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A Markov Chain Analysis of the XFL Overtime Rules

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Abstract

The purpose of this project was to investigate how fair the NFL overtime system is compared to the XFL overtime model using the NFL overtime model proposed by Jones, "The New Rules for NFL Overtime". Jones claims that the NFL overtime system neatly balances out the coin toss advantage without significantly extending the expected length of the game. Although the system may seem mathematically appealing there is still some skewness favoring the team that wins the coin toss. To identify which overtime system is fairer, we created a discrete-time Markov chain model of the XFL overtime rules and compared the model outcomes for the two rule sets. The XFL claims these rules are fairer. That is, if given equally skilled competitors who enter overtime, they will have the same chance to win. We also explored a second XFL claim: that their rules lead to shorter overtimes. To accomplish this, we equated steps in the Markov chain model with times and evaluated the claim that the XFL overtimes lead to shorter over time than the current NFL overtime rules.

Introduction

Discrete time Markov chain theory has become a standard topic in probability theory and forms the basis for much work in stochastic processes. Discrete time Markov chains serve as a flexible modeling platform in a number of application domains and as a powerful tool in data analysis.

The current overtime rules of National Football League(NFL) allow a 10-minute overtime such that each team has the opportunity to possess the ball unless the team that gets the ball first scores a touchdown.

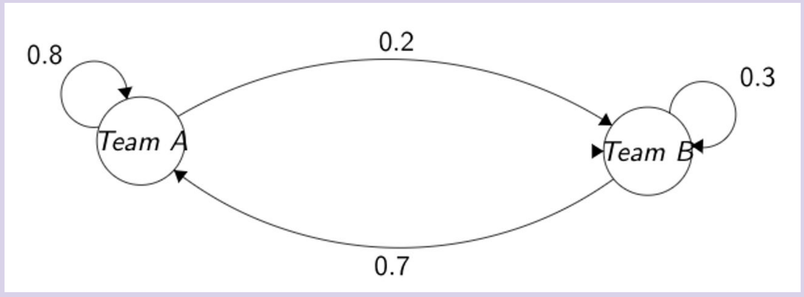
On the other hand, the winner of an XFL overtime is decided by a five-round shootout of two-point conversions similar to that of a penalty shootout in Major League Soccer (MLS).

Each round starts at the 5-yard line and the offensive team has one play to score. The team with the most points at the end of the 5 rounds is declared the winner. If the rounds end in a tie then they will move on to a sudden death.

There has been some work to date in exploring the applicability of discrete time Markov Chain Theory to rules in NFL football but no apparent published work on the new XFL overtime rules.

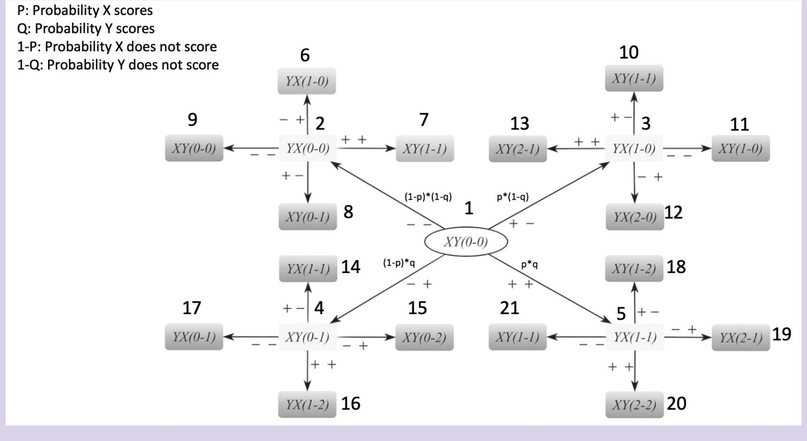
Discussion:

Example:



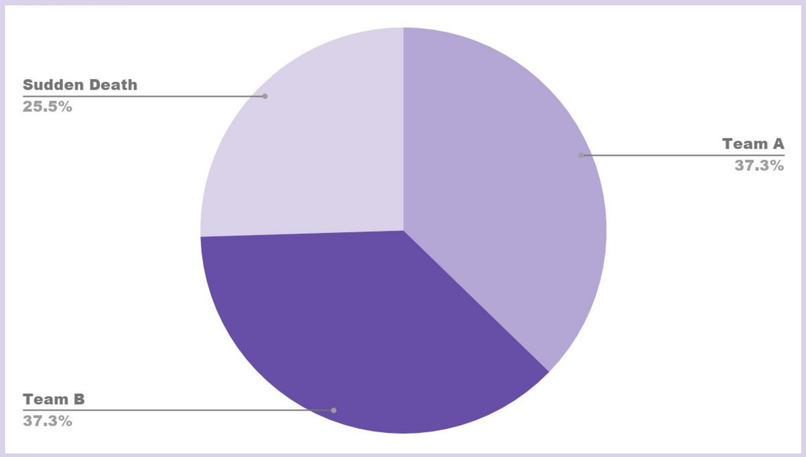
$$Q=\begin{bmatrix} & a & b \\ a & 0.8 & 0.2 \\ b & 0.7 & 0.3 \end{bmatrix}$$

$$Q^{1000}=\begin{bmatrix} & a & b \\ a & 0.777778 & 0.222222 \\ b & 0.777778 & 0.22222 \end{bmatrix}$$



Results

We discovered that the XFL overtime rules are fairer than the current NFL overtime rules and it can also be demonstrated that the XFL overtimes are shorter than the current NFL overtime rules.



Finally, if two evenly skilled teams play in overtime then Team A and Team B have 37.3% probability of winning and there is a 25.5% probability of going into sudden death.

References

1] Jones, Chris. "The new rules for NFL overtime." Mathematics Magazine 85.4 (2012):277-283.

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[4] Jones, Michael A. "Win, lose, or draw: A Markov chain analysis of overtime in theNational Football League." The College Mathematics Journal 35.5 (2004): 330-336.

Acknowledgements

Dr. Christopher Brown

Dr. Allan Knox and Dr. Paloma Vagas

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