7	Game 8	Game 9	Game 10	Game 11	Game 12	Game 13	Game 14	Game 15
South Alabama	1526.342984	1514.329621	1526.312942	1546.379446	1531.690775	1524.648476	1533.231281	1538.091505	1529.454703	1523.902992	1531.361696	1537.845933	1530.019587	1536.934392		
South Carolina	1481.587048	1470.101204	1485.94444	1479.21884	1492.260418	1483.923682	1473.696241	1470.237548	1463.516253	1474.826806	1480.71453	1490.852601	1485.679604			
South Florida	1500.600277	1485.845033	1501.948682	1492.846859	1505.44369	1516.175161	1500.853033	1486.836068	1493.612347	1488.595756	1493.608767	1487.130214	1492.737511	1501.369816		
Southern Califor	1583.454723	1595.900465	1602.709963	1612.062306	1618.142897	1626.50258	1637.819485	1626.358556	1616.871	1622.309028	1617.406897	1611.320268	1602.607421	1611.761192		
Southern Metho	1606.365652	1614.55403	1600.114284	1610.449662	1595.006164	1600.735832	1605.44476	1608.355248	1612.935899	1618.272729	1622.604841	1630.956503	1635.616472	1644.36148	1633.474401	
Southern Missis	1409.732992	1420.306563	1422.991614	1414.932965	1405.234523	1398.208602	1389.143194	1384.26297	1379.672204	1388.03614	1396.742412	1392.71812	1389.789668			
Stanford	1433.378849	1449.091545	1439.738302	1427.780304	1421.506111	1417.374567	1432.495843	1427.883309	1425.845642	1436.091003	1432.178166	1425.739009	1422.477991			
Syracuse	1506.717192	1520.900619	1533.970559	1546.645135	1557.641819	1546.880056	1537.614839	1531.770897	1523.096751	1515.296664	1521.029182	1513.277058	1520.255591	1511.623285		
Temple	1375.240918	1360.648295	1353.10086	1374.002275	1368.548808	1359.684142	1352.935019	1344.261683	1341.351196	1352.283737	1347.270726	1340.959673	1338.406006			
Tennessee	1593.723604	1602.1425	1612.429332	1591.838437	1601.814904	1610.15164	1620.240064	1614.089972	1621.350926	1625.184456	1618.748084	1613.840864	1617.069869	1625.011334		
Texas	1672.080764	1680.387896	1696.283131	1708.413727	1712.156705	1721.451402	1708.129307	1711.166049	1715.420042	1721.287389	1724.810539	1729.128047	1733.071481	1738.731104	1731.845172	
Texas A&M	1532.429748	1543.961386	1528.769893	1540.89353	1553.303548	1562.110427	1564.330448	1544.242024	1550.563319	1545.643758	1552.44434	1550.134458	1552.501788	1546.09679		
Texas Christian	1496.354065	1478.140723	1493.742305	1507.889913	1523.31341	1513.818111	1502.204212	1515.51412	1509.640527	1501.817807	1498.094657	1504.100874	1500.045388			
Texas Tech	1549.725689	1559.970777	1542.770522	1555.463237	1560.992438	1567.946359	1553.711657	1561.139799	1554.789742	1562.517245	1554.799203	1545.308815	1553.216161	1559.854062		
Texas State	1524.225045	1511.147392	1502.095555	1516.47188	1506.885768	1516.892345	1525.865917	1516.410676	1508.65378	1516.6765	1527.288335	1534.988394	1531.044961	1538.724766		
Texas-El Paso	1404.848623	1395.915899	1415.048565	1404.188568	1396.371777	1390.210105	1378.665183	1391.59285	1387.026569	1394.059402	1389.494295	1382.341682	1380.429332			
Texas-San Ant	1545.642112	1533.858503	1551.058759	1532.686153	1522.709687	1529.458809	1538.201797	1544.341689	1548.114736	1554.015027	1560.498747	1566.9773	1561.116696	1567.006492		
