



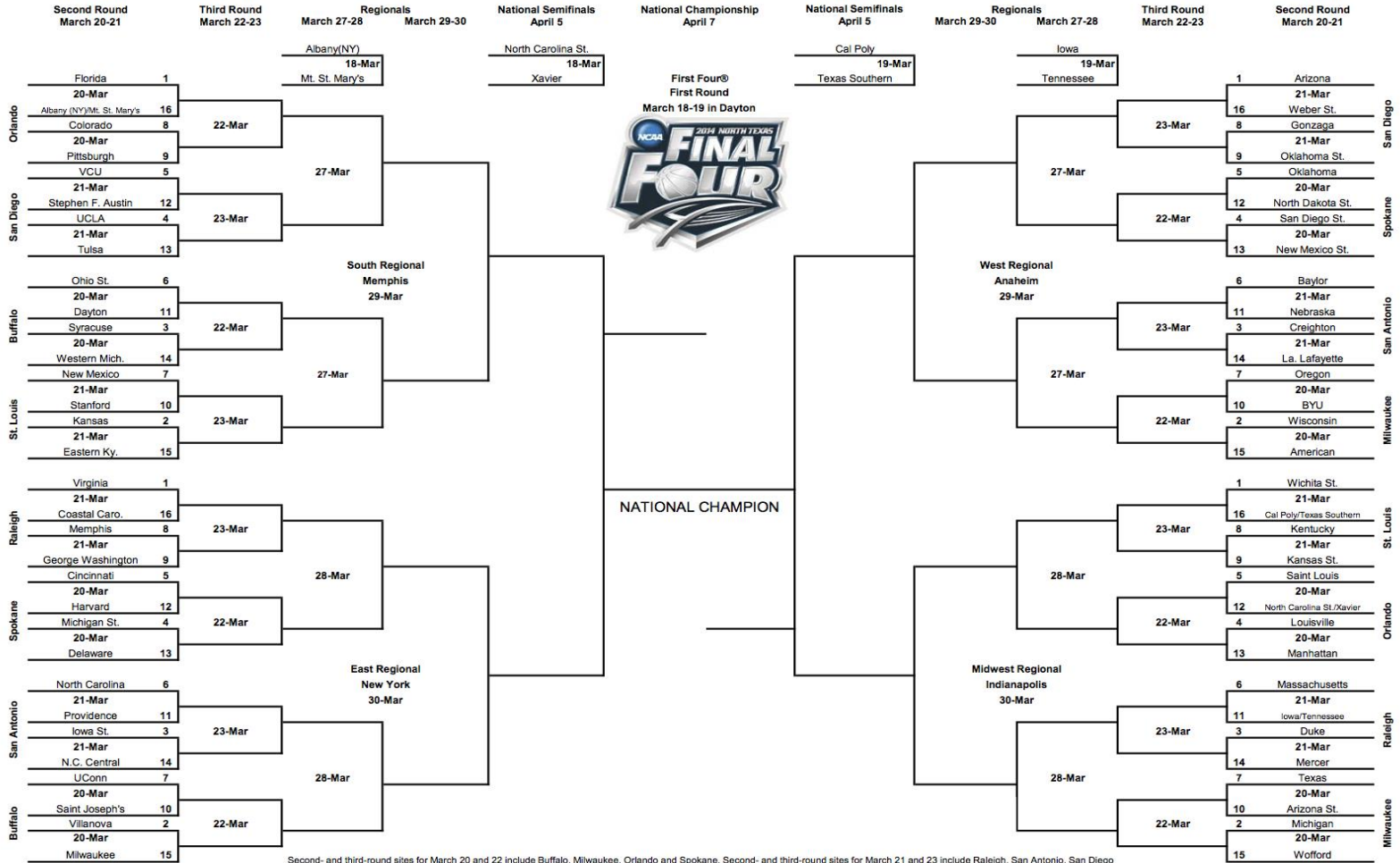
“The Mathematics of the Billion Dollar Bracket”

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Bracket

2014 NCAA Division I Men's Basketball Championship



Second- and third-round sites for March 20 and 22 include Buffalo, Milwaukee, Orlando and Spokane. Second- and third-round sites for March 21 and 23 include Raleigh, San Antonio, San Diego and St. Louis. Regional sites for March 27 and 29 are Anaheim and Memphis. Regional sites for March 28 and 30 are Indianapolis and New York City.



