



Montana Mathematical
Modeling Challenge
2016

“Grow” the Economy...?

In 2016, nine different states have ballot measures to expand or alter laws pertaining to the use of marijuana. Some initiatives push for full legalization of marijuana, while others allow for (or expand) the use of marijuana for medical purposes. In November, Montana voters will weigh in on the Montana Medical Marijuana Initiative (I-182), which would change limits on medical marijuana providers. While there are many arguments both for and against new legislation, one thing is clear: changes in marijuana laws will have a financial impact on the states that enact them.

Create a mathematical model to estimate the financial impacts on the State of Montana if it approves complete legalization of marijuana. Use your model to give predictions for five and ten years from now.

There are MANY things you may consider as you approach this problem, and you certainly don't have time in 24 hours to consider all of them. Determine the most important factors and justify why you included those and ignored others. Here are some of the things you might consider; note that this NOT an exhaustive list, but rather a few ideas to help you start brainstorming the factors your solution will consider.

- Montana would collect revenue by taxing the sale of marijuana. Will the federal government want its share? If so, does that change the tax rate Montana would set?
- How would federal legalization of marijuana impact your analysis?
- Will there be an increase in jobs in Montana? By how much? Does that stimulate other parts of the state economy? How can we quantify all of that?
- Will there be a decrease in crime rates and police expenses, since possession of marijuana won't be a crime? Similarly, will there be a decrease in prison expenses associated with marijuana-related crimes?
- States that have already legalized marijuana have invested significant funding in educating the public in the responsible use of marijuana, and also minors since their brains are still developing. How much will Montana likely have to invest in education programs over time? How can we account for the portion of those costs that would occur BEFORE the date of legalization?
- Are there potential negative health effects that should be considered when quantifying costs? Are consumers more likely to try other/illegal drugs if marijuana is legal? Should we expect to see an increase in DUIs?
- Montana would only consider legalizing marijuana if there was an entire regulation system, which will likely be a bureaucratic burden. You may want to consider the costs associated with the regulation of the marijuana industry.

Remember that you are to provide an analysis and projected outcomes, ***not an opinion or recommendation.***

For either question, be sure that your summary and presentation address strengths, weaknesses, and ideas for further improvements to your model.



Montana Mathematical
Modeling Challenge
2016

Montana Mokémon Co!

With the overwhelming popularity of Niantic's Pokémon Go! app, multiple game developers are jumping at the opportunity to cash in on the success. The Montana version, **Montana Mokémon Co**, is now being beta tested, and you have been tasked with some of the algorithm development. The game is played on a coordinate grid and has many features similar to the Pokémon Go! game.

- Moké appear at random locations on the map at intervals of (on average) 30 minutes. The Moké stay there for a fixed amount of time (15 minutes) and then disappear.
- Each Moké has a point value associated with it, ranging from 1 to 20 points. The lower valued Moké are fairly common, but the high point valued ones are quite rare.

Your goal is to develop an algorithm to move around the map to collect as many points as possible in a 12 hour period. In your executive summary and presentation be sure to discuss strengths and weaknesses of your model, and give an estimate for the expected number of points your algorithm can earn you in a typical 12 hour period.

At first glance this problem may seem like a "Traveling Salesperson Problem," but don't be fooled! Because we never know where or when the next Moké will show up, we'll need to make our decisions based on imperfect information that changes over time.

The dataset "Montana Mokemon.xlsx" contains data from the last 42 days of Moké appearances in a 4 mile by 4 mile downtown grid (broken into a 10 by 10 grid). You can use this data to build and test your model. Just like the Pokémon Go! game, Montana Mokémon Co is meant to be played by people who walk from location to location. Be sure to consider this in your model. Also note that the grid is meant to represent the layout of streets in a downtown-type area with buildings, businesses, restaurants, pedestrian traffic, and residents.

For either question, be sure that your summary and presentation address strengths, weaknesses, and ideas for further improvements to your model.