Rank Sum Method for Determining the FedEx Cup Winner

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Abstract

The current PGA Tour determines the winner of the season long FedEx Cup by summing up each player's reset points earned prior to the final tour championship with the points earned in the final event. Simple as this methodology seems to be, evaluating the potential placements in real time during the tournament can be very confusing for players, golf analysts, and fans alike. To make the procedure more intuitive and easier to update during the tournament, we propose a new system for determination of the FedEx cup winner using only the players' ranks before the final event and those from the final event. A novel simulation method is introduced which allows realistic recreations of the entire FedEx Cup season. The new ranking system is compared with the current system through a simulation study of the entire 2012 FedEx cup season based on each player's estimated strength. We find that the current system heavily favors reset point leaders while the newly proposed system allows a higher probability for a larger portion of the field to win based on final tournament performance.

Key Words: rank sum, FedEx Cup, player's strength estimation

1. Introduction to the FedEx Cup

The PGA Tour is the organizer and promoter of the main men's professional golf tour in North America. Beginning in 2007 the PGA Tour divided its tournament calendar into two parts, the FedEx Cup Season and the FedEx Cup Playoffs (PGA Tour, 2012). For example, during 2012 the FedEx Cup Season began in early January with the season-opening Hyundai Tournament of Champions at the Plantation Course in Kapalua, Maui, HI and ended with The Wyndham Championship at Sedgefield Country Club in Greensboro, NC, for a total of 37 PGA Tour events. PGA Tour players can earn FedEx Cup points in each event they play. The point distribution, which is based on each player's final rank in a tournament, varies across events (Table 1). Currently, upon completion of the final season event, all points are summed up and the top 125 point leaders advance to the FedEx Cup Playoffs.

In 2012, the FedEx Cup Playoffs began in the middle of August and consisted of four events: (a) The Barclays at Bethpage Black Course in Long Island, NY; (b) the Deutsche Bank Championship at TPC Boston in Norton, MA; (c) the BMW Championship at Crooked Stick Golf Club in Carmel, IN; and (d) the Tour Championship at East Lake Golf Club in Atlanta, GA. The point distribution for all playoff events is also presented in Table 1. Under current rules the points earned in the FedEx Cup Season are combined with the cumulative points earned in the first three Playoff events to determine which players qualify for the last playoff event. In 2012, the Barclays opened with 125 players,

followed by the Deutsche Bank Championship with 100 players, and the BMW Championship with 70 players.

Currently, the top 30 point leaders through the third playoff event (BMW Championship) qualify for the Tour Championship and have their points "reset", meaning that a new value is allocated to each player according to their rank (Table 2). The final points which determine the FedEx Cup winner will be sum of the reset points and the playoff points from the Tour Championship. The player with the most total points wins the FedEx Cup and receives top prize. In 2012 the winner received $10 million (Table 2), the runner-up $3 million, 3rd place $2 million, etc., with 126th through 150th place receiving $32,000.

2. Issues with the Current Ranking System

In the current system, the winner of the FedEx Cup is determined by adding up each player's reset points to the points earned in the final event. The goal of this system is to ensure that any of the 30 players entering the Tour Championship has a chance to win the FedEx Cup, but to provide an advantage to those that performed best throughout the season and playoffs. Any of the top 5 players are mathematically assured of winning the FedEx Cup by winning the Tour Championship (e.g., the player who ranks 5th highest in reset points and wins the final event earns a total of 4100 points, which is guaranteed to be higher than the maximum alternative of 4000 points earned by the reset points leader if he places second in the final event). Hence, players 6 through 30 would need the stars to align perfectly, or misfortune on behalf of the top players in order to accumulate the most points at the conclusion of the final event.

Although the methodology of adding reset points to points earned from the Tour Championship seems simple enough, the actual process can be quite confusing for players, media members, golf analysts, and fans alike. The confusion escalates during the final four days of the Tour Championship when players' ranking positions change hole-by-hole, stroke-by-stroke. As broadcasters and analysts attempt to give their expert projections, millions of fans watching in person and on television may find it difficult to make sense of the constant fluctuation in lead changes. What final position does player "X" need to place in order to accrue enough points to beat out player "Y"? More importantly, players themselves are often unsure as to how well they must perform in order to surpass the field in points. For example, Tiger Woods commented in 2012: "Guys still don't understand the points system yet." To clarify this confusing situation we present two examples extracted first from the 2012 and then the 2011 Tour Championship. To illustrate, we restrict our discussion to a few relevant players in determining the FedEx Cup winner.