How Does it Work ?

- 4 sub-brackets (Regionals) of teams seeded 1 through 16
- 1 vs 16, 2 vs 15, 3 vs 14, ..., 8 vs 9
- There are 32 first round games, 16 second round games, 8 third round games, 4 quarterfinal games, 2 semifinal games, and 1 title game for a total of 63 games.



Warren Buffet's Challenge

- The Quicken Loans Billion Dollar Bracket would pay out 1 billion dollars to a contest entrant who picks all 63 games correctly prior to the start of the tournament
- Limited to 15 million entries
- Users need to have Yahoo ID and give out personal information (collected by Quicken and Berkshire Hathaway)



What is the Probability of Winning ?

- What is the probability of winning the bracket challenge?
- A number thrown out on the news a lot was 1 in 9,223,372,036,854,775,808 or over 1 in 9.2 quintillion.
- This is the probability of correctly predicting 63 tosses of a fair coin in a row, .



1 in 9.2 Quintillion

- Not an appropriate figure
- 9.2 Quintillion possible winning brackets
- Not all are equally likely
- What are the real odds of winning?



“The Experts”

- Tim Chartier of Davidson College, Jeff Bergen of DePaul University and other “experts” weighed in.
- They held seminars, posted You Tube Videos, and had Bracket Parties.
- At the end of the day, nobody even came close.



Real Odds of Winning

- Bergen estimates 1 in 128 billion under best case scenario conditions that make a lot of assumptions.
- The actual number is between 1 in 128 billion and 1 in 9.2 quadrillion.



Buffett's Challenge

- Limited to 15 million entrants. Even if there were 15 million unique brackets entered (all done by “expert analysis”), the probability of somebody winning would be

$$\frac{15000000}{128000000000} \approx \frac{1}{8500}$$



Buffett's Money

- His money was never in any real danger.
- Quicken Loans got a lot of free information they would have otherwise needed to pay to gather.



How to Expertly Fill Out a Bracket?

- Some Common Strategies
 - Always Pick Higher Seeded Teams (Until Final Four)
 - Use probability-based prediction from an expert like Jeff Sagarin or Ken Massey
 - Look at the Las Vegas lines for round as “experts” have created a market



Other Less Scientific Strategies

- Pick the team you like the best
- Pick the team whose mascot would win in a fight
- Put team names on two bowls of dog food and see which bowl the dog eats from first



Looking for Expert Advice

- <http://masseyratings.com/cb/arch/compare2014-19.htm>
- 65 vetted scientific ranking systems for ranking college basketball teams
- Well known experts like Massey, Sagarin, Pomeroy, Wolfe, and Burrus



Why So Many Opinions?

- Different Factors may play into different ranking systems. Audience Poll: Rank these different factors from Most to Least Important:
 - A) Margin of Victory (winning by 2 or by 20)
 - B) Location of Game (home, away, neutral)
 - C) Strength of Opponent
 - D) Strength of Opponent's Other Opponents.



Ratings Percentage Index

- The NCAA's official ranking system which is used to determine which teams do and do not play in the NCAA tournament
- Also, used by the NCAA selection committee to seed 1 through 16 for each region



The RPI

For the RPI,

C) Strength of Opponents (Counts for 50%)

D) Strength of Opponents' Other Opponents
(Counts for 25%)

B) Location of Game (home, away, neutral)
(Counts for the 25% of the Winning Percentage)

A) Margin of Victory (winning by 2 or by 20)
(Counts for Nothing...Just like the BCS for
Football)



Home vs Away Adjustment

- 1 win is not always equal to 1 win. 1 loss is not always equal to 1 loss
 - Wins at home are worth 0.6 wins
 - Wins at neutral site are worth 1.0 win
 - Wins on the road are worth 1.4 wins
 - Losses at home are worth 1.4 losses
 - Losses on the road are worth 1.0 loss
 - Losses on the road are worth 0.6 losses



Example

- Suppose you wanted to rank the following four teams by RPI, do so using the following data:

Home Team	Score	Road Team	Score
Rice	75	Texas A&M	57
Rice	72	Houston	66
Texas	66	Rice	69
Texas A&M	65	Rice	59
Houston	81	Texas	77
Texas	55	Texas A&M	65



RPI For Rice

Won 2 Home Games, Won 1 Road Game,
and Lost 1 Road Game.

