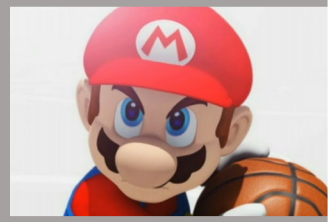
Basketball VI

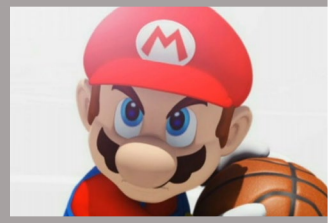
Produced by Dr. Mario

UNC STOR 538

End-Game Strategy

- Focus on Two End-Game Situations
  - Situation 1
    - Your Team Has the Ball With 5 Seconds Left and Losing by 2 Points
    - Should You Attempt 2-Point Shot to Tie or 3-Point Shot to Win?
    - Example: Philadelphia Versus Indiana in 2001 Playoffs (Game 1)
  - Situation 2
    - Your Team is Defending With 5 Seconds Left and Winning by 3 Points
    - Should You Foul or Allow Opponent to Attempt a 3-Pointer for the Tie?
    - Example: Dallas Versus Phoenix in 2005 Playoffs (Game 6)
- Actual Outcomes
  - Situation 1: Reggie Miller Won Game with 3-Pointer at Buzzer to Win
  - Situation 2: Steve Nash Tied the Game with 3-Pointer and Later Won the Game after a Double Overtime



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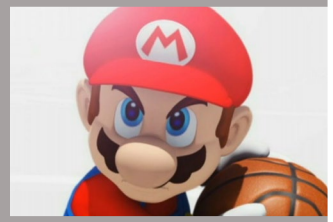

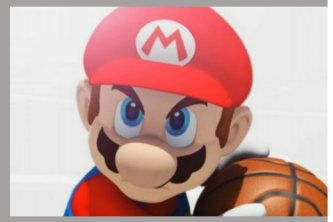

- Decision Making for Situation 1
  - Goal: Make Decision that Maximizes Probability of Winning
  - Two Assumptions
    - Other Team Will Not Foul on Shot
    - Game Will End on Our Shot
  - Important Events
    - A = Event that a 2-Pointer is Good
    - B = Event that a 3-Pointer is Good
    - C = Event that We Win in Overtime
    - W = Event We Win the Game
    - L = Event We Lose the Game
  - Probabilities Based on Data Over Many Seasons

$$P(A) = 0.52 \qquad P(B) = 0.36 \qquad P(C) \approx 0.5$$

  - If Attempting 2-Pointer, We Win if Shot is Made and Win in Overtime
  - If Attempting 3-Pointer, We Win if Shot is Made

