Artificial Intelligence Project Proposal

I will be generating Minimum Spanning Trees using a Genetic Algorithm. If time permits, I will attempt to add an additional method to attempt to gain a better evolution through peak migration. I will determine the effectiveness of my idea by comparing the results of both algorithms.

I plan on using Python to write this project. I have experience with a genetic algorithm framework in Python and, although I do not plan on using it for this project, if I choose to pursue this topic further it would be easy to transition to using a supported framework. Also, Python has very simple CUDA translation for executing certain functions in parallel on Nvidia GPUs which can be beneficial to time performance in the future.

I will be running the program on a UNIX based operating system, but I have not decided which distribution yet. I will most likely be using Ubuntu because of its ease of installation onto a virtual machine.

The program will use a text-based user interface.

Since I am going to be attempting to generate a Minimum Spanning Tree in this project I will represent the individuals as an array of biases elements long. This representation comes from a paper that shows an excellent way of representing trees in genetic algorithms in such a way that the individuals have good locality, only represent trees (meaning no individuals that are disconnected or have cycles can be created), and can easily be converted to and from a tree data structure.

I will be representing the population as a Linked List structure. I am choosing a Linked List because the most frequent operation that will be applied to the population is going to be cycling through all individuals sequentially. This will reduce the memory requirements for the algorithm on larger populations while not sacrificing performance.

To determine the fitness of an individual I will add the weight of each edge contained in the individual. The paper I found shows a way to represent individuals in such a way that non-tree individuals can not be formed; therefore, I should not have to worry about a case that would have to be disregarded in the fitness function.

I plan on using basic mutation and crossover operations for this project. Single element mutation and single split crossover between two individuals.