# DAT 520 Problem Set 6 Markov Modeling in Decision Trees

Module Six introduces the Markov model. In this model, there are a defined set of states and we then have the probability of jumping to the next state. Consider the states being the nodes of the tree and the probability as the jump to the next state. These chains are simply another way to define the probability we need for moving from state to state in the decision tree.

This Module Six assignment will take you through the process of using real data to generate values that will feed a Markov chain. We will also build a transition matrix in this assignment. The steps are simple and explicit to allow you to focus on the learning of building a Markov model. Make sure to take the time to understand the steps you are executing.

In this assignment, we will use a Markov model to calculate an accurate X% for the *Mopps with Commas* data set. To achieve this, we will explore this question: “How do you measure success?”

The steps needed to complete this assignment are as follows:

1. From your learning environment in the Virtual Lab, download the following files to Documents folder. These will all be found in the DAT 520 Data Files folder in the Start Here area.
   1. *Mopps with Commas*: This is the data set for the problem.
   2. *ProblemSet 6 Tree*: This is the tree we will fill in values to in the exercise.
   3. *Module6\_Problem3*: This is the R code needed for problem 3 below.
2. Open *Mopps with Commas* in Excel.
3. Determine *d* and *f* using the data set.

Note: Success is any company that had at least two occurrences when it had more profit than the previous year and a rising market index, simultaneously. These are reflected in the tot\_success variable. Non-success is defined as two or more occurrences of decreasing year-to-year profit and decreasing market index. These are reflected in the total\_nsuccess variable.

* 1. How many businesses have tot\_success of at least two?
     + What percentage is that of the entire data set? This is the *d* in the Markov model.
  2. How many businesses have two or more occurrences of non-success (total\_nsuccess)?
     + What percentage is that of the entire data set? This is the *f* in the Markov model.

You now have enough information to construct a Markov model. You have:

Two into two matrix with d, one minus d, one minus f, and f inside

The letters *d* and *f* here refer to the values from the assignment’s questions, a and b, above.

Now complete the following problems. Ensure that you provide an answer for each problem below and submit it via a Word document:

1. **Assuming previous success [1 0], what is the probability of having a successful year?**

One into one matrix with the numbers one zero multiplied by two into matrix with d, one minus d, one minus f, and f inside  

**Hint:** Use R and enter the matrix using the *d* and *f* values from the assignment questions a and b, found above. Refer to Module One homework for assistance with R matrix math.

1. **What is the probability of having two successful years?**

One into one matrix with the numbers one zero multiplied by two into matrix with d, one minus d, one minus f, and f inside squared

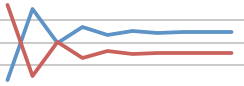
**Hint:** Use R and enter the matrix using the *d* and *f* values from the assignment questions a and b, above. Refer to Module One homework for assistance with R matrix math.

1. **Using the strategy outlined in the document “How to Iterate Markov Processes in R,” show the table of values for 10 years of success:**

One into one matrix with the numbers one zero multiplied by two into matrix with d, one minus d, one minus f, and f inside to the power one to ten

**Hint:** Use R and enter the matrix using the d and f values from the assignment questions a and b, above. Refer to Module One homework for assistance with R matrix math. Use the Module6\_Problem3 file to execute in R. Note: You will have to replace the d, 1-d, 1-f, f in mat2 with the values you determined in questions a and b. Copy the printed matrix and paste to Word as your answer.

1. **Using the Success and 1-Success matrix output from problem 3, produce a line graph in Excel showing how the probabilities stabilize over time. It will look something like this:**



**Hint:** Using the values from the printed matrix in Problem 3, copy these and paste into the Tab Markov model cells B2:C11 in the Problem 6 Tree file. The graph should adjust accordingly.

1. **At the end of 10 years, what are values of the blue and red lines? These are your new X% and 1-X% in the Tree Model. These represent the long-term probability of success or non-success, given the starting state of a business.**

**Hint:** These are the values found in row 10 of your matrix output. Column 1 is Success and Column 2 is 1-Success.

1. **Should you employ Dustin to do the research or not? State the new EVs and explain your decision and what the tree is telling you. Use the new X% and 1-X% in your Problem 6 Tree model in Excel and recalculate the tree.**

**Hint:** These are the values found in row 10 of your matrix output. Column 1 is Success and Column 2 is 1-Success. Use these values and enter Success in D9 and 1-Success in D10.

**Turn In Your Assignment**: To complete this assignment, you will turn in a single Word document with the answers for problems 1–6 included. Also, at the end of the Word document, include the images from your Problem Set 6 Tree updates. You will highlight the Markov model values and graph produced in Problem 4 found on tab Markov model and in Word paste image. On tab Problem 6 Tree, highlight and copy the recalculated tree and paste image in Word.