**Let’s play Plinko! (Plinko.R)**

Description

Plinko is a game played on The Price is Right TV show. Contestants drop a circular disk, referred to as a “chip”, from the top of a board. The chip travels down the board and bumps into pegs that can change its direction. Eventually, the chip will reach the bottom of the board and land in a slot. Each slot has a dollar amount that the contestant wins. Below is a picture of the board.



An example of the game being played is available at <https://youtu.be/hOIWhnoU5Pw?t=113>. Notice the contestant is not sure where to drop the chip.

Research question

Where should the chip be dropped?

Study description

I recorded The Price is Right every day it was on TV for one year! If Plinko was played, I kept the recording. Otherwise, I deleted it. A graduate student watched ALL of these recordings and collected data about where the chip was dropped and the amount won.

Variables of interest

Response: The landing slot (location)

This is an ordinal categorical variable! How should we represent it?

Explanatory: The drop slot (relative to the landing slot)

This is an ordinal categorical variable as well. How should we represent it?

Data

The data is available in Plinko.csv.

Questions

1. Why would a proportional odds regression model potentially be better than a multinomial regression model for this data?
2. Estimate and state a proportional odds regression model using the landing slot as the response variable and the drop slot as the explanatory variable.

1. For the odds ratio corresponding to the drop slot:
   1. What should we use for c?
   2. Estimate
   3. Find 95% profile LR confidence interval
   4. Interpret
2. Use a likelihood ratio test to evaluate the importance of the drop slot. Relate this to the profile LR confidence interval result.

1. Estimate the probabilities for the landing slots when the chip is dropped in the middle of the board.
2. While the odds ratios indicate that one should drop more toward the middle of the board, why is winning $10,000 not the largest estimated probability in 5)?
3. Plot the estimated model allowing for the drop slot to be a continuous variable.
4. Where should the chip be dropped?

Additional questions/comments

1. From a research prospective, what could be done next?
2. There are alternative ways to look at this problem. In particular, one could derive a probability distribution for the amount won. This would allow for the calculation of
   * The probability of wining $10,000 for each drop slot and
   * The expected winnings for each drop slot.

However, the derivation for this probability distribution makes some assumptions that may not be true!