Math 305 Homework 4

Theodore Koss

April 2023

Problem 1

- Colley Ratings: Where C = Colley rating of a team
  W = number of wins by the team
  P = number of opponents the team has played
  G = number of games played by the team

  - $C_1 = \frac{W_1+P_1}{2G_1} = \frac{5+3}{12} = .66$
  - $C_2 = \frac{W_2+P_2}{2G_2} = \frac{3+3}{12} = .5$
  - $C_3 = \frac{W_3+P_3}{2G_3} = \frac{3+3}{12} = .5$
  - $C_4 = \frac{W_4+P_4}{2G_4} = \frac{1+3}{12} = .33$
- Massey Ratings: (Not sure)

Problem 2

Experienced chess players A and B both start with a rating of 2600. They play two games, first A beats B, then B beats A. Will the rating of A equal the rating of B after these two games? Should the ratings be equal? Describe your thoughts.

No, the ratings would not be equal, because although they begin at the same place, after player A beats B, their rating goes up, whereas player B's rating goes down. Therefore, for the next game, when player B wins, they are beating a higher rated player, therefore gaining more elo than if they were both the same.

Problem 3

Two chess players have Elo ratings that differ by 400n, where n is a non-negative integer. How likely is the higher rated player to win for different values of n? How much more likely is the higher rated player to win than the lower rated

one for different values of n? (Consider n = 0, 1, 2, . . . 4 to see a pattern or analyze the formula for win probability.)

- $n = 0$, $P = 50\%$
- $n = 1$, $P = 90.91\%$
- $n = 2$, $P = 99\%$
- $n = 3$, $P = 99.9\%$
- $n = 4$, $P = 99.99\%$
- $n = i$, $P = \frac{1}{1+10^{-i}}$

Problem 4

Suppose a truck rental company has locations in Dallas, TX, Raleigh, NC and Miami, FL. The company permits one-way rentals and knows that based on previous experience that during a typical week the following truck movements occur: Of the trucks that start in Dallas:

- 50% stay in Dallas
- 25% travel to Raleigh
- 25% travel to Miami

Of the trucks that start in Raleigh:

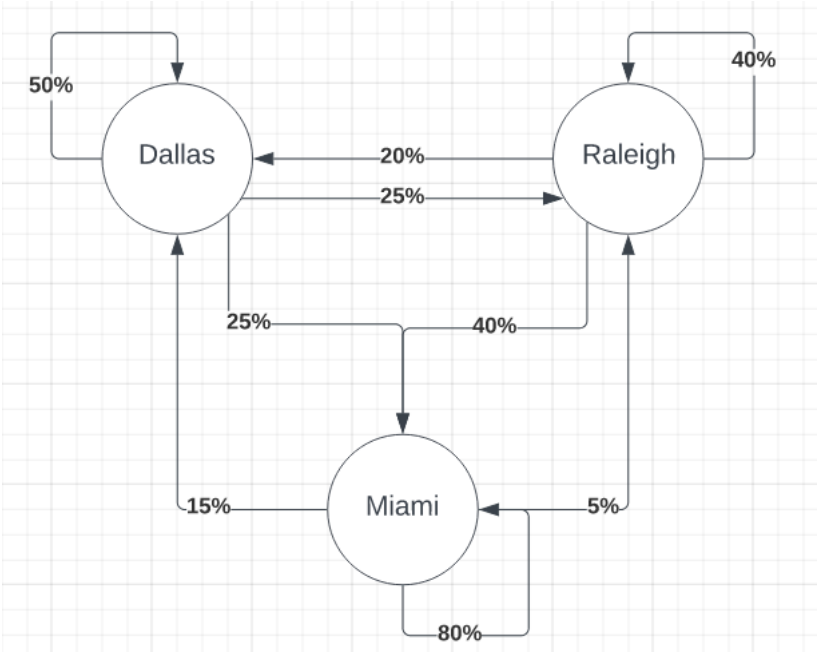
- 40% stay in Raleigh
- 20% travel to Dallas
- 40% travel to Miami

Of the trucks that start in Miami:

- 80% stay in Miami
- 15% travel to Dallas
- 5% travel to Raleigh

Draw a transition diagram for the model adding the given probabilities. If 150 trucks start in each city, use MATLAB to determine the long-term numbers of

trucks in each city (steady-state)



$$A = \begin{pmatrix} .5 & .25 & .25 \\ .2 & .4 & .4 \\ .15 & .05 & .8 \end{pmatrix}$$

$$\lambda_1 = 1$$

$$v_1 = (1\ 1\ 1)$$

Therefore all 3 cities will have 150 trucks as time goes on.