

1. Calculate the following matrix expressions.

(a) $\begin{pmatrix} 5 & 10 \\ 0 & 10 \end{pmatrix} \begin{pmatrix} 1 & 1 \\ 2 & 1 \end{pmatrix}$

(b) $\begin{pmatrix} 1 & 2 & 3 \\ 6 & 5 & 4 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ 2 \end{pmatrix}$

(c) $\begin{pmatrix} 0.6 & 0.3 & 0.1 \end{pmatrix} \begin{pmatrix} 0.5 & 0.5 & 0 \\ 0 & 0.5 & 0.5 \\ 0 & 0 & 1 \end{pmatrix}$

(d) $\begin{pmatrix} 2 & 3 \\ 1 & -1 \end{pmatrix}^2$

2. Bob is playing miniature golf. One hole on the course has a windmill obstacle. If Bob putts before he has gotten past the windmill obstacle, there is 40% chance he will get past the obstacle but won't get the ball in the hole, a 10% chance he will get the ball in the hole, and the rest of the time he won't get past the obstacle. If he putts after the obstacle, there is a 30% chance he will get the ball in the hole, and at 70% chance he won't (but he will still be past the windmill obstacle).

(a) Draw and label a graph for this Markov chain.

(b) What is the transition matrix for this Markov chain?

(c) What is the probability that the ball will be in the hole after 5 strokes? (Use a matrix calculator)

3. A drunkard lives 4 blocks away from a bar. He is currently halfway between the bar and his house. He wants to go home, but unfortunately, he is also drunk and disoriented. So at each intersection he randomly walks either one block towards the bar or one block towards his house (50-50 chance). If he reaches either the bar or his home, he will stay there.
- (a) Draw and label the graph for this Markov chain.
 - (b) Find the transition matrix for this Markov chain.
 - (c) What is the probability vector for the location of the drunk guy after 2 rounds? Explain what each number means.
 - (d) If the drunkard starts 1 block away from home, what is the probability that he will end up back at the bar? Hint: calculate the probability vector after a large number of rounds.
4. Albert and Bob are playing a best out of three chess match. The first player to win two games wins the match. Albert is a little better at chess so he wins a game 60% of the time, Bob wins the other 40% of the time. Draw and label a graph that models this as a Markov chain. Hint: each state has two numbers: the number of times Albert has won and the number of times Bob has won.