Cairo University
Faculty of Computers and Information

Final Exam

Department: Computer Science
Course Name: Genetic Algorithms
Course Code: CS464
Instructor(s): Prof Amr Badr
Prof Ibrahim Farag

Date: 11/1/2015
Duration: 2 hours
Total Marks: 60 marks

ANSWER ALL QUESTIONS

Question 1 [7 marks]

Given a stock market information system with governing variables x1, x2 and x3. It is required to infer the decision D. The following information is provided,

x1 range 0..100 with fuzzy sets L, M, H.
x2 range 0..100 with fuzzy sets L, M, H.
x3 range 0..100 with fuzzy sets L, M, H.

and D with decisions sets Sell:S and Buy: B. range 0..100
The following decision blocks apply,
DB1:
IF x1=L AND x2=L THEN y=L
IF x1=M AND x2=H THEN y=H
DB2:
IF x3=L AND y=L THEN D=B
IF x3=M AND y=H THEN D=S
Intermediate variable y is
y range 0..100 with fuzzy sets VL, L, M, H, VH
determine the decision D for x1= 30, x2=70 and x3=30.

Question 2 [7 marks]

A seller has 3 parameters A, B, C affecting his market Risk,

A range 0..100 with fuzzy sets L, M, H.
B range 0..100 with fuzzy sets L, M, H.
C range 0..100 with fuzzy sets L, M, H.

And Risk: -100..100 with fuzzy sets VL, L, M, H, VH
The following rules govern,
IF A = L AND B=M AND C = H THEN Risk = L
IF A= M OR B= L AND C = H THEN Risk = M
Estimate Risk, A= 40, B=30, C=70.

Question 3 [6 marks]

a- Prove that any string of length m is an instance of 2^m different schemas.**[3 marks]**
b- Define the fitness f of bit string x with length m = 4, to be the integer represented by the binary number x. (eg. f(0011)=3, f(1111)=15). What is the average fitness of the schema **1* under f? What is the average fitness of schema *0** under f?**[3 marks]**

Question 4 [6 marks]

Calculate the probability that a binary chromosome with length L will not be changed by applying the usual bit-flip mutation with Pm=1/L.

Question 5 [6 marks]

The correct representation of a problem is vital to its solution.
a-Taking the problem of function optimization, discuss the suitability of binary and floating point representations.
[3 marks]
b-Calculate the number of bits necessary to represent a precision of 6 decimal places over a range of [1, 5].
[3 marks]

Question 6 [7 marks]
Evolutionary computation is used to prove and deduce physical constants. It is required to use an evolutionary algorithm to deduce the gravitational acceleration constant g and the equation for free-fall of an object. Design the algorithm and state how it can be applied.

Question 7 [7 marks]
The parameters that control the performance of a nuclear plant are balanced. This balance serves in preventing catastrophe. Design an evolutionary system for control of a nuclear plant given that the main parameters for control are x1, x2, …, xm.

Question 8 [7 marks]
Histone methylation is one of the causes for cancer. There are a large number of histones in our bodies. The levels of histones can be represented as a datafile where each column represents a particular histone and the rows represent patients. It is required to determine the histones responsible for each type of cancer. Design a Genetic algorithm to perform such a task.

Question 9 [7 marks]
Design an evolutionary algorithm for strategy war game playing. The parameters of the game range from military power, man power, capital power, industrial power etc…It is required to design a system that will adapt itself to the parameters and at the same time respond quickly to actions.