Toledo	1614.514977	1592.566209	1602.026557	1613.296647	1619.539625	1626.688651	1631.135842	1636.147184	1644.273843	1647.472469	1651.793331	1657.089994	1661.182722	1652.934829	1643.946411	
Troy	1615.542953	1625.274585	1608.115182	1594.725313	1605.572922	1617.136227	1625.245881	1632.93198	1639.302036	1644.853747	1647.810777	1652.593704	1655.522156	1651.783623	1652.405218	
Tulane	1614.773041	1626.786404	1612.146195	1620.204843	1626.328434	1632.013433	1644.06545	1648.192765	1652.923881	1655.189259	1658.713599	1662.205169	1668.065773	1659.320765	1648.14976	
Tulsa	1444.422961	1461.467859	1455.702993	1448.256892	1461.480658	1470.345324	1456.905511	1449.669576	1445.088925	1435.594975	1432.070635	1424.295147	1430.451456			
UCLA	1565.607394	1581.105183	1592.805286	1603.505321	1589.955012	1600.667099	1589.490844	1594.103378	1599.876033	1592.214748	1580.279355	1588.992203	1579.144741	1586.585099		
Utah	1540.23177	1522.830721	1533.754548	1546.830215	1560.770524	1550.299317	1570.477692	1565.108458	1569.830066	1565.974623	1559.370664	1565.393146	1557.157133			
Utah State	1482.369565	1477.70605	1484.629302	1474.35945	1468.701981	1479.335528	1480.834787	1482.781173	1474.666187	1482.052164	1487.067884	1480.013154	1486.682242	1480.282578		
Vanderbilt	1395.132533	1413.433228	1431.889454	1418.236717	1408.8766	1402.389395	1388.714468	1390.981203	1388.143996	1385.74091	1380.866229	1374.978505	1371.749459			
Virginia	1414.800012	1406.381116	1400.328806	1392.232029	1384.730499	1376.452182	1391.670138	1404.671473	1400.335625	1395.254441	1392.407235	1404.846574	1399.152939			
Virginia Tech	1517.145281	1532.248808	1512.122941	1496.880912	1485.665587	1495.20995	1490.343942	1502.423505	1511.097651	1506.258223	1515.023158	1507.932954	1513.626588	1524.797593		
Wake Forest	1467.203601	1483.229226	1496.882044	1513.018961	1501.177072	1492.647541	1480.567979	1487.321436	1484.374012	1479.193131	1472.763204	1468.671832	1481.693299			
Washington	1716.477978	1724.702176	1730.467132	1737.141851	1742.427301	1750.197465	1760.423553	1762.213222	1764.250889	1769.153021	1773.008464	1778.006436	1780.888775	1787.430896	1794.316829	1786.65935
Washington St	1504.576259	1518.903411	1536.049923	1549.114823	1563.519079	1552.416992	1541.893591	1537.077095	1526.049301	1515.803941	1507.263676	1514.61484	1511.734501			
West Virginia	1588.68334	1567.197538	1577.594175	1587.327355	1596.913466	1606.408765	1589.025778	1581.467045	1587.702025	1594.396887	1588.34878	1592.718436	1596.755084	1605.237796		
Western Kentuc	1549.688178	1563.423422	1575.28268	1561.25702	1560.409411	1558.932119	1565.702037	1558.142703	1553.571069	1568.136976	1560.299523	1554.270833	1558.589582	1565.392348		
Western Michiga	1437.477222	1454.83006	1441.840121	1431.705323	1425.462345	1437.319646	1427.136011	1421.593082	1417.460716	1426.980053	1436.329182	1429.325198	1423.450842			
Wisconsin	1533.292475	1543.842337	1526.958525	1542.842087	1551.645939	1564.850677	1553.814458	1560.179971	1554.639695	1544.954028	1536.714925	1543.543354	1550.751681	1545.389334		
Wyoming	1588.403123	1601.480776	1610.562055	1598.431459	1609.329555	1615.86257	1628.064346	1616.435602	1606.235186	1611.032969	1602.789502	1607.015855	1609.787901	1618.77632		

