AEEM 5197/6097 "Soft Computing Based AI" or AEEM 7010: Prof. Kelly Cohen - Fall 2019

Take Home Test T#2

This is an Individual Test and comprises 5% of your Final Grade

Due Tuesday, October 29, 2019, 10 AM

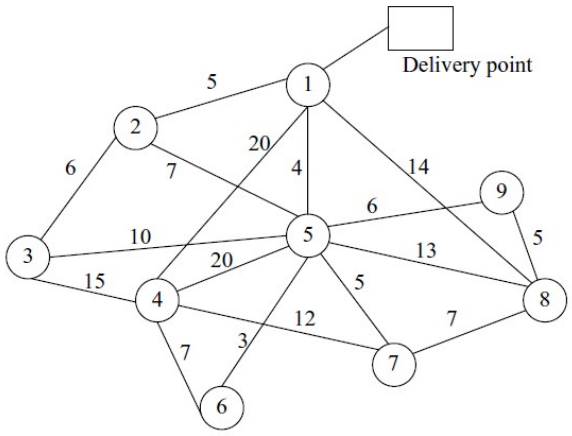
Upload on BB a single Pdf document and a single ZIP file containing your codes

Instructions:

PLEASE develop you VERY own code which can be based on Dr. Seyedali Mirjalili's code I shared with class **(WHICH NEEDS TO BE ATTACHED)** for the following GA problem:

Problem 1

The figure below shows the mileages of the feasible links connecting nine offshore natural gas well heads with an inshore delivery point. Since well head 1 is closest to the shore, it is equipped with sufficient pumping and storage capacity to pump the output of the remaining eight wells to the delivery point. Using GA, determine the minimum pipeline network that links the well heads to the delivery point.



a. Develop a GA to solve to obtain length and sequence of minimum pipeline network. Describe your rationale in selecting all of the GA stochastic operators and how did you approach the optimization constraints (**plot GA convergence over generations**, **25 points**)

b. What are the lessons learned in this exercise concerning your ability to develop an effective GA for the above class of problems (~ **1 page, 10 points**)

c. Explain the main challenges if you need to scale your solution for a large number of well heads (>200) (~ **0.5 page, 10 points**)

d. Attach a complete set of all software developed for this test. Please add detailed comments (**5 points**)

Hint: Please relate to this problem as a variation of the Traveling Salesman Problem (TSP) where we seek a minimum tour which ends in well head 1 and connects each and every well head just once

Problem 2

Please download the pdf document from Blackboard titled "10 Lectures on GFS". After reading chapter 10 titled: "*Learning with Genetic Fuzzy Systems: Other Approaches*" thoroughly (pages 63-68), address the following:

a. **IN YOUR OWN WORDS**, write a **half page** summary on each of the 4 approaches discussed, namely: (1) Offline Optimization of a Table-Based TSK Controller; (2) The Nagoya Approach; (3) Optimizing Hierarchical Structures of Fuzzy Systems (4) Fuzzy Genetic Programming (**10 points**)

b. Which of these 4 approaches do you prefer and why? (**1 page, 10 points**)

c. Provide on example when you could see an advantage to incorporate your preferred approach as cited in part 2 b. (**0.5 page, 5 points**)

Problem 3

Please download the pdf document from Blackboard titled "1995-IEEE_TFS-Homaifar-GFS-RB_MF". After reading this paper titled "*Simultaneous Design of Membership Functions and Rule Sets for Fuzzy Controllers Using Genetic Algorithms*" thoroughly address the following:

a. **IN YOUR OWN WORDS**, write a **two-page** summary on this paper addressing each of the use cases with a focus on how the GA Chromosome was constructed (**15 points**)

b. What lessons have you learned from this paper which you may consider incorporating into your own GFS codes in the future (**1 page, 10 points)**