MATH 340 October 2

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20 October 2019

1 Markov Chains

- Markov Chains are a type of probabilistic matrix model we can easily implement in `MATLAB`.
- We played a fun game of chutes and ladders in class using Markov Chains!
- Remember how we visualized Markov chains by drawing a graph! This technique is extremely useful. Drawing an edge-weighted graph will make it much easier for you to set up stochastic matrices in my experience.
- If you want another board game example, try looking up some stuff about moving knight pieces in chess. There is a good variant of this problem using Markov chains to get the probability of a knight being on different squares of the board.
- After we played our fun game and draw a non-planar graph, we turned our results into a really big system of equations.
- We then used the power of linear algebra to get a really nice and beautiful matrix system, where all of our probabilities became a **stochastic matrix**. This system has the following genereal form.

$$\begin{bmatrix} x_0^{n+1} \\ x_1^{n+1} \\ \vdots \\ x_i^{n+1} \end{bmatrix} = \begin{bmatrix} P_{0,0} & P_{0,1} & \dots & P_{0,i} \\ P_{1,0} & P_{1,1} & \dots & P_{1,i} \\ \vdots & \vdots & \ddots & \vdots \\ P_{i,0} & P_{i,1} & \dots & P_{i,i} \end{bmatrix} \begin{bmatrix} x_0^n \\ x_1^n \\ \vdots \\ x_i^n \end{bmatrix} \tag{1}$$

Or for short,

$$\mathbf{x_{n+1}} = \mathbf{M}\mathbf{x_n} \tag{2}$$