Cairo University
Faculty of Computers and Information

Final Exam

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

Date: 16/1/2017
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

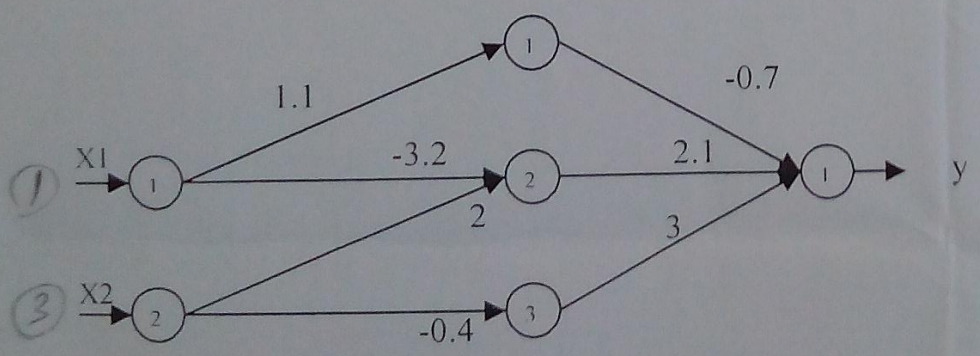
The following rules govern,

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]

Given the following FFNN with weights



The network when properly trained should respond with y1=0.9 to inputs $\begin{bmatrix} x1 \\ x2 \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$. The network weights have been initialized as shown. Analyze a single feedforward and backpropagation step for the network. Find updated weights [W^h] and [W^o]. Apply sigmoidal activation function. Learning rate =1.

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]
Gray code is a binary code which, unlike usual binary code, differs in just one bit between a code and the next. Discuss its suitability for use in a genetic algorithm.

Question 7 [7 marks]
Sometimes a dataset can have no output class (label). Design a system where you can classify and predict the category of a record in the dataset in such a case.

Question 8 [7 marks]
Design a controller for a genetic algorithm that will control and fine-tune its function.

Question 9 [7 marks]
Given the prisoner's dilemma problem that states that 2 prisoners are interrogated. The following strategies can be considered:
*Tit-for-Tat: cooperate with the other prisoner for cooperation and defect for defecting.
*Anti-Tit-for-Tat: defect for cooperating and cooperate for defecting.
*Random strategy.
Note that score for both cooperating is 2-2, for both defecting 0-0, and defect for cooperate 3-1. Design a GA that will predict the best strategy for n-cycles. What do you think is the strategy with highest score?

EXAMINERS
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