In 2012, the top five reset point leaders entering the Tour Championship were Rory McIlroy, Tiger Woods, Nick Watney, Phil Mickelson, and Brandt Snedeker with reset points 2500, 2250, 2000, 1800 and 1600 respectively. On the final day of the Tour Championship with approximately 5 hours left to play, Justin Rose (who entered the final event in 24th place, which equaled 270 reset points) and Snedeker were tied for 1st at 8 under par, and McIlroy was tied for 3rd with three others at 5 under par. Figure 1 shows some possible scenarios for determining the winner by only considering Rose, Snedeker and McIlroy. In this figure the letters are the initials of the players' last name. Each letter is followed by a potential final position for this player in the Tour Championship. So, M1 indicates that McIlroy finishes 1st in the Tour Championship. The golden cup denotes

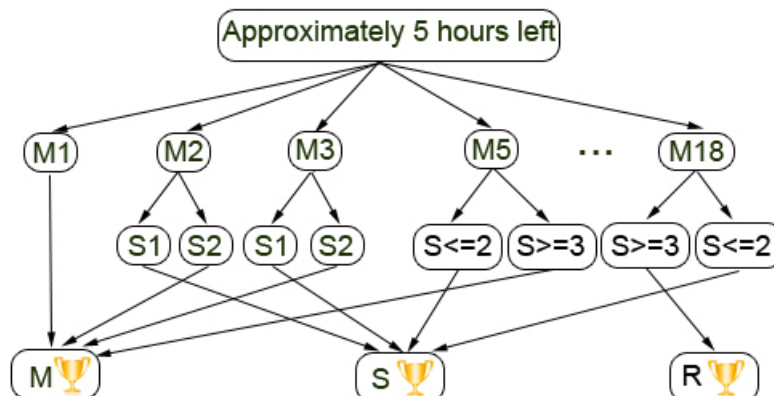the winner of the FedEx cup. Here we consider scenarios where one of these three players wins.

Figure 1: Projected scenarios for FedEx Cup winner under current point system with 5 hours left to play in the 2012 FedEx Tour Champion. The upper case letters indicate the three leading players (M = McIlroy, S=Snedeker, R=Rose), followed by their potential finishing position in the Tour Champion. The golden cup indicates the winner of the FedEx Cup. In this figure we consider scenarios where one of the three listed players wins.

From the diagram we summarize several scenarios:
1. First Branch - Obviously if McIlroy wins, as the reset point leader, he is guaranteed the cup (represented as the vertical arrow on the left).
2. Branches 2 & 3 -If McIlroy finishes second or worse and Snedeker finishes first, Snedeker takes the cup
3. Branch 4 - If McIlroy finishes fifth and Snedeker finishes second or better, then Snedeker wins.
4. Branch 5- If McIlroy finishes 18th, Rose wins and Snedeker finishes second, Snedeker wins; if Snedeker finishes 3rd or worse, then Rose wins.

In 2011 the situation was much more complicated and it was extremely difficult to project the FedEx Cup winner during the final hours of the Tour Championship. The top five reset point leaders entering the Tour Championship were Webb Simpson (2500), Dustin Johnson (2250), Justin Rose (2000), Luke Donald (1800), and Matt Kuchar (1600). In addition, Hunter Mahan was 21st (300), Bill Haas was 25th (260), and Aaron Baddeley was 27th (240). Table 3 presents the reset point ranks for these players as well as their current standings (T1 for Tied at 1st place) at three different times during the final hours of the Tour Championship. Due to the numerous possible scenarios, we will restrict our discussion to only five players- Simpson, Donald, Mahan, Haas, and Baddeley. Unlike the situation in 2012 when McIlroy, who was the top ranked reset point player was also in 3rd position in the Tour Championship with five hours left, in 2011, none of the top 5 reset point leaders held top 5 positions in the tournament in the final hours, while the top three players in the tournament were all positioned at 21st or worse in reset points.
(a) With five hours and seven minutes left until completion, Baddeley and Mahan were tied for first. If Mahan won the tour championship, he would beat Simpson and win the FedEx Cup. However, if Baddeley won the tournament, he would tie with Simpson.

