**Is the NBA Draft Lottery a Rigged System?**

**A Simulation**

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**The Rules**

* The NBA Draft Lottery is an annual event held (usually in May) by the NBA in which the 14 teams who missed the playoffs in the previous season (or teams who hold the draft rights of another team that missed the playoffs in the previous season) participate in a lottery process to determine the draft order in the NBA Draft (usually in June).
* The lottery process determines which teams receive the top three picks.
* The lottery is weighted so that the team with the worst record (or the team that holds the draft rights of the team with the worst record) has the best chance to obtain a higher draft pick.
* The lottery winner gets the first selection in the draft among college basketball players and other eligible players (including international players). The next team chosen in the lottery gets the second selection. The third team chosen gets the third selection.
* After the top three selections are made, the remainder of the first-round draft order is in **reverse** order of the win-loss record for the remaining teams (or the teams who originally held the lottery rights if they were traded).
* The lottery does not determine the draft order in the subsequent rounds of the draft. [Page\_2](#Page_2)

**The Execution**

* Fourteen ping pong balls numbered 1–14 are placed in a standard lottery machine.



* Four balls are randomly selected from the lot.
* The order in which the numbers are drawn is not important. Thus,  combinations are possible.
* One outcome (11-12-13-14) is disregarded. The remained 1,000 outcomes are distributed among the 14 non-playoff NBA teams.
* As of 2008, with 30 NBA teams, 16 qualify for the playoffs and the remaining 14 teams are entered in the draft lottery. These 14 teams are ranked in reverse order of their regular season record and are assigned the following number of chances. [Page\_3](#Page_3)

**Probability of Receiving the #1 Draft Pick in the NBA Draft Lottery**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Rank | # Combinations | Probability of #1 Draft Pick |
| (Worst Record) → | 1 | 250 | 0.250 |
|  | 2 | 199 | 0.199 |
|  | 3 | 156 | 0.156 |
|  | 4 | 119 | 0.119 |
|  | 5 | 88 | 0.088 |
|  | 6 | 63 | 0.063 |
|  | 7 | 43 | 0.043 |
|  | 8 | 28 | 0.028 |
|  | 9 | 17 | 0.017 |
|  | 10 | 11 | 0.011 |
|  | 11 | 8 | 0.008 |
|  | 12 | 7 | 0.007 |
|  | 13 | 6 | 0.006 |
| (Best Record) → | 14 | 5 | 0.005 |
|  | TOTAL | 1000 | 1.000 |

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**Rigged System?**

NBA Draft Lottery conspiracy theorists claim that NBA commissioner **David Stern** has and continues to rig the lottery for one or more of the following reasons:

* to increase the ratings of teams in a large television market (Ex: 2008 Chicago Bulls, 2009 L.A. Clippers)
* to take care of teams that lose superstars (2010 Washington Wizards, 2011 Cleveland Cavaliers, 2012 New Orleans Hornets)
* to create rivalries to boost rankings and ratings (Cleveland Cavaliers vs. Miami Heat)
* to reward the new team owners with the No. 1 draft pick (2012 New Orleans Hornets) [Page\_5](#Page_5)

<http://bleacherreport.com/articles/1202943-2012-nba-draft-is-it-officially-a-rigged-lottery>

**The Claim**

* The probability of one the top three seed teams (i.e. the teams with the three worst records) receiving the #1 draft pick is = 0.605.
* In the past 8 years (2005 – 2012), the #1 draft pick went to one of the top three seed teams only twice (2009 & 2012). Is this unusual? Does this provide evidence of a rigged system?

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**A Simulation**

* Use a table (or random number generator) to examine groups of three digits from 000 – 999.
* Look for numbers less than 605.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sim #** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | # successes |
| 1 | 132 | 592 | 913 | 547 | 256 | 583 | 875 | 780 | 5 |
| 2 | 771 | 257 | 621 | 455 | 508 | 180 | 687 | 040 | 5 |
| 3 | 392 | 354 | 706 | 815 | 840 | 649 | 253 | 824 | 3 |
|  |  |  |  |  |  |  |  |  |  |
| 1000 | 159 | 708 | 097 | 601 | 010 | 432 | 478 | 574 | 7 |

