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The Game of Thrones: A study of power networks and how they change

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I. Introduction

Who has power may be easy to spot, but who will have power is more subtle. History provides plenty of data that allows the ad hoc analysis of what relationships in a power structure yield other relationships after some change has been made.

But what about a method for predicting how a power structure will change if certain, perhaps controllable, events occur?

By abstracting power structures into networks (or directed graphs), the changes affected by assassination, imprisonment, or other too-costly-to-gather-data methods can also be abstracted and analyzed as though the network were a game. Chess is a game that uses a hierarchical ranking of pieces named after historical societal positions, but the ways in which the pieces interact hardly models the circumstances after which the pieces are named.

The game constructed and considered here was built to the ends of allowing quantitative and qualitative relationships of power to be determined and manipulated in ways that model real-world power exchanges, such as assassination, in the safe confines of abstract Mathematics.

II. Methods

The game is played on a **paired comparison directed graph (PCD)**. A PCD depicts the complete paired comparison among n objects (countries, people, companies) with an arrow between objects whose head points to the "winner" (whatever context engenders in that word) of the comparison.

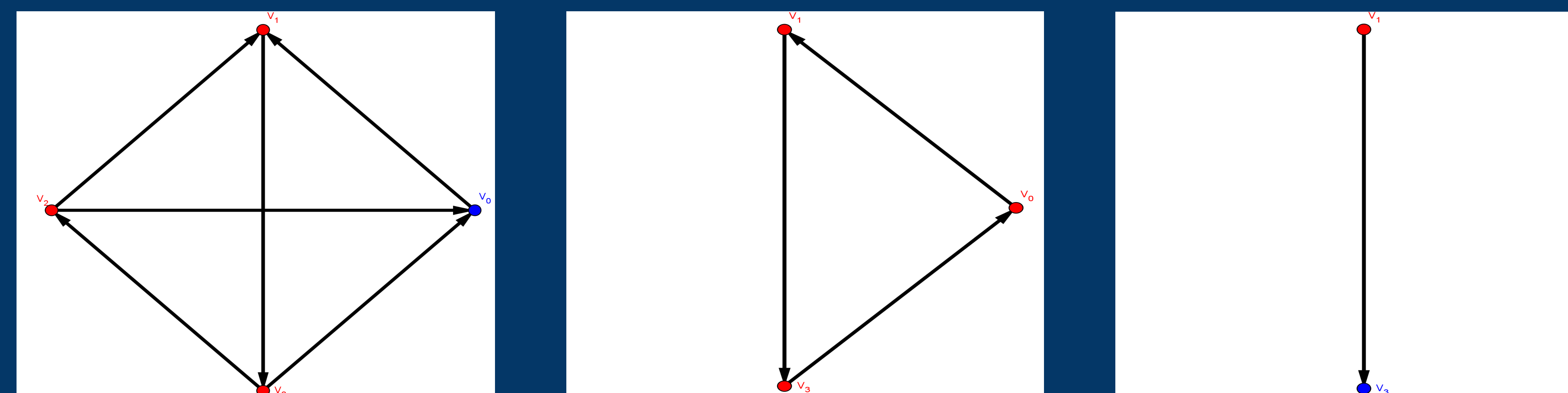
It can be proved that it is unlikely there will be an **overall winner** (an object with an arrow pointing to every other object) so we use a more general notion to model dominance. If A "wins" when paired against B , we say " A **beats** B ".

Suppose object K either beats every other object or, for any object Y that K does not beat, K beats an object X that in turn beats Y . The object K is called a **king**. It is **king-ness** we analyze via the game. We say an object **dominates** a PCD if it is the only king.

One variant of the game is played by removing kings from the PCD and examining the relationships within the resulting PCD. Kings are removed from the PCD until the players are left with a PCD containing a single King.

This variant models something like assassination and captures the idea that some object "wants" to be the sole king. Other versions of the game grant the model the flexibility to conform to many different real world applications.

Figure 2 – An example progression of the game. Red objects are kings. There is a dominant object in two moves.



In order to facilitate the study of the model an electronic version of the game was developed. This electronic version expedited the gathering of data.

Because of the incredible flexibility of the model there is much more work that can be done and many more uses for the model.

We think of a network as **unstable** if it can be represented as a PCD that can be dominated in one move. An unstable PCD representing a real power structure clearly facilitates competition for dominance via the single object whose deletion yields an overall "winner". We regard a network as **stable** otherwise.

