



Monster World

An analysis of a fun game we are sick of overanalyzing.

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Game Rules

Setup

Start with a square board with a grid. The normal size is 10 by 10. One player is the villain, and the other player(s) are heroes. The villain rolls two dice and multiplies the results. This is the number of monsters to be placed on the board. He rolls two dice again to determine the number of treasures. The villain player chooses locations on the grid to hide the monsters and treasures. They cannot be hidden on the top or bottom rows. He writes the locations down on a secret piece of paper. The villain then hides himself in the top row of the board. This is also a secret. The heroes each place a marker on the bottom row of the board. This is their starting location. Each hero rolls a die to determine their starting health points (HP). The villain also rolls a die. He is allotted HP based on Figure 1. If the HP of a player reaches 0, they die in real life.

Play

Travel: Each player takes turns one at a time. The villain acts after all the heroes have moved. Players can choose to take no action (skip a turn) or move. If a player chooses to move, he rolls a die to determine the maximum number of spaces he may travel across. If a hero lands on a monster, treasure, or the villain's hiding place, the villain must tell the hero.

Battle: If a monster is found, both the hero and villain roll a die to determine the winner. Whoever has a larger roll two of three times wins. If the player wins, he rolls a die to determine the "loot" value. This number is added to his HP. If the player loses, he rolls a die and subtracts the number from his HP.

Treasure: If a treasure is found, the finder rolls a die and adds the result to his HP.

Villain Revealed: If the villain is revealed, he must place a marker on the board.

Villain Challenge: If a hero lands on the space occupied by the villain, he enters a battle.

The battle is the same as with a monster, except if the villain loses the match he loses 1 HP.

Endgame: The game is over when the villain has no HP left or the heroes are all dead (zero HP).

Suicide (forfeiture) is permitted, but brings dishonor on the player's family and their cow.

Figure 4: Calculating possible setups for all dice rolls

```

1 var boardlen = 10;
2 var players = 1;
3 var badplayers = 1;
4 var totalcomb = 0;
5 var boardsize = boardlen * boardlen;
6
7 var dicerolls = [1,2,3,4,5,6,8,9,10,12,15,16,18,20,24,25,30,36];
8
9 print("Board: " + boardlen + "x" + boardlen + "(" + boardsize + ")");
10 print("Players: " + players + " good, " + badplayers + " bad");
11 print(" Calculating... ");
12 for (var i = 0; i < dicerolls.length; i++) {
13     m = dicerolls[i];
14     for (var j = 0; j < dicerolls.length; j++) {
15         t = dicerolls[j];
16         var comb_mt = factorial(boardsize - 2 * boardlen) /
17             (factorial(m) * factorial(t) * factorial(boardsize - 2 * boardlen - m - t));
18         var comb_good = factorial(boardlen)/(factorial(players) * factorial(boardlen - players));
19         var comb_bad = factorial(boardlen)/(factorial(badplayers) * factorial(boardlen - badplayers));
20         totalcomb += (comb_mt * comb_good * comb_bad);
21     }
22 }
23 print("Possible board setups: " + totalcomb);

```

Number of possible initial layouts

For a two-player game (1 hero and 1 villain) on a 10x10 board, there are approx. 1.15861×10^{39} possible layouts.

For a game with 1 villain and anywhere from 1-10 players, there are approx. 1.18525×10^{41} layouts.

