2006 Men's NCAA Basketball Tournament

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Chapter 1

Introduction

This report concerns the 2006 Men's NCAA Division I Basketball Tournament. We (the authors) applied techniques of our paper "Optimal Strategies for Sports Betting Pools" (Clair-Letscher, 2005).

We entered three large online pools: ESPN's Tournament Challenge, Yahoo's Tournament Pick'em and CBS Sportsline Bracket Challenge. The pools are free. ESPN scoring is 10,20,40,80,120,160. Yahoo and CBS scoring is 1,2,4,8,16,32.

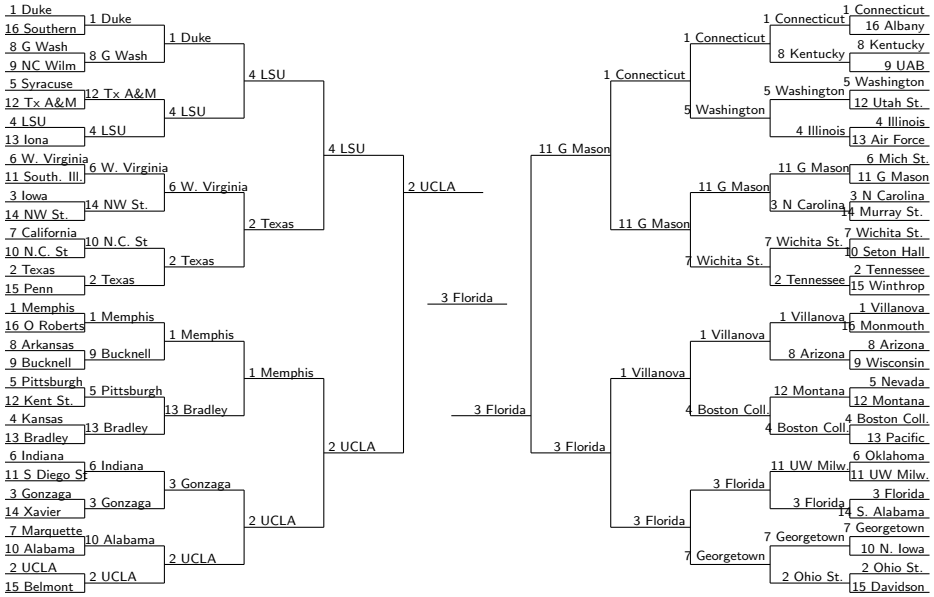
After the winners were announced, ESPN reported "more than 3,000,000" entries. The actual number of competitors in the Yahoo and CBS pools were never published, but from the percentile rankings of our scores along the way, we estimated 1.2 million for Yahoo and 300,000 for CBS. We also estimated 2.6 million entries for ESPN, a bit below their reported figure.

For inputs to our algorithms, we require pool data and actual data. The pool data came from Yahoo. For actual data, we used computer rankings by Jeff Sagarin (www.usatoday.com/sports/sagarin.htm) and by David Letscher (dehn.slu.edu/sports). We also used past results of seed-vs-seed matchups from NCAA history.

This year, we were invited to write an article for the New York Times sports section. The article appeared Monday, March 13, the day after "Selection Sunday". Because of this and other news coverage, many players used our published picks in their pools. The website with our picks received approximately 50,000 hits in the days before the tournament began. From a sample of public picks used in ESPN, we found quite a few players chose our exact picks in the ESPN pool. This has a large negative impact on the quality of these picks in such pools.

This year the tournament featured a number of striking upsets (see Figure 1.1). In particular, heavy favorites Duke and Connecticut failed to reach the final four, making it an ideal year for a contrarian strategy. Our computer generated picks had excellent results. We heard back from about a dozen people who won their pools using our publicly available picks (shown in Chapter 3). All of these reports were from people entered in 20-50 person pools.

Figure 1.1: 2006 Tournament results



Chapter 2

Opponent Perceptions

We had data available from Yahoo, which published the percentage of players picking each team to reach each round, $P(i \to r)$, for all i and r (see Table 2.3). Our values were taken on Wednesday, March 15 at 9:30pm. All perceived values in this report use Yahoo's round-by-round pick data.

