ECE 580 Spring 2018

FunWork #5

Due on April 20

INSTRUCTIONS: The assignment must be typed. Clearly identify the steps you have taken to solve each problem. Use MATLAB to verify your solutions. Include your MATLAB work. Your grade depends on the completeness and clarity of your work as well as the resulting answers.

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1. Consider the classic traveling salesperson problem (TSP): Suppose a salesperson must visit clients in different cities, and then return home. What is the shortest tour through those cities, visiting each one once and only once? Implement in MATLAB a simple variant of the genetic algorithm that optimizes the salesman route for 20 cities. How many different possible paths are there for 20 cities? Use the following representation of any candidate solution: for a given map of the cities to be visited (including the salesperson's home base), assign to each city a positive integer. Thus, for example, if there were six cities, one possible solution might be $\begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 6 \end{bmatrix}$. The above represents an order of progression of the salesman's trip. Note that because the problem requires a round trip, the first coordinate of the vector representing the first city of the trip is also the last city visited by the salesperson. Because the trip is a closed loop, it does not matter from which city the salesperson starts his or her trip. As far

as a crossover operator implementation is concerned, use a single-parent operator that produces an offspring by inverting the visiting order between two randomly chosen coordinates of the parent vector. As an example of this implementation of the single-parent crossover operator, suppose that the parent is as above and that the randomly chosen coordinates, that is, the inversion points, are the second and fifth ones. The offspring would then be $\begin{bmatrix} 1 & 5 & 3 & 4 & 2 & 6 \end{bmatrix}$. First, randomly generate and plot a map with 20 cities over the area

$$\begin{bmatrix} 0, & 20 \end{bmatrix} \times \begin{bmatrix} -5, & 15 \end{bmatrix}.$$

Then, compute the length of your optimal route and mark the obtained salesman's route. Produce plots of the best, average, and the worst objective function values in the population for every generation.

2. Exercise **16.4** from Textbook on page 371.

3. Exercise **16.12** from Textbook on pages 373–374.

4. Exercise **17.3** from Textbook on pages 394–395.

5. Exercise **20.7** from Textbook on page 483.