Math 312 Project Write–ups Spring 2017
Genetic Algorithm for Optimization Projects

Normally there are 4 sections and an appendix to a complete research manuscript. For this project you will only do the first 2 sections and the appendix. This project or a very similar one using agent based models. The length is not prescribed and the size of the appendix can vary greatly dependent on the project. The two sections of the paper are typically 3-6 pages.
TIP: You may want to write the appendix before the second section. The appendix can be full of equations and symbols. The second section should be mostly words that describe in terms of the real setting what the equations in the appendix implement.

Section 1) Statement and Overview
This introductory section should include a description of the problem and what factors you believe to be important. You should include a description of the "thing" to be optimized and how generally one can measure that "thing". You should describe what information is provided to base a decision on and any constraints in possible solutions (can't spend more than some amount for example).

Grading criteria:
1. Is there a clear description of what needs to be optimized, and what assumptions you will make in creating a measure of this?

2. Is it clear what factors are to be chosen to optimize the system? A distinction between information that is provided to the algorithm and that which the algorithm produces must be made.

3. Is there a clear description of the information available to make decisions? Another way to state this is that the algorithm must have some inputs and these should be described completely.

4. Constraints on the possible solutions (if any) should be clearly identified.

5. Is there sufficient description of the model using words to establish an intuition or understanding of how the model relates to the real world system you are modeling. Someone with very little math background should be able to understand the issues you are discussing.

Section 2) Model Description
Give a fairly specific overview of the algorithm operations. General statements about the timing (ordering) of the operations should be included. Conversion from information to strings and strings to fitness should be explicit. These descriptions should primarily use words to describe the model. But they should be complete in that they describe all the parts of the process. Equations and details of the operations should appear in the appendix.

Grading criteria:
1. Is the timing (order) of the operations of the algorithm clear and complete?

2. Is the conversion from input information to strings and strings to fitness clear? Someone should be able to convert from one to the other after reading this section.

3. Is the conversion of input information complete–that is, does the string system presented include all information available to the system? Similarly, does it allow all reasonable solutions to be generated?

Section 3) Results and 4) Model Critique/Conclusion
Not required for this project.

Appendix: Model Specification
Write a concise, mathematical or algorithmic description of each operation in your model. Details of the reproduction, crossover and mutation operations should be included with values given for parameters such as the chance of mutation occurring. This appendix should also describe how the initial population should be created. That is, should the initial population be a random collection of strings, or would you be sure to have at least one string with some character.
In general, if equations can describe the operations simply, you should use equations. If a few words can replace a large algebraic expression, that is also appropriate. Introducing intermediate variables for complicated expressions that are repeated can ease understanding of the model specification as well.

Grading criteria:
1. Is the operation specification complete? Is there a description of how to do each operation and what the result of that operation would be? Are all parameters identified?

2. Between the model description and the appendix is there enough information to proceed from one generation of strings to the next?

3. Are initial population settings clear and appropriate for solving the question being considered?