Being that there are 133 teams, we will not go through every single one. We will look at the same four teams, Michigan, Washington, Clemson, and Florida State, as the initial trial. Michigan would start with an initial rating of 1741.46 and Washington would start with a rating of 1716.48. Both would steadily rise in rating points throughout the season, with Michigan gaining about 7 per game and Washington gaining about 8 per game. Based on the initial ratings, these were the best two teams going into the season and two of the three teams rated above 1700. They would both go on to finish their regular seasons undefeated, win their conference championship game and win their semi-final playoff game. This would pit them against each other in the National Championship game. Michigan would enter with a rating of 1809.20 and Washington with a rating of 1794.32. In our initial trial, these two teams had a much largest rating difference going into this game. After three rounds of initial ratings, we get a match-up of the best two teams in college football. Michigan would go on to defeat Washington and end the season with a rating of 1816.86 while Washington would drop for the first time, falling to 1786.66. Even after losing it's final game, Washington would remain second in overall Elo rating.

Clemson would have a more up and down season than the two national championship participants. They would start the season with a rating of 1597.90. However, they would not keep this rating long as they would drop their first game of the season falling to a 1581.08. They would go on to win their next two before losing their fourth game. This is how the first half of Clemson's season would go. They would eventually get hot and finish the season strong where they would finish with a 1631.28 Elo rating. This is a much larger gain of rating points over the course of the season compared to the initial trial where they would only finish 13.64 points better than where they started.

Florida State would have a very successful season, winning all bu their final game. They would see a steady rise through the rankings until they would meet Georgia in their final game. Florida State would enter with a rating of 1766.89 while Georgia entered with 1759.82 rating. In terms of Elo match-ups, this game was very evenly rated. Georgia would gain a little over 8 points for defeating the unbeaten Florida State. Florida State would drop a little over 8 points as well after finally losing a game.


























## 4.8 Comparing Elo Ratings to College Football Polls

Now that we have our final ratings from round three, we will compare those ratings to the AP Top 25 Poll and The Coaches Poll. Firstly, we'll compare our final ratings to The AP Top 25 Poll. This is what our Elo ratings look like next to the AP Poll:

Final Elo Ratings		Final AP Poll			
1	Michigan	1816.858916	RANK	SCHOOL	POINTS
2	Washington	1786.65935			PREVIOUS
3	Georgia	1767.981903			RECORD
4	Florida State	1758.73075	1	Michigan (61)	1525
5	Texas	1731.845172	2	Washington	1459
6	Alabama	1729.959761	3	Texas	1356
7	Liberty	1727.460467	4	Georgia	1328
8	Oregon	1718.991926	5	Alabama	1321
9	Missouri	1715.10114	T-6	Oregon	1175
10	Mississippi	1701.665143	T-6	Florida State	1175
11	James Madison	1697.214701	8	Missouri	1092
12	Oklahoma	1686.056861	9	Ole Miss	1030
13	Penn State	1683.087019	10	Ohio State	1006
14	Ohio State	1676.877094	11	Arizona	861
15	Louisiana State	1675.11038	12	LSU	853
16	Notre Dame	1672.773694	13	Penn State	796
17	Troy	1652.409218	14	Notre Dame	745
18	Miami (OH)	1648.71783	15	Oklahoma	691
19	Tulane	1648.14976	16	Oklahoma State	528
20	Arizona	1646.686874	17	Tennessee	442
21	Louisville	1644.563568	18	Kansas State	402
22	Toledo	1643.946411	19	Louisville	398
23	Memphis	1638.394553	20	Clemson	327
24	Southern Metho	1633.474401	21	NC State	244
25	Clemson	1631.227779	22	SMU	183
			23	Kansas	153
			24	Iowa	150
			25	Liberty	139

Taking a look at the top ten of each poll, we can see that most of the teams are the same. The biggest outlier in our top ten Elo ratings is Liberty. They would finish the season at number 7 in our poll, however, they would finish as the 25th best team in the AP Poll. Arizona on the other hand, had the opposite result as Liberty. They would finish number 20 in the Elo ratings but would finish as the 11th best team in the AP Poll. James Madison, Troy, Miami (OH), Tulane, Toledo, and Memphis would finish ranked 11, 12, 18, 19, 22, and 23 respectively in the final Elo ratings. However, none of these teams would finish in the AP Top 25.

Now we will compare our Elo ratings to the final Coaches Poll.