- Their raw record is 3-1 with a winning percentage of $3/4=0.75$
- Their weighted record is 2.6-0.6 with a winning percentage of $2.6/3.2 = .8125$ (WP)



Other Components

- Opponents' Winning Percentage (OWP): What was the average winning percentage of Rice's opponents in all games where they did not play Rice?
- No Weights for Home/Away
- Texas A&M is 100%; Houston is 100% and Texas is 0%
- $(1.00+1.00+1.00+0)/4 = 0.75$ (OWP)



Other Components

- Opponent's Opponent's Winning Percentage (OOWP): Average of Opponent's OWP:
- Texas A&M's OWP is $(1+1+0)/3 = .667$
- Houston's OWP is $(0.667+0)/2 = .333$
- Texas's OWP is $(.667+0+.5)/2 = .389$
- Rice's OOWP is $(.667+.667+.333+.389)/4 = .514$



Rice's RPI

- Total RPI is:

$$(.8125)(.25) + (.75)(.5) + (.514)(.25) \\ = .7066$$

At The Top (2013-2014)

<u>Rank</u>	<u>School</u>	<u>W-L</u>	<u>Pct</u>	<u>RPI</u>
1	<u>Florida</u>	32-2	0.9412	0.6764
2	<u>Arizona</u>	30-4	0.8824	0.6731
3	<u>Kansas</u>	24-9	0.7273	0.6610
4	<u>Wichita State</u>	33-0	1.0000	0.6522
5	<u>Villanova</u>	28-4	0.8750	0.6455
6	<u>Wisconsin</u>	26-7	0.7879	0.6418
7	<u>Iowa State</u>	26-7	0.7879	0.6391
8	<u>Virginia</u>	28-6	0.8235	0.6371
9	<u>Duke</u>	26-8	0.7647	0.6371
10	<u>Creighton</u>	26-7	0.7879	0.6332

At the Bottom (2013-2014)

<u>Rank</u>	<u>School</u>	<u>W-L</u>	<u>Pct</u>	<u>RPI</u>
340	<u>New Hampshire</u>	5-24	0.1724	0.3747
341	<u>Houston Baptist</u>	4-23	0.1481	0.3679
342	<u>Mississippi Valley State</u>	6-23	0.2069	0.3611
343	<u>Bethune-Cookman</u>	5-25	0.1667	0.3605
344	<u>Lamar</u>	3-25	0.1071	0.3580
345	<u>The Citadel</u>	4-25	0.1379	0.3562
346	<u>Southern Utah</u>	1-27	0.0357	0.3551
347	<u>Maryland-Eastern Shore</u>	5-23	0.1786	0.3531
348	<u>Grambling</u>	4-23	0.1481	0.3504
349	<u>Presbyterian</u>	4-26	0.1333	0.3415



Women's Basketball

- Larger Gaps in RPI
- Easier to predict with brackets since favorites tend to win
- Would have been more of a threat to Warren Buffett's Challenge if such a challenge were made for women's basketball

RPI Comparison

Men's Rank	Name	RPI	Women's Rank	Name	RPI
1	Florida	.676	1	Notre Dame	.718
10	Creighton	.633	10	Texas A&M	.638
25	N. Carolina	.608	25	Ok. State	.610
64	Mid Tenn	.567	64	Geo. Wash	.565
100	Ore. State	.537	100	Fresno St.	.548