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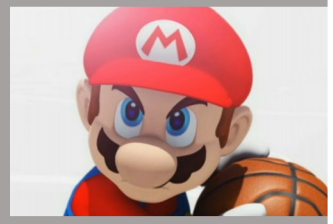
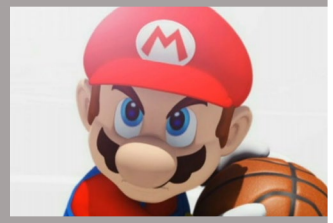
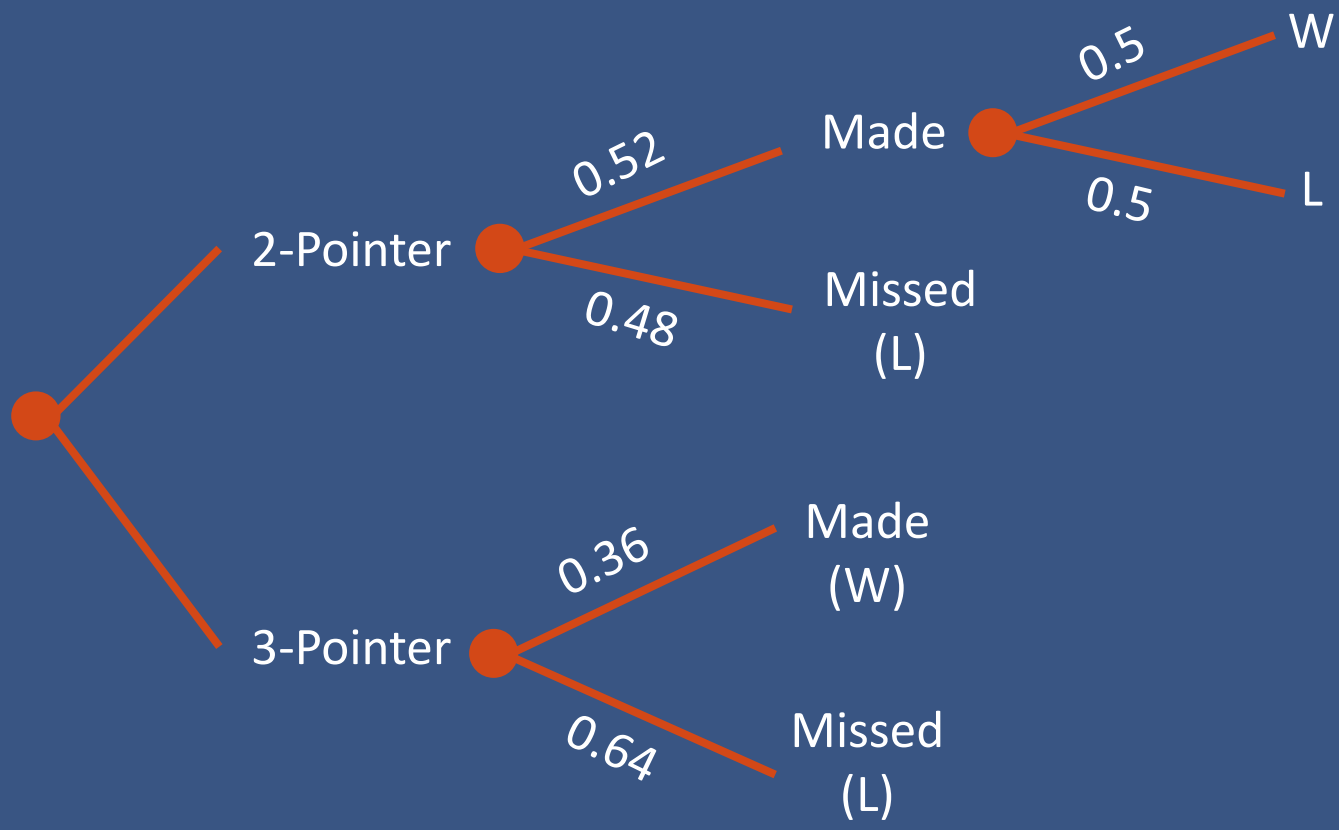


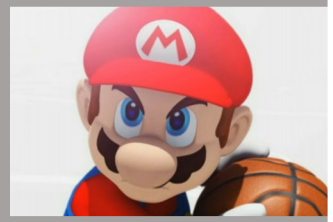


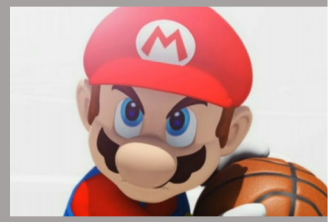
- **Decision Making for Situation 1**
  - **Decision Tree**



  - **Find Probabilities By Multiplying Across Branches**

End-Game Strategy





- **Decision Making for Situation 1**
  - **Probability of W Given Attempting 2-Pointer**

$$P(W|Attempt\ 2-Pointer) = P(A) \times P(C) = 0.52 \times 0.5 = 0.26$$

  - **Probability of W Given Attempting 3-Pointer**

$$P(W|Attempt\ 3-Pointer) = P(B) = 0.36$$

  - **Reality: Most Coaches Will Go for 2-Pointer Due to Perceived Risk**
  - **Conclusion: Always Go For 3-Pointer.**
  - **Sensitivity Analysis (Cases Where 2-Point Attempt is Better)**
    - **Suppose We Have a Play That Scores a 2-Pointer 80% of the Time**