Final Elo Ratings			Final Coaches Poll							
			Rank	Team	Record	PTS	1st	Prev	Chg	Hi/Lo
1	Michigan	1816.858916	1	 Michigan	15-0	1575	63	1	-	1/3
2	Washington	1786.65935	2	 Washington	14-1	1507	0	2	-	2/11
3	Georgia	1767.981903	3	 Georgia	13-1	1389	0	6	↑+3	1/6
4	Florida State	1758.73075	4	 Texas	12-2	1382	0	4	-	4/12
5	Texas	1731.845172	5	 Alabama	12-2	1356	0	4	↓-1	3/12
6	Alabama	1729.959761	6	 Florida State	13-1	1218	0	3	↓-3	3/8
7	Liberty	1727.460467	7	 Oregon	12-2	1213	0	8	↑+1	5/15
8	Oregon	1718.991926	8	 Missouri	11-2	1143	0	9	↑+1	8/NR
9	Missouri	1715.10114	9	 Ole Miss	11-2	1082	0	11	↑+2	9/22
10	Mississippi	1701.665143	10	 Ohio State	11-2	1014	0	7	↓-3	2/10
11	James Madison	1697.214701	11	 Arizona	10-3	898	0	14	↑+3	11/NR
12	Oklahoma	1686.056861	12	 LSU	10-3	890	0	13	↑+1	5/23
13	Penn State	1683.087019	13	 Penn State	10-3	811	0	10	↓-3	5/13
14	Ohio State	1676.877094	14	 Notre Dame	10-3	772	0	16	↑+2	9/22
15	Louisiana State	1675.11038	15	 Oklahoma	10-3	691	0	12	↓-3	6/19
16	Notre Dame	1672.773694	16	 Oklahoma State	10-4	575	0	21	↑+5	16/NR
17	Troy	1652.409218	17	 Tennessee	9-4	529	0	23	↑+6	9/23
18	Miami (OH)	1648.71783	18	 Louisville	10-4	460	0	15	↓-3	9/NR
19	Tulane	1648.14976	19	 Kansas State	9-4	386	0	NR	↑+9	15/NR
20	Arizona	1646.686874	20	 Clemson	9-4	334	0	NR	↑+6	9/NR
21	Louisville	1644.563568	21	 North Carolina State	9-4	271	0	18	↓-3	18/NR
22	Toledo	1643.946411	22	 Iowa	10-4	249	0	17	↓-5	17/NR
23	Memphis	1638.394553	23	 Kansas	9-4	158	0	NR	↑+7	18/NR
24	Southern Methodist	1633.474401	24	 SMU	11-3	119	0	19	↓-5	19/NR
25	Clemson	1631.227779	25	 West Virginia	9-4	117	0	NR	↑+6	25/NR

We can see that our top three teams, Michigan, Washington, and Georgia, match the final Coaches Poll top 3. With a few teams swapping places here and there, both top tens are relatively similar. However, this time Liberty is no longer ranked in the Coaches Poll while sitting at number 7 in the Elo rating. Once again, Arizona is ranked number 11 in the Coaches Poll, leaving them with a 9 spot difference between the two. None of James Madison, Troy, Miami (OH), Tulane, Toledo, and Memphis make an appearance in the Coaches Poll either.

## 5 Takeaways From Comparisons

After comparing our Elo ratings to each poll, we can see that that there were some big differences. Notably James Madison, Troy, Miami (OH), Tulane, Toledo, and Memphis who all appeared in the final Elo ratings but none of them would appear in either top 25 poll. James Madison would finish just 3 Elo points away from being the 11th team with a rating above 1700. They were also the only top 15 team in the Elo ratings to not appear in at least one poll.

While these Elo ratings did do a good job of computing who won the most games, they did not do a great job of giving accurate final ratings. Looking at each team in our top 25, they all won at least 10 games over the course of the season. With Elo, the more wins you have, the more your rating will go up. This seems to be the biggest issue with the Elo system. The system really only takes into account whether a team won or lost and the ratings of each team playing. This makes it difficult for

the system to properly rank college football teams and possibly other team sports.

## 6 Conclusion

We have now taken a deep dive into the Elo rating system. While this system works really well to tell us who won the most games, however it struggled to give us ideal rankings. Much like any sport, college football is a game of ups and downs. Elo does well to follow those ups and downs but it only takes in to account team ratings and whether a team won or lost. In college football there are good wins, bad wins, good losses, and bad losses. Elo does an okay job of mimicking these in its ratings through the use of the rating points but this is hard to replicate with such a simple system. When poll voters vote, they are looking for those good wins or bad losses. It's possible for a team to win over a lesser team in a non-convincing way and the voters may look at this and choose to drop them in their rankings. In the Elo system it is impossible for a team to win and drop in rating.

After our comparisons, we saw a handful of teams that were in the final Elo ratings that were not in the final AP and Coaches polls. While these teams all good seasons, each winning at least ten games, poll voters did not see them as top teams in the country. While changes could be made to the Elo system to be able to better implement these ideas, human voters seem to superior over the Elo system.

A look into other ratings systems may be in order to see if rating systems would be a better approach to rankings over human voters.



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