Also available was ESPN's "National Bracket" which is somehow a consensus bracket based on player picks, and most likely reperesents simply a selection of 63 head-to-head probabilities. We did not use the ESPN information.

To compute means, sd's and covariances, $P(i \to r)$ is enough for all but the opponent score sd. For this, we computed approximate head-to-head perceived probabilites for each pair of teams. We used the formula:

$$P(i \text{ beats } j) = \frac{1}{2} + \frac{1}{2}\left(\frac{P(i \to r)}{P(i \to r-1)} - \frac{P(j \to r)}{P(j \to r-1)}\right) \tag{2.1}$$

for teams i and j which meet in round r. Note that this gives the known correct value for teams that meet in round 1.

We also show, in Tables 2.1 and 2.2, some statistics on opponent scores as predicted by our model with various choices for actual probabilities.

Table 2.1: Opponent Statistics, ESPN Scoring

	Letscher	Sagarin	History
opponent score mean	608.95	637.86	665.90
oppenent score s.d.	177.07	189.18	177.21
correlation between 2 opponents	0.402	0.407	0.356

Table 2.2: Opponent Statistics, Yahoo Scoring

	Letscher	Sagarin	History
opponent score mean	63.69	67.61	69.65
oppenent score s.d.	22.21	24.27	22.41
correlation between 2 opponents	0.370	0.368	0.335

Table 2.3: % of Players picking teams in each round, 2006 Yahoo Pick'em

		First Round	Sweet 16	Elite 8	Final Four	Semis	Champ
1	Connecticut	97.7	94.4	85.1	68.2	54.3	36.3
1	Duke	99.7	97.4	85.5	70.5	57.0	26.6
1	Villanova	97.6	90.6	50.5	36.3	14.7	8.7
3	N. Carolina	97.1	75.2	66.2	18.5	9.5	4.1
2	Texas	98.3	88.5	62.4	17.0	11.2	3.4
4	Boston Coll.	94.5	84.7	43.2	30.8	7.5	3.3
3	Gonzaga	93.5	79.3	46.9	28.1	7.6	3.0
1	Memphis	97.8	87.7	42.1	19.0	6.1	2.5
2	Ohio St.	96.9	70.6	45.1	17.2	5.1	2.2
2	UCLA	97.9	82.3	42.9	25.4	6.4	2.1
4	Kansas	95.2	57.6	35.1	16.2	3.9	1.4
