Creating March Madness Upsets

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1 Introduction

This week's problem statement, found in Zach Wissner-Gross's weekly Fiddler on the Proof column at https://thefiddler.substack.com/p/can-you-root-for-the-underdog, is about simulations of a March Madness-style seeded bracket. Each team is assigned a power rating from 1 to N, where N is the number of teams in the bracket. A boost term B, constant throughout the entire tournament, is added to the underdog's power rating in every matchup, and the team with the highest power ranking including the boost term advances. First, we study the case where there are four teams, and then we study the case where there are 64 teams.

2 Four-team bracket

Depending on the value of B, there are four possible ways the bracket will play out:

- $B \in (0, 1)$. In this case, there are no upsets, because the boost each underdog gets is too small to make them defeat any other team. The 1-seed wins in this bracket.
- $B \in (1, 2)$. The 1-seed defeats the 4-seed, and the 3-seed upsets the 2-seed. In the championship, the 1-seed defeats the 3-seed.
- $B \in (2, 3)$. The 1-seed defeats the 4-seed, and the 3-seed upsets the 2-seed. In the championship, the 3-seed also upsets the 1-seed.
- $B > 3$. The boost awarded to the underdog is now larger than the gap in power ratings between the worst team and the best team. Every game is an upset, and the 4-seed wins.

The only team that cannot win the bracket is the 2-seed; for any value of B which would allow them to defeat the 1-seed, they get upset by the 3-seed in the first round.

3 64-team bracket

The Python file BracketUnderdogBoost.py contains code to compute the possible results as the value of B varies. Since the largest gap in raw power ratings between two teams is 63, it is sufficient to include one value each from the intervals $(0, 1), (1, 2), (2, 3), \ldots, (62, 63)$ and one value greater than 63. For this reason, the code only checks $B \in \{0.5, 1.5, 2.5, \ldots, 63.5\}$.

Using the code, I determined that there are 27 teams which can never win for any value of B.