III. Results

The study of this game has yielded interesting results. Objects which "lose" to only a single object may dominate the PCD in a single move. This may seem overt, but a comprehensive investigation reveals the fact that there may be as many as 3 such objects in a single PCD. Notwithstanding the PCD may still be dominated in a move.

IV. Conclusions

This finding may suggest strategic considerations regarding power structures developed to prevent singular domination, such as a democratic government. There are no **stable** PCD's that have 3 or 4 objects. The smallest stable PCD contains 5 objects. Suggesting that a stable democratic government should be built on 5 branches rather than 3.

Figure 1 – Sometimes less acceptable ways of gaining power are used such as assassination, coup, and imprisonment.

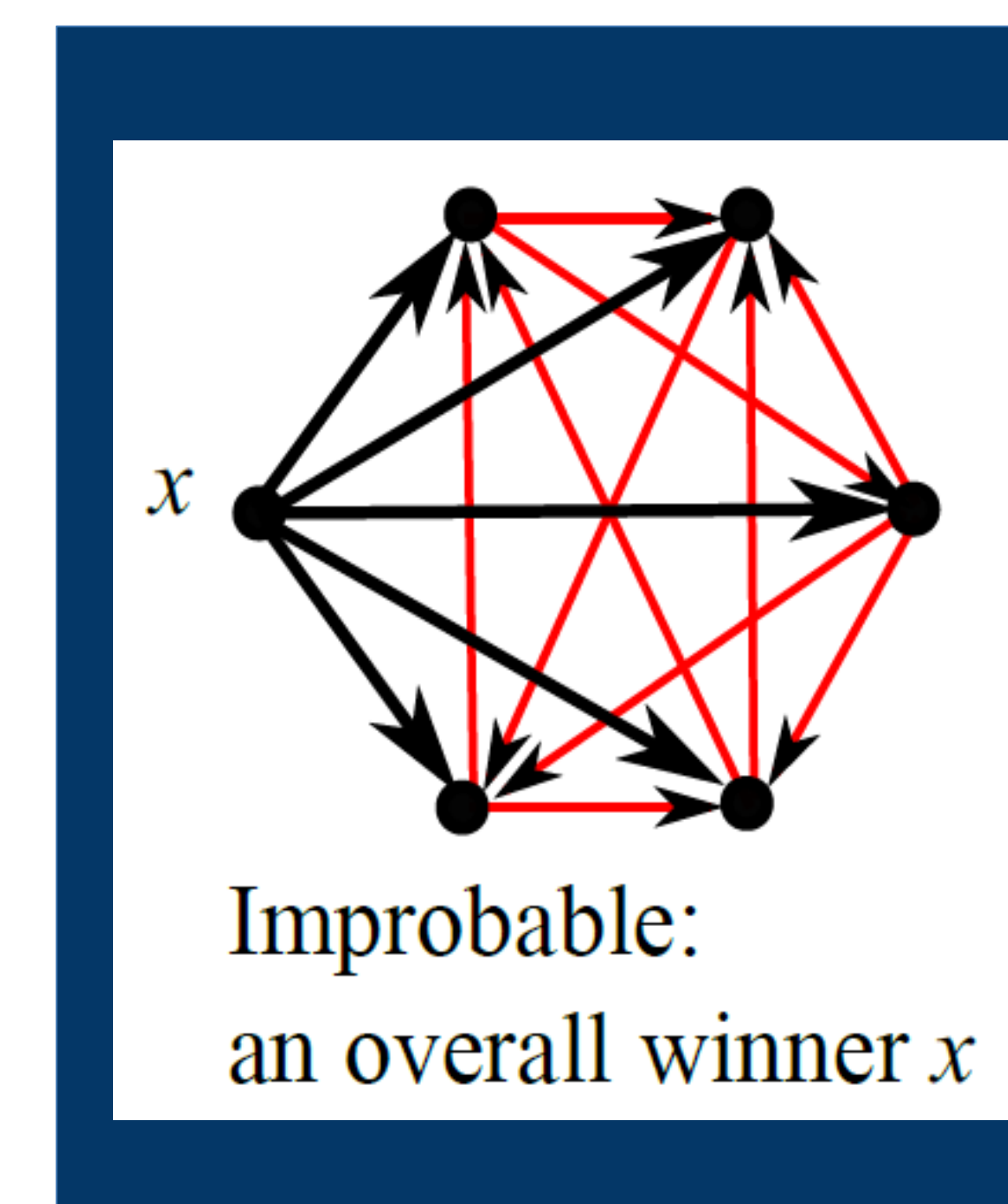


Figure 3– The smallest stable PCD.