(b) With three hours and thirty four minutes left until completion, Mahan, Hass and Baddeley were tied for first. Either Mahan or Haas could win the FedEx Cup if they won the tour championship; but if Baddeley won the tournament, he would still lose the cup to Simpson.

(c) With two hours and eleven minutes left until completion, Hass was the score leader. He would win the FedEx Cup, as he actually did, if he won the tour championship. Note that, at this time, Donald was also in contention for the FedEx Cup. If Donald could move up to finish 3rd or better, he would have a combined score of 1800 + 1000 = 2800, beating Haas and Baddeley no matter what they placed.

Table 3: 2011 FedEx Cup Scenarios for Selected Players

Rank	Player	Points	5:07 hours left	3:34 hours left	2:11 hours left
1	Simpson	2500	T1. Baddeley (2500, 2740)	T1. Mahan (2500, 2800)	1. Haas (2500, 2760)
4	Donald	1800	T1. Mahan (2500, 2800)	T1. Haas (2500, 2760)	2. Mahan (1500, 1800)
21	Mahan	300	3. Haas (1000, 1260)	T1. Baddeley (2500, 2740)	2. Baddeley (1500, 1740)
25	Haas	260	6. Donald (500, 2300)	4. Donald (750, 2550)	6. Donald (500, 2300)
27	Baddeley	240	23. Simpson (240, 2740)	22. Simpson (245, 2745)	22. Simpson (245, 2745)

Standing Before The Tour (Rank, Player, Points). Standing at Time Until Completion (Tour Championship points, total points).

The actual situation could be much more complex by considering all players and scenarios with ties. In short, instead of feeling that they are on the edges of their seats witnessing a high stakes sprint to the finish, spectators may instead feel like they are watching the announcers figure out a Sudoku puzzle during the final hours of the Tour Championship. As players go up and down in their current standings with each stroke, their chances of winning must be recalculated by factoring in the points accrued at each position. To rectify this weakness, the current study proposes a new system to determine the FedEx Cup winner by doing away with points altogether and, instead, using only a player's ranks to determine the winner. Doing so allows fans to more easily understand the possible outcomes and better enjoy the action. While some may find weaknesses with the proposed solution we agree with 2010 FedEx Cup champion Jim Furyk who said it best- "Is it an imperfect system?" he asked, "I'm not sure when you're dealing with points and when you're dealing with a system, per se, I'm not sure there is anything that's perfect." (Sobel, 2012).

3. New Rank Sum Method

The current study proposes to use rank sum method instead of adding up reset points with Tour Championship points to determine the FedEx Cup winner. For each of the top 30 players, the proposed method sums their reset rank when entering the Tour

Championship with their corresponding rank from the event. The player with the lowest rank sum is deemed to be the FedEx Cup winner. We have also considered a weighted rank sum consisting of adding the Tour Championship rank multiplied by a factor of two.

Our rank sum method is easier for media members, analysts, fans, and players themselves to understand because knowledge of a player's rank is easily available to observers whereas the distribution of points is not as readily known. Hence, instead of asking the question, "What final position does player X need to place in order to accrue enough points to beat out player Y", we merely ask, "What final rank does player X need in order to outrank player Y"? For clarification, we present the same scenarios in 2012 and 2011 as discussed previously, but this time using the rank sum method, which means that the Tour Championship rank will have equal weight with ranks from total points accrued earlier throughout the season.

Figure 2 shows several possible scenarios in 2012 FedEx cup with the new system. From a player's point view, he can focus on improving his rank in the final event. In contrast, with the current point system a player needs to first convert his rank in the final event to points and then add this to the reset points to determine his overall points.
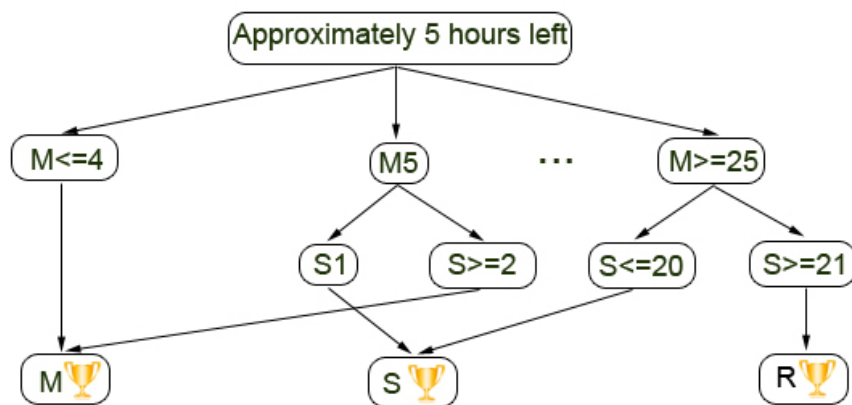

Figure 2: Winning scenarios projected with new system for the 2012 FedEx Cup.

