

# **END GAME STRATEGY**

**STATS INVOLVED IN NBA**

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# IF YOU WERE THE COACH...

- ANALYSIS OF THE OPTIMAL STRATEGY
- *MATHLETICS: HOW GAMBLERS, MANAGERS, AND SPORTS ENTHUSIASTS USE MATHEMATICS IN BASEBALL, BASKETBALL, AND FOOTBALL*
- TWO SITUATIONS SHOWN THROUGH VIDEOS
- CASE 1: TWO POINTER TO TIE OR THREE POINTER TO WIN?

# SHOULD A TEAM GO FOR TWO OR THREE POINTS?

- [HTTPS://WWW.YOUTUBE.COM/WATCH?V=5DH\\_WMIA-GS](https://www.youtube.com/watch?v=5DH_WMIA-GS)
- MAXIMIZE THE PROBABILITY TO WIN THE GAME
- Assume no foul will occur and it's the last shot
- PTWO, PTHREE, POT

- Independent Events Eg: E1 E2 E3
- $P(E1 \text{ union } E2 \text{ union } E3) = P(E1) * P(E2) * P(E3)$
- PTWO, PTHREE, POT
- $PTWO \approx 0.45$  //  $PTHREE \approx 0.33$  //  $POT \approx 0.5$
- $P(WIN) = PTWO * POT \text{ OR } PTHREE$
- $P(\text{win}) = PTWO * POT = (.45)(.5) = .225 < 0.33$



- SENSITIVITY ANALYSIS
- CASE 1: PTHREE & POT REMAIN UNCHANGED
- $0.33 / 0.5 = 0.66$
- CASE 2: PTWO & POT REMAIN UNCHANGED
- $0.45 * 0.5 = 0.225$
- CASE 3: PTWO & PTHREE REMAIN UNCHANGED
- $0.33 / 0.45 = 0.733$

Rk	Player	Age	G	GS	MP	FG	FGA	FG%	3P	3PA	3P% ▼	2P	2PA	2P%	eFG%	FT	FTA	FT%	ORB	DRB	TRB	AST	STL	BLK	TOV	PF	PTS
1	<a href="#">Travis Best</a>	28	<a href="#">77</a>	21	31.9	4.5	10.2	.440	0.5	1.3	.381	4.0	9.0	.449	.464	2.4	2.9	.827	0.5	2.4	2.9	6.1	1.4	0.1	1.6	3.2	11.9
2	<a href="#">Reggie Miller</a>	35	<a href="#">81</a>	81	39.3	6.4	14.5	.440	2.1	5.7	.366	4.3	8.8	.487	.512	4.0	4.3	.928	0.5	3.0	3.5	3.2	1.0	0.2	1.6	2.0	18.9
3	<a href="#">Sam Perkins</a>	39	<a href="#">64</a>	41	15.6	1.3	3.5	.381	0.6	1.7	.345	0.8	1.8	.414	.465	0.5	0.6	.842	0.5	2.1	2.6	0.6	0.5	0.3	0.3	1.0	3.8
4	<a href="#">Jalen Rose</a>	28	<a href="#">72</a>	72	40.9	7.9	17.3	.457	0.8	2.4	.339	7.1	14.8	.476	.480	4.0	4.8	.828	0.5	4.5	5.0	6.0	0.9	0.6	2.9	3.2	20.5
5	<a href="#">Austin Croshere</a>	25	<a href="#">81</a>	23	23.1	3.4	8.7	.394	0.9	2.6	.338	2.5	6.1	.417	.444	2.5	2.9	.866	1.5	3.3	4.8	1.1	0.4	0.6	1.7	2.2	10.1
6	<a href="#">Jeff Foster</a>	24	<a href="#">71</a>	9	16.2	1.4	3.0	.469	0.0	0.1	.286	1.4	2.9	.476	.474	0.7	1.3	.516	2.0	3.5	5.5	0.5	0.5	0.4	0.7	2.1	3.5
7	<a href="#">Jonathan Bender</a>	20	<a href="#">59</a>	7	9.7	1.1	3.2	.355	0.2	0.7	.268	0.9	2.5	.379	.384	0.8	1.2	.735	0.2	1.0	1.3	0.5	0.1	0.5	0.7	1.2	3.3
8	<a href="#">Derrick McKey</a>	34	<a href="#">66</a>	20	15.0	0.9	2.1	.441	0.1	0.3	.200	0.8	1.8	.483	.456	0.3	0.4	.778	0.7	1.9	2.7	1.1	0.7	0.2	0.7	2.1	2.2
9	<a href="#">Terry Mills</a>	33	<a href="#">14</a>	0	8.1	0.8	2.4	.324	0.2	1.2	.176	0.6	1.2	.471	.368	0.0	0.0		0.3	1.2	1.5	0.4	0.2	0.1	0.7	1.4	1.8
10	<a href="#">Tyus Edney</a>	27	<a href="#">24</a>	0	11.0	1.5	3.8	.385	0.0	0.3	.167	1.4	3.5	.400	.390	1.5	1.6	.897	0.2	0.8	1.0	2.3	0.7	0.0	1.0	0.7	4.4
11	<a href="#">Al Harrington</a>	20	<a href="#">78</a>	38	24.3	3.1	7.0	.444	0.0	0.1	.143	3.1	6.9	.448	.445	1.3	2.0	.656	1.5	3.4	4.9	1.7	0.8	0.2	1.9	2.9	7.5
12	<a href="#">Jermaine O'Neal</a>	22	<a href="#">81</a>	80	32.6	5.0	10.7	.465	0.0	0.1	.000	5.0	10.7	.468	.465	2.9	4.8	.601	3.1	6.7	9.8	1.2	0.6	2.8	2.0	3.5	12.9
13	<a href="#">Bruno Sundov</a>	20	<a href="#">11</a>	4	10.9	1.8	3.7	.488	0.0	0.4	.000	1.8	3.4	.541	.488	0.3	0.5	.600	0.4	1.7	2.1	0.2	0.2	0.4	0.3	1.9	3.9
14	<a href="#">Zan Tabak</a>	30	<a href="#">55</a>	14	14.1	1.8	3.4	.527	0.0	0.0		1.8	3.4	.527	.527	0.4	0.9	.426	1.2	2.7	3.9	0.6	0.2	0.5	1.0	2.3	3.9
15	<a href="#">Lari Ketner</a>	33	<a href="#">7</a>	0	3.3	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

