MARCH MATHNESS
for your classroom

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Y me?
CLASSROOM

• These are relative frequency.
• You could count them over some time period.
• We will look from 2000-2019.
• How might these frequencies change over 50 years?
PICK YOUR
RANK 1999-2019
RANK 1999-2019

NCAA 2019 NATIONAL CHAMPION

Division I Basketball Championship

Apple, dog, and cat icons.
RANK 1999-2019

4/20

3/20

1/20
RANK 1999-2019

Otto the Orange 1/20
source: http://bracketodds.cs.illinois.edu/seedadv.html
CLASSROOM

• Why did you guess what you did?
• What would make it easier/harder to guess?
• Make your own.
Probability #1 seed reaches the **FINAL FOUR**

45%
Probability #1 seed reaches the **FINAL FOUR**

40%
Probability #16 seed

WINS

.5%
Probability #16 seed wins 7.7%
Probability #1 seed is the national CHAMPION with a 55% chance.
Probability #1 seed is the national CHAMPION with a 65% probability.
Probability #12 seed wins in 1ST ROUND 31%
Probability #12 seed wins in 1st round with 36% probability.
Why is it so hard to make a perfect bracket?
There are only 63 games!
Combinations get big quickly! So quickly we might not know the number!
practice virtual flips

Let’s practice 5 flips before we do 16!
virtually flipped out

If you have computing, you can flip with Google.
perfect 1\textsuperscript{st} day
CLASSROOM

• How likely were you to get 16 guesses correct?
• Multiplication principle: $2^{16}$, which is about 1 in 65,000.
• How about 32 guesses?
• $2^{32}$ - about 1 in 4.2 billion.
• How big is $2^{32}$?
• Let’s convert $2^{32}$ seconds into years.
TOTAL MADNESS

• How many options are there?

\[ 2^{63} = 9 \times 10^{18} \]

• If you could produce 1 billion unique unique brackets per second, how long would it take to create this many?
300 YEARS
How big?

How big is $2^{63}$?
• Suppose you store each bracket in 64 bits.
• This translates to just under 74 exabytes.
• Storing every spoken word ever is estimated at 5 exabytes.
FAST DATA

• If you made every bracket, you have 89 hours to upload all of them.
• You’d have to upload the equivalent of 66 times the number of stars in our galaxy per second!
Needle in a 9 quintillion HAYSTACK
dabbling in prediction

Picture credit: http://cdn.zmescience.com/wp-content/uploads/2013/10/crystal-ball-prediction.jpg
seeing a bit clearer
better odds

In predicting any of the 63 games, assume your March Madness accuracy is:

• 70%, perfect bracket odds: 1 in 5.7 billion
• 71%, perfect bracket odds: 1 in 2.3 billion
• 72%, perfect bracket odds: 1 in 1 billion

How can we improve our odds?
DIY

Where does this come from?

- 70%, perfect bracket odds: 1 in 5.7 billion
LESSON

small steps = big insight
Bring in math!
Ranking

1. [Logo]
2. [Logo]
3. [Logo]
4. [Logo]
ranking → bracket

Ranking

1. [Team logo]
2. [Team logo]
3. [Team logo] [Team logo]
4. [Team logo]
Ranking  ➔  bracket

Ranking
1.  
2.  
3.  
4.  

Teams:
1. [Team Logo]
2. [Team Logo]
3. [Team Logo]
4. [Team Logo]
Ranking ➔ bracket

1. [Ranking 1]
2. [Ranking 2]
3. [Ranking 3]
4. [Ranking 4]
besting millions

- 2009 – research project – Best bracket – 97%
- 2010 – homework assignment – Best – 99%
- 2014 – used around the world
YOUR TURN
choices

Picture credit: https://pixabay.com/p-1767564/?no_redirect
choice 1
men’s or women’s
Sports Ranking

Let the power of math help your bracketology!

Rank Men's Madness
Rank Women's Madness
choice 2
scores or no scores
Choose a ranking type

Colley Ranking

Massey Ranking

Colley Ranking
A linear system that only uses wins and losses.

Massey Ranking
A linear system that integrates the scores of games.
Choose a ranking type

- Colley Ranking
- Massey Ranking
- Seeded Dice
choice 3

your ideal weight
weighting time

One way to weight is to break the season in half and count games in the first half as $\frac{1}{2}$ and the second half as 1.
Choose a weight

- Uniform Weight
- Log Weighted Time
- Linear Weighted Time
- Intervals
\[ y = mx \]
Colley Ranking

Year

2017

Number of teams to display

enter # of teams to display; default: 20

Home team weight

enter weight for home team; default: 1

Away team weight

enter weight for away team; default: 1

Neutral team weight

enter neutral weight for teams; default: 1

Submit
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>2020</td>
</tr>
<tr>
<td>Number of teams to display</td>
<td>10</td>
</tr>
<tr>
<td>Largest margin of victory</td>
<td>20</td>
</tr>
<tr>
<td>Interval weights</td>
<td>.5, 1</td>
</tr>
<tr>
<td>Home team weight</td>
<td>.75</td>
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<tr>
<td>Away team weight</td>
<td>1.2</td>
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<tr>
<td>Neutral team weight</td>
<td>1.2</td>
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</tbody>
</table>

Submit
## Colley Ranking

<table>
<thead>
<tr>
<th>Rank</th>
<th>College</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kansas</td>
<td>1.09804069431</td>
</tr>
<tr>
<td>2</td>
<td>Baylor</td>
<td>1.02270191229</td>
</tr>
<tr>
<td>3</td>
<td>Dayton</td>
<td>1.01496656346</td>
</tr>
<tr>
<td>4</td>
<td>San_Diego_St</td>
<td>0.993495009157</td>
</tr>
<tr>
<td>5</td>
<td>Gonzaga</td>
<td>0.959098434235</td>
</tr>
<tr>
<td>6</td>
<td>Florida_St</td>
<td>0.958841617702</td>
</tr>
<tr>
<td>7</td>
<td>Auburn</td>
<td>0.955025913244</td>
</tr>
<tr>
<td>8</td>
<td>Duke</td>
<td>0.945428840661</td>
</tr>
<tr>
<td>9</td>
<td>Villanova</td>
<td>0.943371879212</td>
</tr>
<tr>
<td>10</td>
<td>Louisville</td>
<td>0.934665929987</td>
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<tr>
<td>11</td>
<td>Oregon</td>
<td>0.92528202102</td>
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<tr>
<td>12</td>
<td>Seton_Hall</td>
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<tr>
<td>13</td>
<td>Creighton</td>
<td>0.912641433401</td>
</tr>
<tr>
<td>14</td>
<td>Maryland</td>
<td>0.906311853142</td>
</tr>
</tbody>
</table>
• Make a bracket and explain your weighting.
• Override the bracket with other data.
• Have a bracket challenge!
MATHness

http://marchmathness.davidson.edu/
YouTube tutorial

https://youtu.be/QrIBZydp8Ak