**Snakes and Ladders**

In this project, I aim to model the game of Snakes and Ladders using Markov Chains. This problem can be properly modelled in such a way because the next board state depends exclusively on the square the person was in. My key question here is:

**How many dice rolls does it take for** **one to reach the winning square?**

I have in mind a few specific conditions that are relevant to this problem:

* The person rolls 2 completely fair six-sided dice to determine how many steps he moves
* If a person overflows (given that the final square is 100, the person is at square 98 and he rolls a 3) then he has to backtrack the number of steps he over-rolled. In this case, the person takes 2 steps to 100, and 1 back to 99.
* Landing on square 100 is an absorbing state since the person has already won.

In this mini-project, I plan to take a screenshot of an actual snakes and ladders board and model the ladders and snakes after that. If a person lands on the bottom of a ladder, he/she immediately climbs up to the top of the ladder. If the person lands on the mouth of a snake, he is swallowed and is transported to the tail.

After constructing the matrix, I plan to calculate 2 things:

1. Take the fundamental matrix and calculate the mean number of moves required to win the game.
2. Plot a graph of probability to win against the number of moves

Since this project is seen as a little too small in scale, I’ve thought about doing another subsidiary project on non-linear programming.

**Nonlinear Programming**

In terms of non-linear programming, applications of this are rather generic. I’m not exactly sure on how I’d like to formulate this problem, but reflecting on this semester, I felt that Sodexo had a rather “interesting” run with the food poisoning incident. Therefore, I’d like to roleplay as one of the finance officers and try to understand how difficult it is to run a for-profit business while minimizing my cost.

**Question: Can I include decision trees here as a supplementary analysis or should I just exclusively focus on nonlinear programming?**

There are decision variables that I’ve been strongly considering:

1. Cost of procuring Vegetables
2. Cost of procuring Halal Food
3. Cost of procuring meat
4. Cost of preparation
5. Cost of sanitation
6. Amount of manpower to allocate per given day
7. Cost of Dessert

After that, I plan to formulate a non-linear programming problem and just solve it as per normal in R.