4	Illinois	95.5	74.6	9.6	4.8	2.3	1.1
5	Syracuse	79.1	49.6	6.2	3.4	1.9	0.9
3	Florida	94.3	73.6	34.0	9.4	2.3	0.8
6	Michigan St.	87.9	22.1	17.7	2.5	1.1	0.5
5	Pittsburgh	88.9	39.1	19.3	7.4	1.5	0.4
3	Iowa	95.8	53.4	19.2	3.0	1.2	0.4
2	Tennessee	93.4	71.8	12.7	2.8	1.2	0.4
4	LSU	93.1	44.1	6.5	2.7	1.1	0.3
6	W. Virginia	77.0	40.8	13.1	1.8	0.8	0.2
7	Georgetown	81.2	25.7	13.5	2.0	0.5	0.2
8	Kentucky	51.6	2.7	1.4	0.6	0.4	0.2
6	Indiana	68.3	14.5	4.2	1.1	0.3	0.1
5	Washington	77.5	20.7	1.6	0.6	0.3	0.1
6	Oklahoma	63.2	16.6	4.2	0.9	0.2	0.1
8	Arizona	45.5	3.8	1.6	0.7	0.2	0.1
10	N.C. State	61.9	6.3	2.3	0.3	0.1	0.1
8	Arkansas	49.8	7.1	1.1	0.3	0.1	0.1
8	G Washington	69.7	1.8	0.8	0.3	0.1	0.1
7	Marquette	56.7	10.8	2.8	0.5	0.1	0
5	Nevada	84.3	11.3	1.6	0.4	0.1	0
9	Wisconsin	51.8	3.5	1.0	0.3	0.1	0
7	California	37.1	4.1	1.5	0.2	0.1	0
10	Alabama	41.2	5.3	1.1	0.2	0.1	0
12	Texas A&M	20.1	4.7	0.3	0.1	0.1	0
10	Seton Hall	61.9	14.0	0.8	0.1	0	0
11	UW-Milwaukee	34.2	6.9	0.6	0.1	0	0
7	Wichita St.	35.7	11.0	0.5	0.1	0	0
9	Bucknell	48.2	3.3	0.5	0.1	0	0
11	South. Ill.	22.0	4.2	0.4	0.1	0	0
14	Xavier	4.9	2.0	0.4	0.1	0	0
11	San Diego St	29.8	2.7	0.3	0.1	0	0
12	Kent St.	9.3	1.2	0.3	0.1	0	0
9	UAB	46.0	0.9	0.3	0.1	0	0
13	Air Force	2.4	0.8	0.1	0.1	0	0
16	Oral Roberts	0.8	0.2	0.1	0.1	0	0
16	Albany	0.4	0.2	0.1	0.1	0	0
10	N. Iowa	16.3	1.5	0.3	0	0	0
14	Nwestern St.	3.4	0.8	0.2	0	0	0
11	George Mason	9.8	0.6	0.2	0	0	0
15	Pennsylvania	1.2	0.4	0.2	0	0	0
12	Utah St.	20.1	1.9	0.1	0	0	0
15	Winthrop	4.5	1.2	0.1	0	0	0
13	Pacific	3.3	1.2	0.1	0	0	0
14	S. Alabama	3.3	0.8	0.1	0	0	0
12	Montana	13.1	0.6	0.1	0	0	0
13	Bradley	3.2	0.5	0.1	0	0	0
9	NC Wilmngton	29.3	0.2	0.1	0	0	0
14	Murray St.	0.9	0.2	0.1	0	0	0
15	Davidson	0.9	0.2	0.1	0	0	0
15	Belmont	0.6	0.2	0.1	0	0	0
16	Monmouth	0.3	0.1	0.1	0	0	0
13	Iona	6.1	0.8	0	0	0	0
16	Southern	0.2	0.1	0	0	0	0

