

## Modeling a Market Share Problem with Advertising Options as a Markov Decision Process

You run a small company in a very specialized field where you only have two other competitors. Therefore, each month your company will either have the lead market share, second best market share, or smallest market share. Your company makes \$50,000 in a month when you have the lead, \$35,000 a month when you have second best market share, and \$15,000 when you have the smallest market share. In each month, your company has the option to maintain normal advertising levels or implement a new type of 'aggressive' level advertising campaign. You have collected enough data on your normal advertising levels to have observed the following transition probabilities between the states under these levels:

	Lead	2nd	Smallest
Lead	.70	.30	0
2nd	.20	.50	.30
Smallest	0	.40	.60

The aggressive advertising campaign has been shown to have a success rate of landing a company for the next month in lead market share 50% of the time and in the 2nd market share 50% of the time at a cost of paying \$10,000 for the month of aggressive advertising. We are interested in formulating a Markov Decision Process to model the problem of determining what situations to maintain normal advertising levels and when to be aggressive as well as determining our long-run cost (or 'negative' profits) per unit time. We will then formulate a linear program in order to help determine the optimal policy to this MDP.