END GAME STRATEGY

STATS INVOLVED IN NBA

WENBO HUANG
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

• 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

• \( P(E1 \cup E2 \cup E3) = P(E1) \times P(E2) \times P(E3) \)

• \( PTWO, PTHREE, POT \)

• \( PTWO \approx 0.45 // PTHREE \approx 0.33 // POT \approx 0.5 \)

• \( P(WIN) = PTWO \times POT \) OR \( PTHREE \)

• \( P(win) = PTWO \times POT = (0.45)(0.5) = 0.225 < 0.33 \)
• 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
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**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.


- 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.

• \( P(\text{win}) = \frac{41}{205} \times 0.5 \approx 0.1 = 10\% \)

• **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
     
     • \( P \approx 0.33 \)

\[ P(\text{win}) = 0.75 \times 0.14 \times 0.33 = 0.03465 \approx 3\% \]
• 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