When considering the three players in contention in 2012, we find that the complexity of our diagram has decreased dramatically. We now understand that McIlroy will win if he finishes better than 5th, will win if he finishes fifth and Snedeker doesn't win, and will lose to Snedeker if he finishes lower than 24th with Snedeker finishing at 20th place or above. Finally if Rose wins the tournament, McIlroy finishes 25th or worse and Snedeker is at 21st or worse, then Rose would win the FedEx Cup.

Similarly, we list some scenarios from 2011 under the new system:
(a) Suppose Baddeley finished 1st, he would have 27 + 1 = 28. Baddeley would beat Haas, Mahan, Donald and Simpson if they finished 4th, 8th, 25th and 28th or worse, respectively. Thus both Donald being at worst 6th and Simpson being at worst 23rd in each time period, would still beat Baddeley.
(b) Suppose Haas finished 1st, he would have 25 + 1 = 26. Haas would beat Baddeley no matter what the latter placed. He would also beat Mahan, Donald and Simpson if they finished 6th, 23rd and 26th or worse, respectively.

(c) Suppose Mahan finished 1st, he would have 21 + 1 = 22. Mahan would beat Haas and Baddeley no matter what they placed. He would beat Donald and Simpson if they finished finish 19th and 22nd or worse, respectively.

(d) Suppose Donald finished 3rd, he would have 4 + 3 = 7. Donald would beat Mahan, Haas, and Baddeley no matter what they placed. Simpson would have to finish 7th or worse for Donald to beat him.

4. Simulation Methods and Results

In order to evaluate the strengths and weaknesses of the proposed ranking system we develop an individual player level simulation which generates hole by hole outcomes of each player in each tournament that they participated in. With these results we can recreate realistic regular season, playoffs, and Tour Championship scenarios which can provide insight into both ranking systems.

4.1 Estimation of Player Strength

A total of 604 players participated in the 2012 FedEx Cup. Each player's individual hole scores for all of the par 3, 4, and par 5 holes from every PGA Tour tournament in which they participated in was recorded through the ShotLink System™. There were a total of 41 events in 2012 (37 regular season tournaments, and 4 playoffs). If a player participated in 70 rounds, he would have a score for 1260 holes, which could be separated into groups of par 3, 4, or 5 holes. This data was organized in 604 individual player matrices of dimension 3 (par 3, 4, and 5) x 12 (scores -3 to +8 relative to par) that gives each player's estimated score distribution on a hole of a particular par.