**SOURCE : [HTTP://WWW.BASKETBALL-REFERENCE.COM/TEAMS/IND/2001.HTML](http://www.basketball-reference.com/teams/ind/2001.html)**

# CASE 2

- Rule: the player who was fouled will get two free throws
- Question: whether a team with a three- point lead should foul the other team when little time remains on the clock.
- [HTTPS://WWW.YOUTUBE.COM/WATCH?V=MJ2AMHLLVCO](https://www.youtube.com/watch?v=MJ2AMHLLVCO) (1:25)
- Adrian Lawhorn and David Annis ([HTTP://WWW.82GAMES.COM/LAWHORN.HTM](http://www.82games.com/lawhorn.htm))
- No Definite Answer yet



- 41 out of 205 three- pointers.

- $P(\text{win}) = 41/205 * 0.5 \approx 0.1 = 10\%$

- Strategy:

- 1. make the first free-throw and miss the second free throw intentionally

- $P \approx 0.75$

- 2. get the rebound

- $P \approx 0.14$

- 3. Case 1:2 pointer to tie or 3 pointer to win

- $P \approx 0.33$

- $P(\text{win}) = 0.75 * 0.14 * 0.33 = 0.03465 \approx 3\%$

Time Left	Deficit	3-Pt FGM	3-Pt FGA	FG Pct
<11 Seconds	3 Points	41	205	20.0%



- Critic : This possession isn't the last possession of the ball.
- Turn into Case 1 situation :  $P(\text{win}) = 0.33 = 33\%$
- FOULING MAY NOT BE THE CORRECT STRATEGY

- KEVIN KLOCKE
- ACTUAL SITUATION STATS
- FROM 2005 TO 2008, CASE 2 SITUATION OCCURRED IN 287 GAMES
- 260 TEAMS DIDN'T FOUL, 27 FOULED
- $P(\text{DIDN'T FOUL}) = 91.9\%$
- $P(\text{DID FOUL}) = 88.9\%$
- NO SIGNIFICANT INCREASE IN THE CHANCE OF WINNING