

1 Project 2: When Research Meets Reality

1.1 Purpose

The purpose of this assignment is to introduce you to some real-world research techniques, because a lot of the time, having the right algorithm for the job is only a fraction of the work that needs to be completed. We will do our best to simulate such a lesson using the following imaginary-world scenario...

The state of Missouri has decided its electrical, internet, road, and railway infrastructure systems are out of date and are in need of a complete overhaul. The state government has offered a long-term and lucrative contract for a design company to oversee the construction of this project. As part owner and chief science person for your firm, your job is to write the proposal that your company will submit for its competitive bid. In your proposal you will need to detail out your suggested investments in infrastructure between 25 of Missouri's cities and towns. Which 25 cities you use are up to you, but remember, you are trying to win a bid, so the selection of which cities could also be part of your strategy. Your electric, road, railway, and internet systems are all separate entities. So where you place a railway may not necessarily be the same place you put an electrical line. You will want to consider several metrics for your decisions: population and distance are not everything. Agricultural and industrial towns may be far away and be low in population, but they still need a way to get their products out. Finally, since this is just the bidding process, some estimation is expected. You can assume there are no geographical features between the cities and the distance is merely as the crow flies. For any estimates or metrics that you use in your calculations, please make sure that they are cited.

For the actual programming part, you are to implement your own algorithms based on our discussions of graph theory. Which algorithm you write will depend on which metrics you select. You will then use this code to write a report on your findings and on the efficiencies of your algorithm. I expect to see pseudocode that is written in the same style used in class. I also will be checking the rigor of your tests. I don't care what programming language you use to implement these algorithms.

1.2 Organization

- Introduction
- Metrics
- Algorithms
- Methods
- Results
- Conclusions
- Appendix

1.3 Content

1.3.1 Introduction

All I want out of your introduction is an overview of what's to come. What is the purpose of this proposal? How do you expect to win this bid?

1.3.2 Metrics

Explain what resources you have decided to use as measures for a city's importance in receiving electrical power, rail service, roadways, and internet bandwidth. Why have you decided to use these? What items have you selected to ignore?

1.3.3 Algorithms

Once you have described how you have determined the importance of a city receiving the state's limited resources, your next step is to describe your solution for distribution. What algorithms have you come up with? How do they make sense for that system?

1.3.4 Methods

Think of this section as a recipe. You are describing to your audience exactly how you conducted your tests. The goal here is to leave nothing to the imagination of the reader. Just as if you are trying to make some brownies from a Betty Crocker book; you wouldn't want to have to guess what to do at any part of the process. So, try to place yourself in the mind of those who will be reading your work. What would they need to know in order to replicate your tests to achieve the same results?

1.3.5 Results

The results section is self-explanatory. There is very little discussion taking place. This section is a collection of tables, charts, graphs, plots, etc built from the data gathered in the experiments.

1.3.6 Conclusions

This is where you state your observations and the actions that you would take upon them. This part doesn't have to be extensive, but it does need to help funnel the readers thoughts into how your research shows that your proposal is the superior offer.

1.3.7 Appendix

You are required to include the code you used to execute your experiments in the appendix. Not all of the code is required, just the parts relevant to your algorithms. Other than the code, your appendix should include anything relevant to your research that could not be fit within the main body of the paper.