One major problem with this calculation is that some players may have only participated on a few courses that are familiar to them. The method would then overestimate their ability to reach par relative to other players who played on more difficult courses. Hence, we decided to incorporate shrinkage estimation to correct for this problem. Each player's estimated probabilities were improved upon by shrinking them to the overall league average score distributions from 2012. More specifically, we estimated each player's strength parameter by adding league average results on 120 par 3, par 4, and par 5 holes to each player's records. For example, suppose Player X played 200 par 5 holes, 300 par 3 holes, and 400 par 4 holes and his total number of strokes were 1100 for par 5 holes, 1200 for par 3 holes, and 1650 for par 4 holes. Using shrinkage, we calculated the league average number of strokes for each type of holes and added 120 holes of this average onto Player X's results. In this manner, we produced 6 unique distributions for each player (3 distributions based on raw scores and 3 distributions with shrinkage applied). Figure 3 shows the curves for Tiger Woods in 2012 for the likely range of scores from -2 to +3 relative to par: (a) The left panel gives individual probabilities of obtaining scores from -2 to +3 by par 3, 4, and 5 holes; (b) the center panel gives league average probabilities of obtaining scores -2 to +3 for each type of holes; and (c) the right panel gives shrinkage estimates of the probabilities of obtaining scores -2 to +3 for each type of holes. These shrunken proportions represent estimates of true player strength in 2012 and they were used to simulate the entire 2012 FedEx Cup Season for each player.
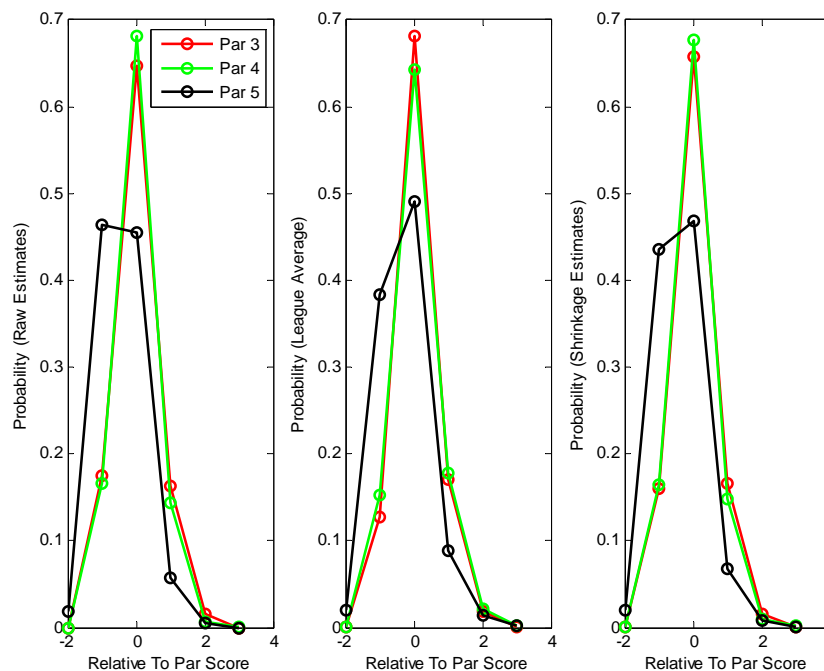
Figure 3: Probability distribution of relative-to-par scores by type of holes (par 3, 4, 5).

4.2 Simulation of 2012 Season

For every par 3, 4, and 5 hole that each player actually participated in 2012, we used the player's strength estimates to randomly simulate his score. For example, in 2012 the first PGA regular season event was the Hyundai Tournament of Champions. There were 3 par 3 holes, 11 par 4s, and 4 par 5s. We simulated the scores for each player that participated in the first 36 holes and then kept the top 70 players. We then simulated scores for the next 36 holes for those who make the cut and distributed FedEx Cup points according to how they finished in the simulation. This process was repeated for every regular season event and points were given out according to the point distribution in Table 1. Next, we simulated the 4 playoff tournaments with 125, 100, 70, and 30 players selected based on number of points accrued up to each event. Last, the top 30 players' final placements were determined with the current point system and the rank sum method. This completes one simulated season. We repeated this process 20,000 times in order to evaluate the strengths and weaknesses of the two methods.

4.3 Results of Simulations

One principle question about different ranking systems is how they correlate with the players' actual strengths. Figure 4 shows the simulated probability of winning the FedEx Cup as a function of true player strength estimates (as measured by expected score if they play in the Tour Championship). Since both ranking methods have similar probabilities, this suggests that the relationship between player strength and probability of winning the FedEx Cup is not different between the two systems. Note that in general, a higher ranking of true strength is associated with a greater chance to win it all. There are some discrepancies, for example, if a player participated in few events (e.g., the player with the 5th best estimated strength), thereby not being able to accumulate enough FedEx Cup points to compete in the playoffs, then his probability of winning is low.
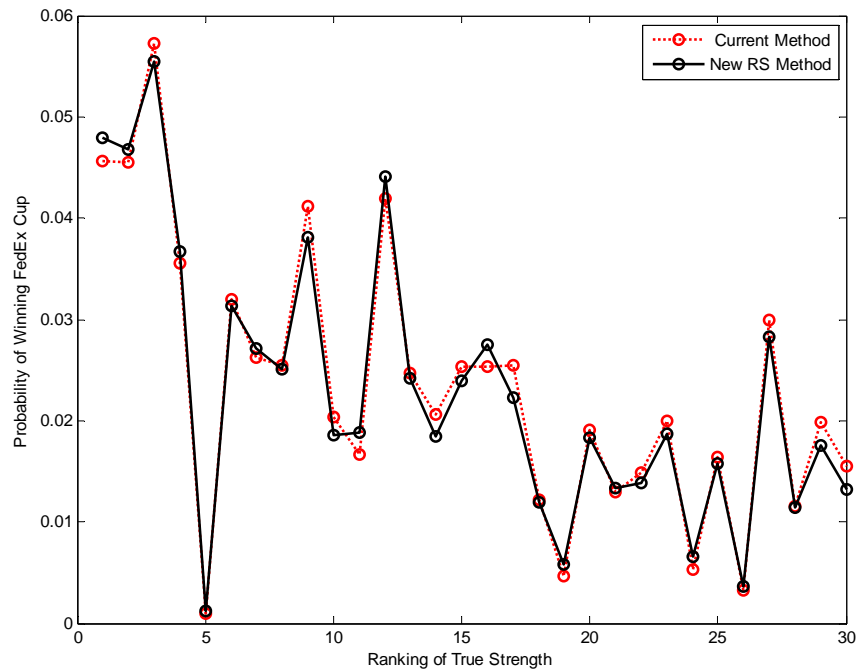
Figure 4: Probability of winning FedEx Cup by player's ranking of true strength