Chapter 3

Letscher Ratings

Our primary source of actual probabilities was a rating system developed by one of the authors. There is more discussion of this at *http://dehn.slu.edu/sports*.

The Letscher ratings are shown in Table 3.2. To interpret these ratings, for a head to head matchup take the difference of the ratings. This gives the expected winning margin. To convert to a probability, we assume game scores are normally distributed with a standard deviation of $\sigma = 16.7$, computed from games over the past few seasons. That is,

$$P(A \text{ beats } B) = \Phi(\frac{r(A) - r(B)}{\sigma})$$

where Φ is the normal cumulative distribution function.

All picks with Letscher ratings used the 2^n scoring (1,2,4,8,16,32). Using Letscher actuals, we predicted mean scores, correlation with opponent scores, and expected returns for the optimal picks shown below, as well as other canonical picks. This data is shown in Table 3.1.

Table 3.1: Statistics for picks (using Letscher actuals)

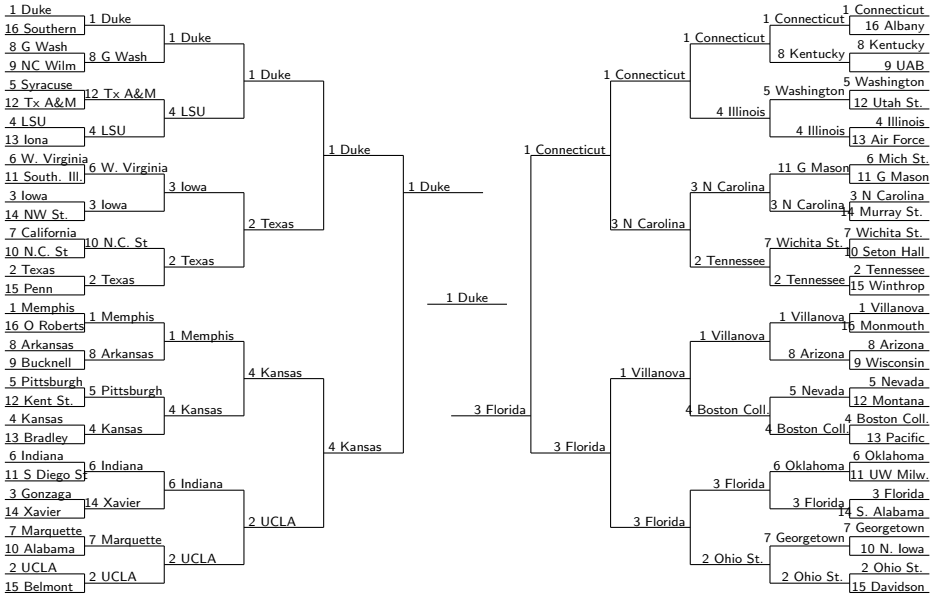
	Mean	Opp.	Expected Returns		
	Score	Corr.	n=50	n=5,000	n=500,000
Most likely picked	67.2	0.55	0.2	0	0
Favorites	78.2	0.43	6.1	30.4	124
Maximum expected score	78.9	0.48	5.5	18.6	46.1
Optimal picks, n = 50	76.4	0.06	9.1	165	2988.9
Optimal picks, n = 5,000	73.4	-0.04	8.7	177.1	3751.2
Optimal picks, n = 500,000	73.2	-0.05	8.6	176.9	3775.6

Table 3.2: Letscher 2006 Pre-tournament Power Rankings

Duke	92.1	NC State	79.55	WI Milwaukee	72.83
Texas	91.27	Indiana	78.85	S Illinois	72.67
Florida	89.17	Michigan St	78.35	Air Force	72.32
Memphis	88.31	Wisconsin	77.94	UNC Wilmington	72.12
Kansas	88.25	San Diego St	77.75	UAB	71.46
Connecticut	87.31	Marquette	77.7	Utah St	71.16
Villanova	86.27	Arizona	77.63	Seton Hall	70.78
LSU	85.78	Xavier	77.46	Winthrop	70.52
Washington	85.39	Gonzaga	77.26	Penn	69.99
Illinois	85.31	Nevada	77.17	Iona	68.12
Ohio St	84.74	Oklahoma	76.91	Montana	65.87
Boston College	82.29	N Iowa	76.7	Pacific	65.82
UCLA	82.24	Georgetown	76.39	S Alabama	64.89
North Carolina	82.22	Bradley	76.06	Kent	62.3
Pittsburgh	81.98	West Virginia	75.78	Northwestern LA	61.16
Arkansas	81.1	Syracuse	75.31	Murray St	60.3
Texas A&M	81.01	G Washington	74.84	Oral Roberts	59.39
Kentucky	80.87	California	74.74	Albany NY	56.96
Iowa	80.73	Bucknell	74.61	Davidson	56.1
Tennessee	80.43	Alabama	74.48	Belmont	48.17
George Mason	80.21	Wichita St	73.88	Southern Univ	39.37
				Monmouth NJ	38.71

