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Data Structures and Algorithms II
Project 3
User's Manual

Setup and Compilation

1. Download and unzip the submission from eLearning and run on a Linux machine(SSH Server).
2. The submission includes:
    - bruteforce.cpp
    - bruteforce.hpp
    - distances.txt
    - ga.cpp
    - ga.hpp
    - project3results.xlsx
    - main.cpp
    - Makefile
    - UMLDiagram.pdf

3. Environment: This program has been tested on the UWF SSH Server and will work there.

4. Compiling. This program includes a `Makefile`. At the command line in Linux, type `make clean main`. The program produces an executable entitled `main`

Running the program. Issue the command `./main` No command line arguments are required or checked.

User input: Upon execution, the program will sequentially ask for the number of cities to simulate, the number of tours in a generation, the number of generations to run, and the percentage of generation that is mutated.

Output: All output goes to the console. After entering all input parameters, the program will automatically run and the results will be displayed. The program outputs the number of cities that ran, the brute force optimal cost, the time it took the brute force, the genetic algorithm optimal cost, the time it took the genetic algorithm, and the percentage error from the genetic algorithm.

Important Note: The mutation in my project is done by picking random cities in the tour and swapping them; this means that the genetic algorithm can perform different every time it is ran. While this did end up adding inconsistency into the results, it seemed to perform better on average than when I picked certain cities to mutate.

```
---------Welcome to Service Simulator! Please enter required parameters.---------

Please enter number of arrivals to simulate (between 1000 and 5000): 5000


Please enter number of average arrivals per time unit (lambda): 2


Please enter number of average customers served per time unit (mu): 3


Please enter number of service channels (1 to 10): 2


Analytical Model of Percent Idle Time: 50%
Simulated Percent Idle Time: 49.36%

Analytical Model of Average Number of People in the System: 0.75

Analytical Model of Average Time a Customer Spends in the System: 0.375
Simulated Average Time in System: 0.3895

Analytical Model of Average Number of Customers in Queue: 0.08333

Analytical Model of Average Time Waiting in the Queue: 0.04167
Simulated Average Queue Wait Time: 0.04848

Analytical Model of Utilization Factor: 0.3333
Simulated Utilization Factor: 0.341

Probability of a Customer Having to Wait: 18.28%
```