Another property of interest is how the reset ranks before the Tour Championship affect the probability of winning the FedEx cup. Figure 5 shows the probability of winning the FedEx Cup as a function of reset rank (i.e., rank of top 30 players just prior to the final event). The current points system favors the player ranked highest much more relative to the rank sum method, which levels the playing field for the top 7 players much more. In other words, the rank sum method lowers the chance of winning for the reset rank leader but increase the chance of winning for the 2nd to 7th place reset rank players, creating a richer competition during the Tour Championship.

A third quantity of interest is the distribution of the finish of the reset point leader. Figure 6 compares the probability distribution of the final FedEx Cup placement for the reset point leader determined through both the current and sum of ranks methods. It is clear that with the current method the reset point leader is almost guaranteed to finish in the top 5 of the FedEx Cup standings no matter how he performs in the Tour Championship. Using the rank sum method, however, the reset point leader can fall quite a number of spots if he happened to choke in the final event.

The PGA typically doesn't want a player's positive accomplishments in an entire year to be heavily affected by a single poor performance in the final event. Hence, as a compromise, we propose that the rank sum method be applied only to determine the winner of the FedEx Cup, and the current points system continue to be used to determine the 2nd place and beyond. As shown in Figure 6, such a mixed method guarantees the reset rank leader a top 5 position.
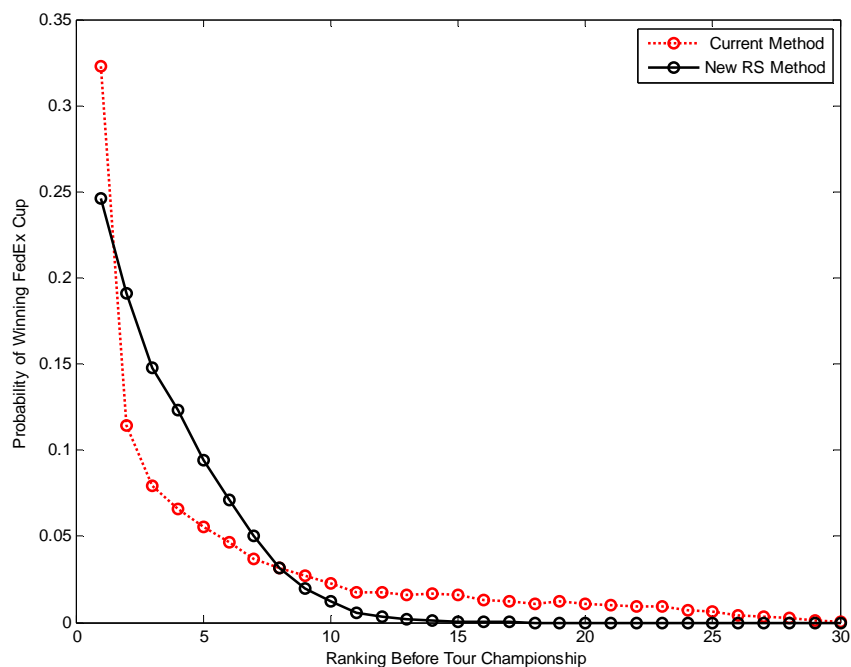
Figure 5: The relationship between probabilities of winning and the ranking before the Tour Championship
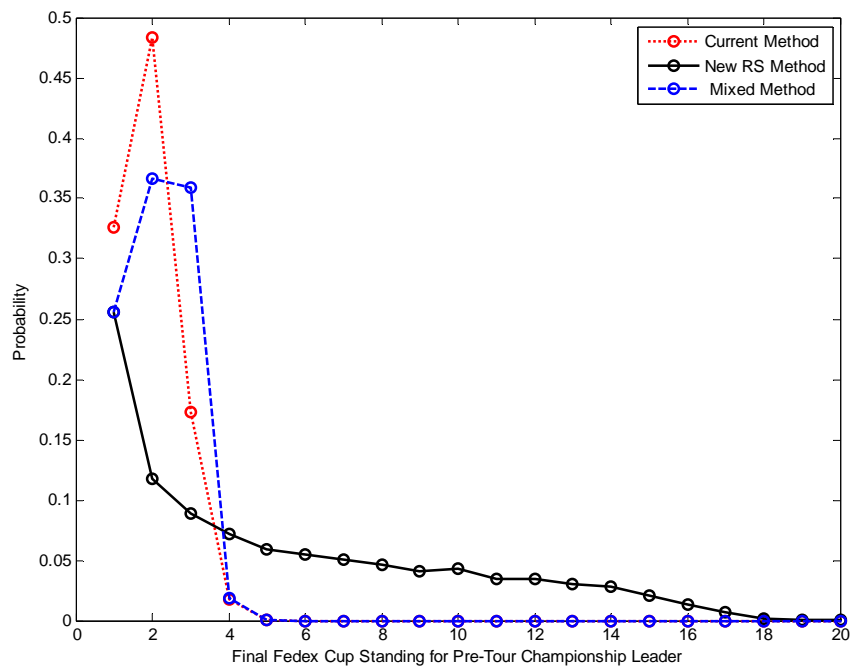

