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Project: Traveling Salesman Approximation

Motivation: P versus NP is a problem that asks whether every problem whose solution can be quickly verified can also be solved quickly. It remains unsolved. There are many real-world applications of this problem that can all be simplified and amalgamated to reflect The Traveling Salesman Approximation. The brute force method, which is guaranteed to work, runs in O(n!) time. This is extremely inefficient to the degree of being nearly unusable. Luckily there are approximations that allow for the relaxations of absolute accuracy so that the runtime can become reasonable. In this project, several approximations will be compared with each other to determine which has the better run time and therefore practicality.

Features: The goal of this experiment will not be to find a solution to P versus NP, which for these purposes would be to find the optimal solution for large inputs. Using small inputs, approximation algorithm outputs will be run against a brute force algorithm allowing for the comparison of results. When applying large inputs the distance of the algorithm generated will be plotted, showing the visualization of the approaching of a lower limit. See example below:

A picture containing text, plot, line, diagram

Description automatically generated

Data: We intend to use the coordinates of the 200 highest population Florida cities. There are (n-1)! different possible solutions which comes to ~4x10372.

Tools: The code will be written using python and the visualization of the data will be created using pygame.

Visuals: Rough draft of visualization can be seen below. A map of the state of florida

Description automatically generated with medium confidence

Strategy: The currently planned algorithms include a greedy algorithm, 2-Opt, 3-Opt, a genetic algorithm, as well as the brute force method being used for comparison. Data will first be presented through a graph displaying the total distances of the routes being generated by the approximations during each iteration. Second, said routes should be shown on a map. This allows the visualization of the route as it approaches an optimal result.

Responsibility and roles: As the project is still within the planning stages specific tasks have not yet been assigned. As the problem is laid out, it will then be broken down into tasks and assigned using sprint techniques. Currently there are two members within the group, so distribution of responsibilities and roles should be divided equally.