World Cup 2014

Round of 16

Quarter-Finals

Semi-Finals

Semi-Finals

Quarter-Finals

Round of 16



- A** Brazil
- Croatia
- Mexico
- Cameroon

- b** Spain
- Netherlands
- Chile
- Australia

- C** Colombia
- Greece
- Ivory Coast
- Japan

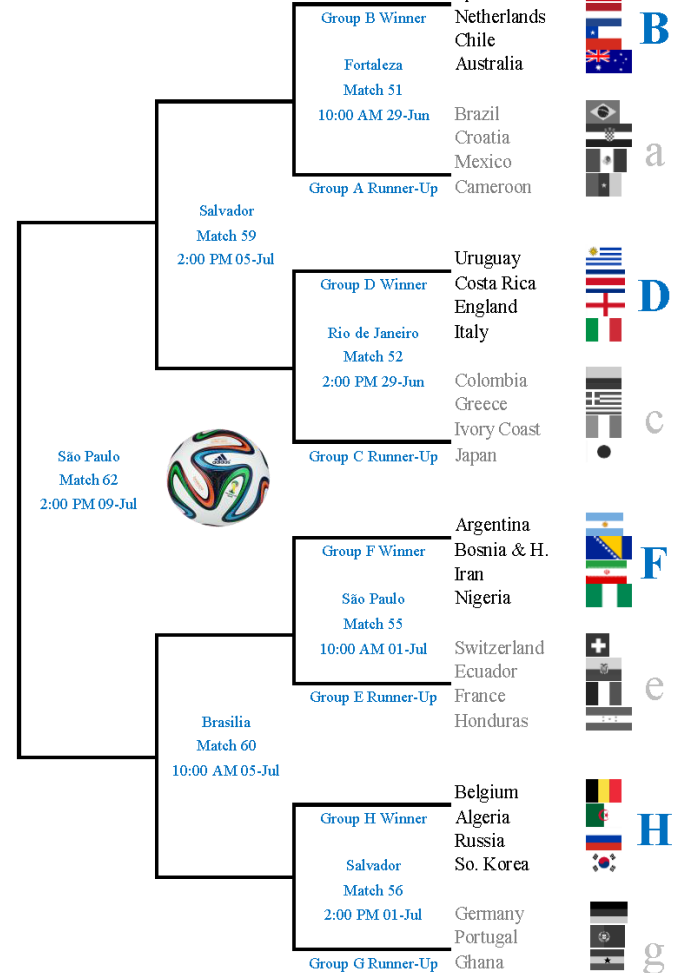
- d** Uruguay
- Costa Rica
- England
- Italy

- E** Switzerland
- Ecuador
- France
- Honduras

- f** Argentina
- Bosnia & H.
- Iran
- Nigeria

- G** Germany
- Portugal
- Ghana
- USA

- h** Belgium
- Algeria
- Russia
- So. Korea



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Information correct as of 23 January 2014. File version 1.2

All times are US CDT (GMT-0600) (Brazil is -0300)

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@GraphicStrick



World Cup 2014

- 32 team tournament
- 8 Groups of 4 teams
 - 4 Permutations of 2 for $4 \times 3 = 12$ possible orderings of the top 2 in each group.
 - $12^8 = 429,981,696$ ways of picking the 16 correct slots in from pool play to round of 16
 - Many of you with much more soccer knowledge than me will know that it's a lot easier than 1 in a half a billion to pick these correct outcomes (not one game but 3 games are played...less chance of upsets)



World Cup 2014

- After that, there are 15 games played in a format similar to the Sweet 16 from College Basketball
- Probability of picking the correct winners assuming equal probability for the whole tournament is $1/(12^8 \cdot 2^{15})$ or 1 in 14 trillion



College World Series 2014

- Issue comes in the fact that there are 8 teams split into two groups of 4
 - Each group of 4 plays double elimination tournament
 - Some “if necessary games”
 - Two group winners play a best two out of three final (losses from initial group play don’t carry over)



What's Next ?

- 2014-2015 basketball season:
 - Will there be another billion dollar bracket challenge?
- Advice: Don't spend too much time trying to get the perfect bracket...that time is probably better spent doing other things.