Figure 1: Villain Health

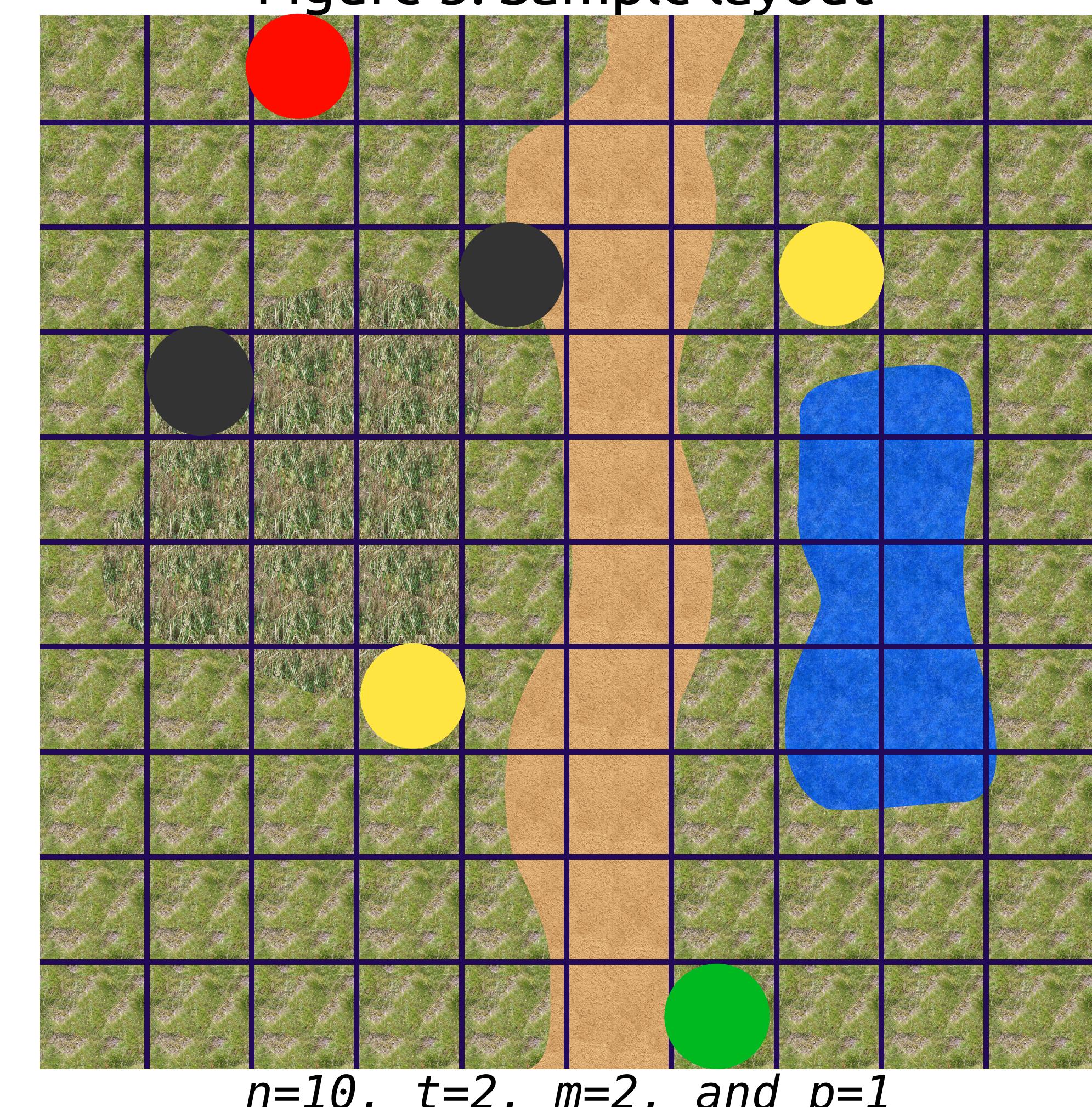
$$\begin{aligned}
 d &= \text{die roll} \\
 n &= \text{number of heroes} \\
 h &= \text{villain health} = d * n * 2 \text{ (at start of game)} \\
 \\
 \text{Once the villain leaves his hiding place:} \\
 h &= \lceil h/2 \rceil
 \end{aligned}$$

Figure 2: # of possible starting layouts with given inputs

$$\begin{aligned}
 n &= \text{length of side of square board} \\
 t &= \text{number of treasures} \\
 m &= \text{number of monsters} \\
 p &= \text{number of heroes}
 \end{aligned}$$

$$\frac{(n^2 - 2n)!}{t! * m! * ((n^2 - 2n) - t - m)!} * \frac{n!}{p! * (n - p)!} * \frac{n!}{1! * (n - 1)!}$$

Figure 3: Sample layout



Analysis of Figures 2 and 4

Figure 4 shows JavaScript code that implements the formula in figure 2 to calculate all the possible ways the board can be set up. Basically, the formula in figure 2 calculates how many ways the game can be set up with a given number of players, size of game board, number of monsters and number of treasures. The JavaScript program calculates all the possible ways to set up the game by plugging in all possible values for the afore mentioned variables. We can determine all possible variable inputs based on the rules of the game.