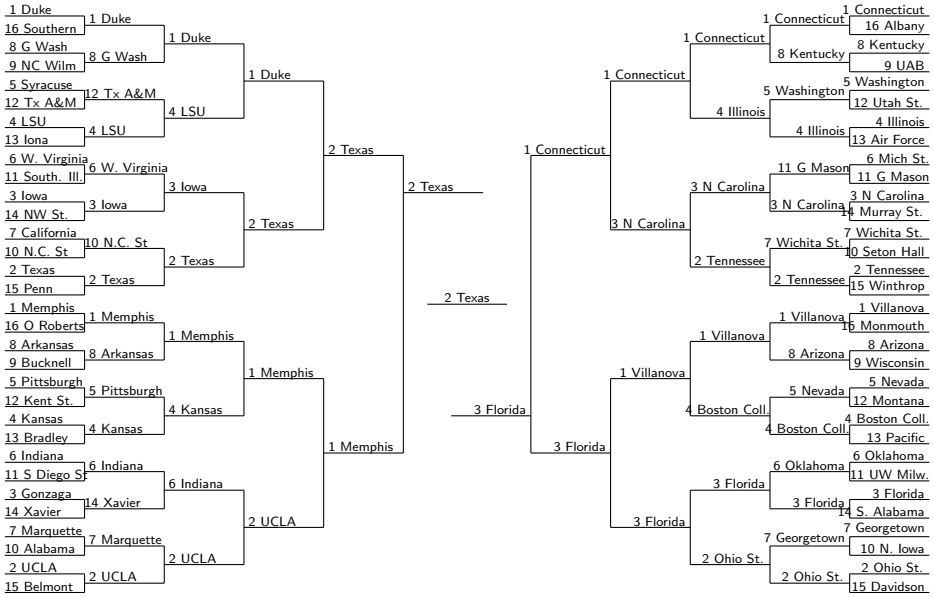
3.1 Letscher Favorites

These picks scored 87 out of 192 using 2^r scoring.



3.2 Letscher for $n = 50$, 2^r scoring

These picks scored 91 out of 192.



3.3 Letscher for $n = 5000$, 2^r scoring

These picks scored 91 out of 192.

3.4 Letscher for $n = 500000$, 2^r scoring

We entered these picks into ESPN's pool. They scored 870 (of 1680) points and finished 48,998th in the 98.2 percentile. (With 2^r scoring, these picks score 91 out of 192.)

Chapter 4

Sagarin Ratings

Our second source of actual probabilities was Jeff Sagarin's computer rankings. To interpret these ratings, for a head to head matchup take the difference of the ratings. This gives the expected winning margin. To convert to a probability, we assume game scores are normally distributed with a standard deviation of $\sigma = 16.7$, computed from games over the past few seasons. That is,

$$P(A \text{ beats } B) = \Phi(\frac{r(A) - r(B)}{\sigma})$$

where Φ is the normal cumulative distribution function.

Table 4.1 shows mean scores, correlations with opponent scores, and expected return for various picks in various pool sizes. Also note the last column uses ESPN scoring. The picks are all based off of 2^n scoring except for the last row, which is optimized for ESPN scoring. The mean score column is the mean score with 2^n scoring.

Table 4.1: Statistics for picks using Sagarin actuals

			Expected Returns			
	Mean	Opp.	2^n scoring			ESPN
	Score	Corr.	n=50	n=100K	n=3M	n=3M
Most likely picked	73.7	0.54	0.6	0.01	0	0
Favorites*	83.4	0.53	3.3	2.0	1.1	0.26
Optimal picks, n = 50	80.6	0.31	4.9	59.2	163	74.3
Optimal picks, n = 100K & 1M	70.0	0.007	4.3	230	1427	1575
Optimal picks, n = 3M, ESPN	69.5	-0.001	4.3	226	1406	1578

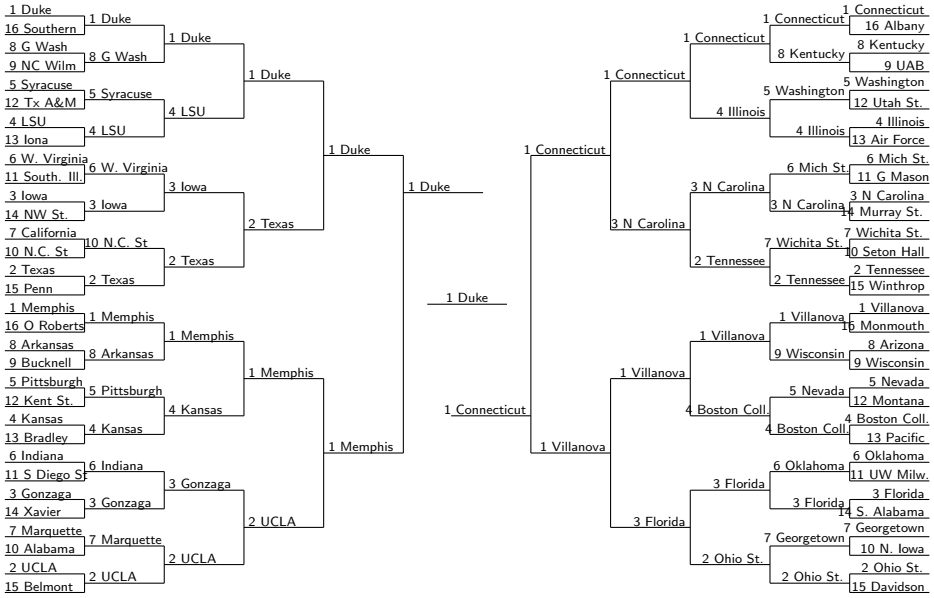
* The picks for favorites and maximum expected score are identical