Figure 6: Distribution of final FedEx Cup ranks for the Pre-Tour Championship point leader.

Finally, Figure 7 shows how winning the Tour Championship determines placement in the FedEx Cup final standings. With the current method, if a top 30 player wins the Tour Championship event, he has a .60 chance of being the FedEx Cup champion and is almost guaranteed to finish no worse than 5th place. The difference in using the rank sum method is again apparent, as the winner of the Tour Championship can wind up as low as 10th place in the final FedEx Cup standings depending upon their starting rank in reset points. This may be undesirable as it devalues the importance of the final event of the PGA season. Hence, by using the rank sum method to determine a winner but using the current points system to determine 2nd and beyond, we potentially find a more attractive compromise.
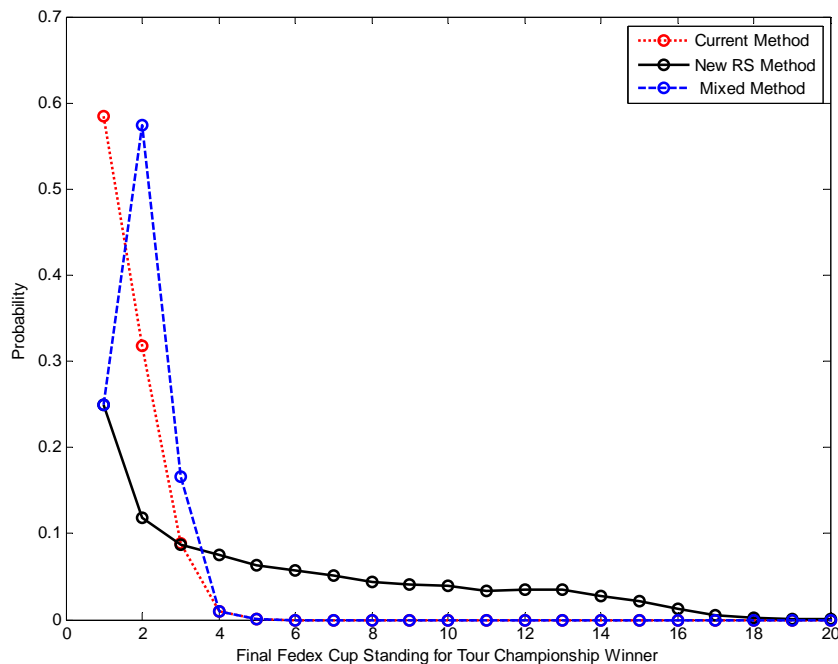

Figure 7: Distribution of FedEx Cup rank for Tour Championship winner.