Figure 5: Possible layouts for 1-10 heroes

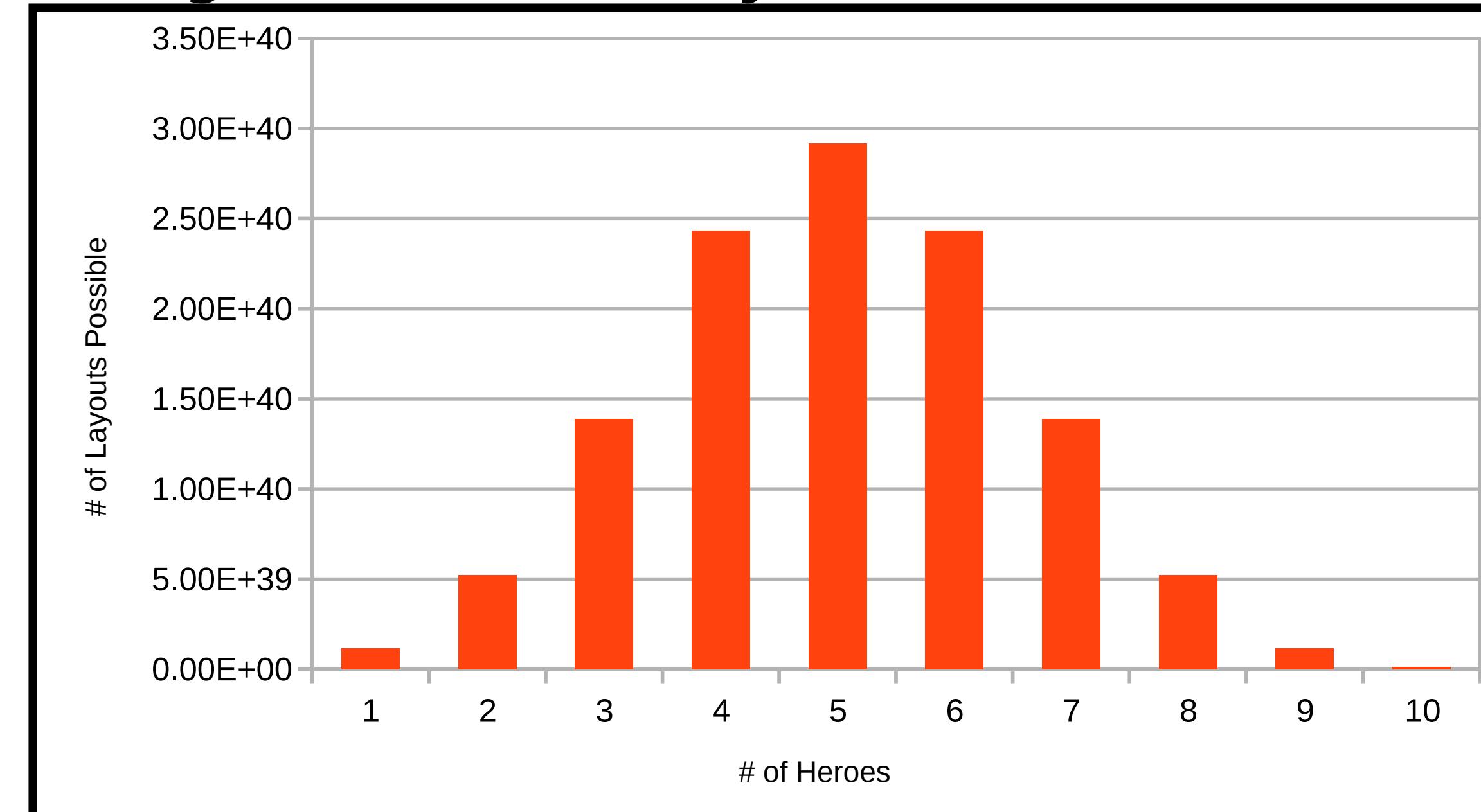
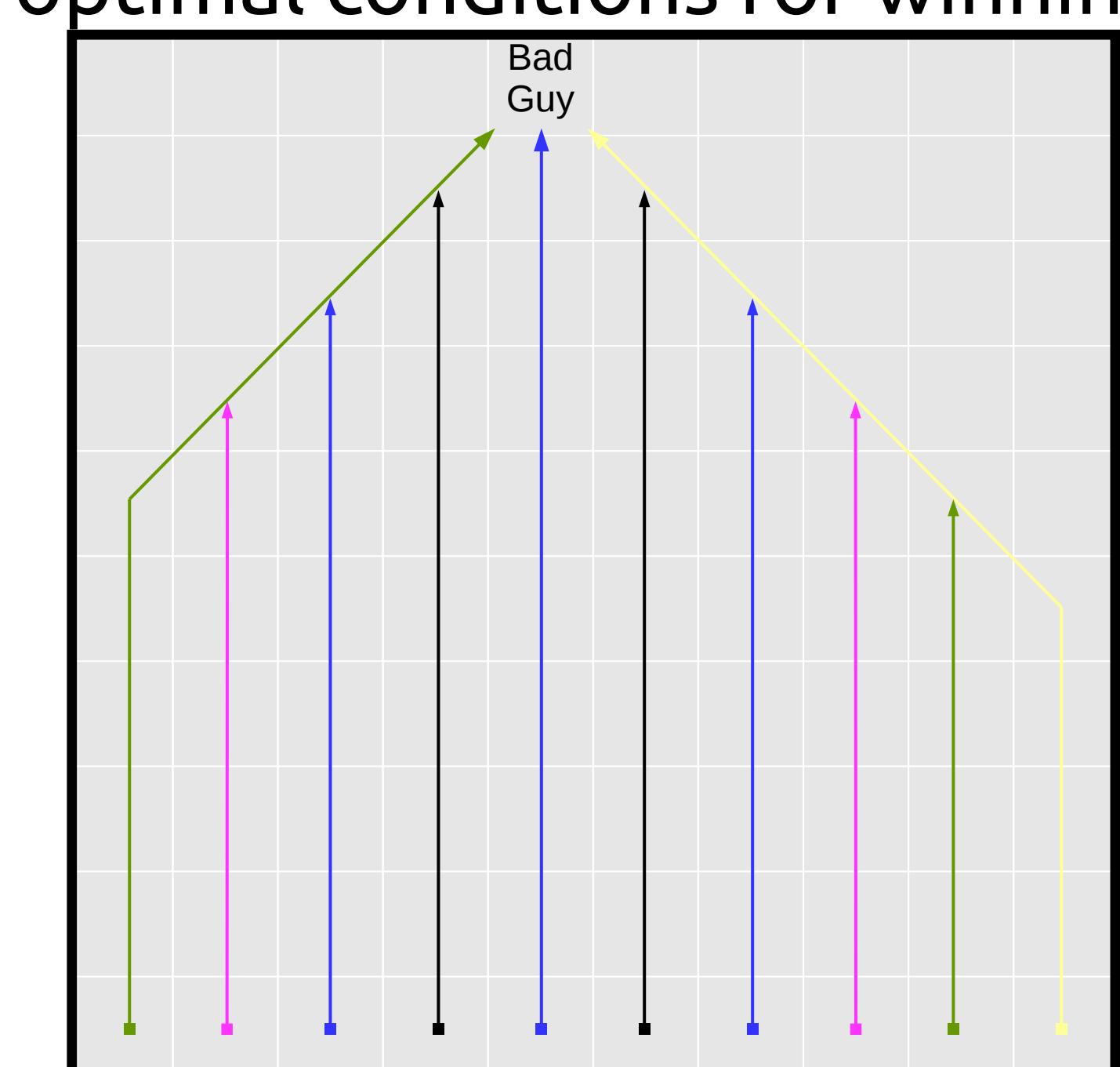


Figure 6: Best paths to villain with optimal conditions for winning



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