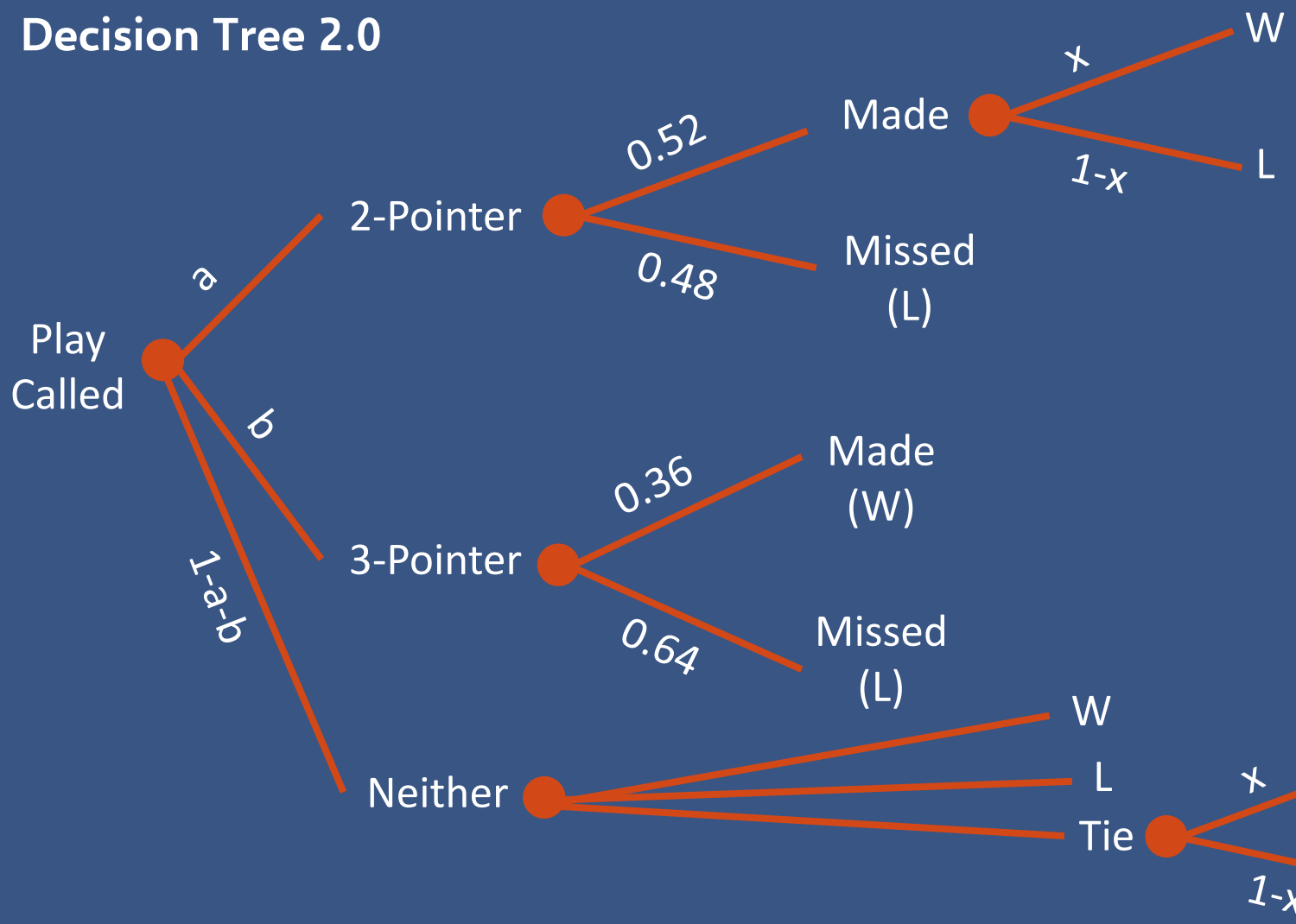
$$P(W|Attempt\ 2-Pointer) = P(A) \times P(C) = 0.8 \times 0.5 = 0.4$$