Table 4.2: Sagarin 2006 Pre-tournament Power Rankings

Duke	95.09	NC State	85.58	Alabama	81.85
Connecticut	93.95	Indiana	85.21	Seton Hall	81.54
Villanova	93.18	Michigan State	84.77	Iona	81.30
Texas	91.40	Syracuse	84.70	San Diego State	81.14
Memphis	90.96	Nevada	84.68	Kent State	80.97
North Carolina	89.60	Marquette	84.46	Wis.-Milwaukee	80.74
Illinois	89.48	Northern Iowa	84.31	Utah State	80.74
Florida	89.45	Kentucky	84.26	Winthrop	80.30
Ohio State	89.38	Wichita State	84.21	Pacific	79.75
Kansas	88.13	Wisconsin	84.19	Northwestern St	78.70
Pittsburgh	88.06	Oklahoma	84.15	South Alabama	78.57
LSU	87.84	Bradley	83.90	Montana	78.47
Tennessee	87.12	George Mason	83.77	Murray State	78.46
Iowa	87.11	Texas A&M	83.67	Pennsylvania	78.40
UCLA	87.04	Arizona	83.32	Oral Roberts	75.94
Boston College	86.86	Bucknell	83.05	Davidson	75.76
Georgetown	86.58	Southern Illinois	82.92	Albany-NY	73.12
Gonzaga	86.05	UAB	82.92	Belmont	71.26
Arkansas	86.04	NC Wilmington	82.76	Monmouth-NJ	70.70
Washington	85.83	California	82.40	Southern U.	69.45
George Washington	85.80	Air Force	82.06	Hampton	65.01
West Virginia	85.71	Xavier-Ohio	81.85		

4.1 Sagarin Favorites

These picks would have scored 67 out of 192 points with 2^r scoring.



4.2 Sagarin for $n = 100,000$ and $n = 1,000,000$ with 2^r scoring

These picks were optimal for both $n = 100,000$ and $n = 1,000,000$. We entered these picks into Yahoo's pool, and in the CBS sportsline pool. They scored 63 (out of 192) points. In the CBS pool they finished 80,278th out of about 300,000 entrants.

4.3 Sagarin for $n = 3,000,000$, ESPN scoring

We entered these picks into ESPN's pool. They scored 650 (out of 1680) points and finished 587,112th in the 78th percentile.

Chapter 5

NCAA Historical

The NCAA Tournament has been played in its current format since 1985. Teams are seeded into four regions, and ranked within regions from 1-16 by the selection committee. These seedings give some standard for comparing team strengths from year to year.

We took all previous tournament seed-vs-seed records and computed a probability of winning for each possible seed matchup. The head-to-head values we used for the #1-#16 seeds are shown in Table 5.2. Matchups occurring fewer than 10 times in the past were discarded, and teams with the same seed were set to a probability of .5. This resulted in the values shown in **bold**. The remaining less common matchups were computed by fitting to the known data.

Table 5.1 shows mean scores (using 2^n scoring), correlations with opponent scores, and expected returns in different size pools. Note that the last column uses ESPN scoring, and the last row pick are optimized for ESPN scoring.