5. Summary and Discussion

The current FedEx Cup scoring system involves several conversions between points and ranks. During the Tour Championship it is difficult for players, media, and fans to predict the final winner and it is not easy for a player to estimate how his performance will affect his final overall rank. As shown in Figure 8, with the current system this player needs to transform his rank into playoff points, and add it to his reset points to get the overall rank, a nearly impossible feat while trying to perform on the course. On the other hand, with our proposed new ranking system a player may be able understand his potential to win and take appropriate risks. Because the system does not impact the relationship between the player strength and the probability of winning, the proposed method may be considered by many to be superior in that it provides a clearer understanding to the players and the audience.

Our conclusions were made possible by a powerful stratified shrinkage simulation method, which can produce simulated scores on a hole-by-hole basis for each player and allow one to simulate the entire FedEx Cup point generating process for the entire tour

across the full season. These simulations allow us to carefully address a number of key questions regarding point system performance and furthermore to easily propose and evaluate new systems. Using this simulation we are able to show that the current point methods heavily favors the reset point leader along with the top 5 finishers. A new rank sum system provides higher probabilities of a larger portion of the field winning. A hybrid between the two systems is also proposed which protects the gains due to season long performance of the players captured in the players reset points.
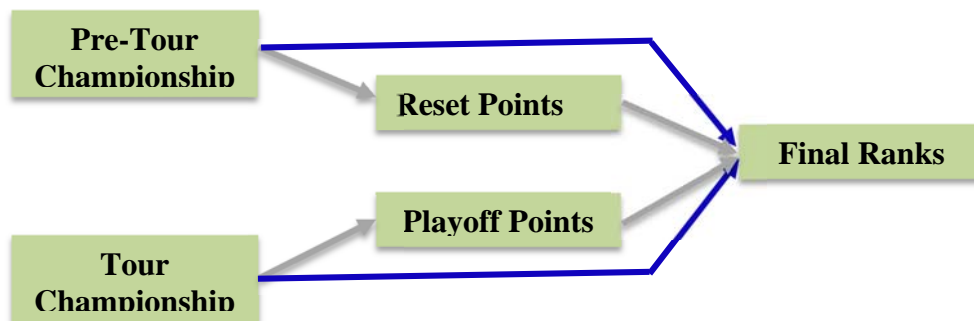
Current point system (grey) and new (1+1) method (blue)

Figure 8: Comparison of the current PGA system with the proposed rank sum method.

Acknowledgements

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Table 1: FedEx Cup Season and Playoffs Point Distribution

Position	PGA Tour Events	World Golf Championships	Masters, Players, US Open, British Open, and PGA Championship	Additional Events	Playoffs [a]
1	500	550	600	250	2500
2	300	315	330	165	1500
3	190	200	210	105	1000
4	135	140	150	80	750
5	110	115	120	65	550
6	100	105	110	60	500
7	90	95	100	55	450
8	85	89	94	50	425
9	80	83	88	45	400
10	75	78	82	40	375
11	70	73	77	37.5	350
12	65	69	72	35.0	325
13	60	65	68	32.5	300
14	57	62	64	31.0	285
15	56	59	61	30.5	280
16	55	57	59	30.0	275
17	54	55	57	29.5	270
18	53	53	55	29.0	265
19	52	52	53	28.5	260
20	51	51	51	28.0	255
...	…	…	…	...	...
66	5	5	5	5	25
67	4	4	4	4	20
68	3	3	3	3	15
69	2	2	2	2	10
70	1	1	1	1	5

[a] Playoffs include The Barclays, Deutsche Bank Championship, BMW Championship, and Tour Championship

Table 2: Reset Points and Bonus Money at Conclusion of the Tour Championship

Position	Reset Points	Bonus Money
1	2500	$10,000,000
2	2250	$3,000,000
3	2000	$2,000,000
4	1800	$1,500,000
5	1600	$1,000,000
6	1400	$800,000
7	1200	$700,000
8	1000	$600,000
9	800	$550,000
10	600	$500,000
11	480	$300,000
12	460	$290,000
13	440	$280,000
14	420	$270,000
15	400	$250,000
16	380	$245,000
17	360	$240,000
18	340	$235,000
19	320	$230,000
20	310	$225,000
21	300	$220,000
22	290	$215,000
23	280	$210,000
24	270	$205,000
25	260	$200,000
26	250	$195,000
27	240	$190,000
28	230	$185,000
29	220	$180,000
30	210	$175,000