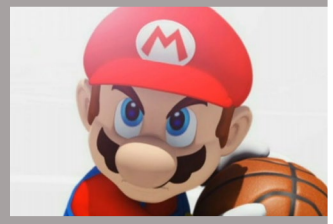
    - **Suppose Our Best 3-Point Shooter Scores a 3-Pointer 20% of the Time**

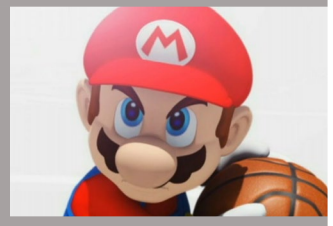
$$P(W|Attempt\ 3-Pointer) = P(B) = 0.20$$

End-Game Strategy

- **Decision Making for Situation 1**
  - **Decision Tree 2.0**







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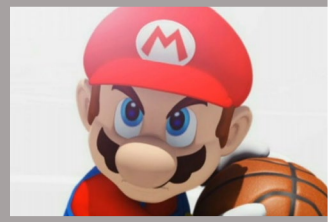
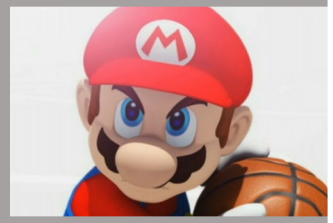




- Decision Making for Situation 2
  - Two Researchers Concluded Defensive Team Should Foul
    - Adrian Lawhorn (Contributor to Hoops Habit)
    - David Annis (Statistical Consultant in Charlotte)
  - Based on Annis Lawhorn
    - Assume Last Possession
    - Within 11 Seconds, Offensive Teams Scored 3-Pointers 20% of the Time

$$P(Other\ Team\ Wins|You\ Don't\ Foul) = 0.2 \times 0.5 = 0.1$$

    - If Defensive Team Fouls, Offensive Team Must Intentionally Miss a Free Throw
    - Probability Other Team Wins Off 2 Pointer

$$P(Other\ Team\ Wins|You\ Foul) = 0.77 \times 0.14 \times 0.46 * 0.5 = 0.025$$

    - Probability Other Team Wins Off 3 Pointer

$$P(Other\ Team\ Wins|You\ Foul) = 0.77 \times 0.14 \times 0.3 = 0.03$$

End-Game Strategy

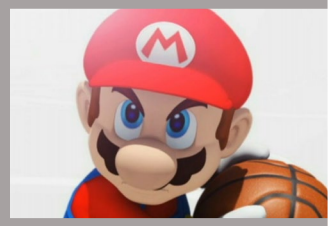
- **Decision Making for Situation 2**
  - **32 Games where Team Trailed by 3 Points and Leading Team Fouled**

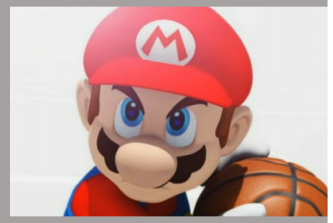
$$\frac{7\ Ties}{32\ Games} = 21.9\%\ (\pm 14.6\%)$$

  - **Bad Assumption Because Multiple Possessions Possible**
  - **Historical Aggregation Shows Probability of Winning Higher if Leading Team Doesn't Foul (2005-2008)**

Scenario	Sample Size	Probability Leading Team Wins	95% CI
Close Game Where Leading Team Didn't Foul	260	91.9%	(88.5%, 95.2%)
Close Game Where Leading Team Did Foul	27	88.9%	(76.8%, 100%)

95% Confidence Interval for Proportion: $\hat{p} \pm 2\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$






Final Inspiration

I cannot dunk a basketball,
but I can Dunkin' Donuts.

- Mahatma Mario