Table 5.1: Statistics for picks using History actuals

			Expected Returns	
	Mean Score	Opp. Corr.	2^n scoring n=30K	ESPN n=1M
Most likely picked	74.4	0.52	0.01	0
Favorites	85.6	0.49	2.48	3.08
Max expected score	86.2	0.50	1.50	0.79
Optimal picks, n = 30K	82.6	-0.002	396	3331
Optimal picks, n = 1M, ESPN	82.3	-0.003	395	3347

Table 5.2: Historical head-to-head percentages

	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	#10	#11	#12	#13	#14	#15	#16
#1	**0.50**	**0.56**	**0.44**	**0.70**	**0.83**	**0.70**	0.73	**0.75**	**0.93**	0.77	0.83	**1.00**	0.93	0.93	0.96	**1.00**
#2	**0.44**	**0.50**	**0.64**	0.65	0.70	**0.74**	**0.74**	0.72	0.72	**0.53**	0.72	0.82	0.86	0.89	**0.95**	0.95
#3	**0.56**	**0.36**	**0.50**	0.56	0.58	**0.50**	0.62	0.66	0.68	**0.70**	**0.68**	0.71	0.80	**0.83**	0.88	0.89
#4	**0.30**	0.35	0.44	**0.50**	**0.58**	0.55	0.59	0.62	0.64	0.66	0.64	**0.55**	**0.80**	0.82	0.84	0.85
#5	**0.17**	0.30	0.42	**0.42**	**0.50**	0.53	0.56	0.59	0.61	0.64	0.67	**0.68**	**0.83**	0.82	0.82	0.82
#6	**0.30**	**0.26**	**0.50**	0.45	0.47	**0.50**	0.53	0.56	0.59	0.63	**0.70**	0.70	0.77	**0.82**	0.79	0.78
#7	0.27	**0.26**	0.38	0.41	0.44	0.47	**0.50**	0.52	0.54	**0.61**	0.64	0.67	0.71	0.73	0.74	0.73
#8	**0.25**	0.28	0.34	0.38	0.41	0.44	0.48	**0.50**	**0.45**	0.54	0.59	0.63	0.66	0.68	0.69	0.69
#9	**0.07**	0.28	0.32	0.36	0.39	0.41	0.46	**0.55**	**0.50**	0.53	0.56	0.59	0.61	0.63	0.64	0.65
#10	0.23	**0.47**	**0.30**	0.34	0.36	0.37	**0.39**	0.46	0.47	**0.50**	0.53	0.55	0.58	0.59	0.60	0.61
#11	0.17	0.28	**0.32**	0.36	0.33	**0.30**	0.36	0.41	0.44	0.47	**0.50**	0.53	0.55	0.56	0.57	0.58
#12	**0.00**	0.18	0.29	**0.45**	**0.32**	0.30	0.33	0.37	0.41	0.45	0.47	**0.50**	0.52	0.54	0.55	0.55
#13	0.07	0.14	0.20	**0.20**	**0.17**	0.23	0.29	0.34	0.39	0.42	0.45	0.48	**0.50**	0.52	0.53	0.53
#14	0.07	0.11	**0.17**	0.18	0.18	**0.18**	0.27	0.32	0.37	0.41	0.44	0.46	0.48	**0.50**	0.51	0.52
#15	0.04	**0.05**	0.12	0.16	0.18	0.21	0.26	0.31	0.36	0.40	0.43	0.45	0.47	0.49	**0.50**	0.51
#16	**0.00**	0.05	0.11	0.15	0.18	0.22	0.27	0.31	0.35	0.39	0.42	0.45	0.47	0.48	0.49	**0.50**

(Fixed values in bold, others are computed)

5.1 NCAA History Favorites

These scored 59 out of 192 using 2^r scoring.

5.2 NCAA History for $n = 1,000,000$, ESPN scoring

We entered these picks into ESPN's pool. They scored 550 (out of 1680) points and finished 1,496,138th in the 44th percentile.

5.3 NCAA History for $n = 30,000$, 2^r scoring

We entered these picks into the CBS sportsline pool. They scored 55 (out of 192) points.