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**Simulation Summary**

|  |  |  |
| --- | --- | --- |
| **# Successes** | **Frequency** | Estimated p-value = True p-value = 0.047 = P( X < 2 )for X ~ Bin( n = 8, p = 0.605 ) |
| 0 |  0 |
| 1 |  8 |
| 2 |  44 |
| 3 | 110 |
| 4 | 207 |
| 5 | 300 |
| 6 | 227 |
| 7 |  85 |
| 8 |  19 |
| **TOTAL** | **1000** |

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**But Wait? Can we assume that p is constant from year-to-year?**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **# Combos** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
| 1st  | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 |
| 2nd  | 178 | 199 | 199 | 199 | 178 | 199 | 199 | 199 |
| 3rd  | 177 | 138 | 156 | 138 | 177 | 156 | 156 | 138 |
| **Total** | **605** | **587** | **605** | **587** | **605** | **605** | **605** | **587** |

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**Ties are possible!**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Rank** | **# Combinations** | **Team** | **Win-Loss****Record** | **Actual # Combinations** |
| 1  | 250 | Orlando Magic | 20-62 | 250 |
| 2 | 199 | Charlotte Bobcats | 21-61 | 199 |
| 3 | 156 | Cleveland Cavaliers | 24-58 | 156 |
| 4 | 119 | Phoenix Suns | 25-57 | 119 |
| 5 | 88 | New Orleans Pelicans | 27-55 | 88 |
| 6 | 63 | Sacramento Kings | 28-54 | 63 |
| 7 | 43 | Detroit Pistons | 29-53 | 36 |
| 8 | 28 | Washington Wizards | 29-53 | 35 |
| 9 | 17 | Minnesota Timberwolves | 31-51 | 17 |
| 10 | 11 | Portland Trail Blazers | 33-49 | 11 |
| 11 | 8 | Philadelphia 76ers | 34-48 | 8 |
| 12 | 7 | Toronto Raptors | 34-48 | 7 |
| 13 | 6 | Dallas Mavericks | 41-41 | 6 |
| 14  | 5 | Utah Jazz | 43-39 | 5 |
| **TOTAL** | **1000** |  |  | **1000** |

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**Reexamine the Simulation**

* Look for numbers less than 605 for years 2005, 2007, 2009, 2010, 2011.
* Look for numbers less than 587 for years 2006, 2008, 2012.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |  |
| **Sim #** | **(605)** | **(587)** | **(605)** | **(587)** | **(605)** | **(605)** | **(605)** | **(587)** | **# successes** |
| 1 | 132 | 592 | 913 | 547 | 256 | 583 | 875 | 780 | 4 |
| 2 | 771 | 257 | 621 | 455 | 508 | 180 | 687 | 040 | 5 |
| 3 | 392 | 354 | 706 | 815 | 840 | 649 | 253 | 824 | 3 |
|  |  |  |  |  |  |  |  |  |  |
| 1000 | 159 | 708 | 097 | 601 | 010 | 432 | 478 | 574 | 6 |

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**Revised Summary**

|  |  |  |
| --- | --- | --- |
| **# Successes** | **Frequency** | Estimated p-value =  |
| 0 | 0 |
| 1 | 11 |
| 2 | 51 |
| 3 | 108 |
| 4 | 223 |
| 5 | 292 |
| 6 | 219 |
| 7 | 79 |
| 8 | 17 |
| **TOTAL** | **1000** |

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**Conclusion?**

<http://probasketballtalk.nbcsports.com/2013/05/21/why-theres-a-100-percent-chance-the-nba-lottery-is-fixed/>

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**Fun with Probability**

For some fun with probability, try finding the probability that a given team receives the #2 draft pick.

**Warning: You’re gonna need Bayes’ Rule ……..**

P(Seed 3 gets #2 draft pick)

= P(Seed 3 gets #2 | Seed 1 gets #1 ) ⋅ P(Seed 1 gets #1)

 + P(Seed 3 gets #2 | Seed 2 gets #1 ) ⋅ P(Seed 2 gets #1)

+ P(Seed 3 gets #2 | Seed 3 gets #1 ) ⋅ P(Seed 3 gets #1)

+ P(Seed 3 gets #2 | Seed 4 gets #1 ) ⋅ P(Seed 4 gets #1)

+ P(Seed 3 gets #2 | Seed 5 gets #1 ) ⋅ P(Seed 5 gets #1)

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 .

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+ P(Seed 3 gets #2 | Seed 14 gets #1 ) ⋅ P(Seed 14 gets #1)

Try finding the probability that seed 3 receives the #3 draft pick …. It’s a little messy!