RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES, MIHINTALE

B.Sc. (Four Year) Degree in Information and Communication Technology
Forth Year – Semester I Examination – April/May 2015

ICT 4402 – INTELLIGENT SYSTEMS

Answer **FOUR** questions only   Time allowed: 3 Hours

The use of a non-programmable electronic calculator is permitted.

1.

a.

(i) Explain advantages of First Order Logic (FOL) over Proposition Logic using suitable examples.

(ii) "Order of Quantifiers are important in FOL sentences". Explain above statement using suitable examples.

(35 marks)

b.

Figure 1 and **Figure 2** shows initial and goal state of the eight puzzle problem respectively.

A	B	C
D		F
G	E	H

Figure 1

A	B	C
D	E	F
G	H	

Figure 2

FOL sentences regarding the some possible legal movements are given below:

∀x1,x2,x3,x4,x6,x7,x8,x9 Move(State(x1,x2,x3,x4,Empty,x6,x7,x8,x9), State(x1,x2,x3,x4, x8,x6,x7,Empty,x9)).

∀y1,y2,y3,y4,y5,y6,y7,y9 Move(State(y1,y2,y3,y4,y5, y6,y7,Empty,y9),State(y1,y2,y3,y4,y5, y6,y7,y9,Empty)).

Solutions for given initial state p and goal q can be expressed as follows using FOL.

∀p,q,z [Solution(p,q) ← [Move(p,q) V [Move(p,z)^ Solution(z,q)]]].

(i) Convert above knowledge into Conjunctive Normal Form (CNF).

(ii) Prove Solution(State(A,B,C,D,Empty,F,G,E,H),State(A,B,C,D,E,F,G,H,Empty)) is correct according to the above given Knowledge using resolution rule.

(65 marks)

2.

a.

(i) Describe the Turing Test briefly.

(ii) Mention two drawbacks of the Turing Test.

(iii) Explain how you would modify the Turing Test to overcome above mention drawbacks.

(50 marks)

b.

(i) Describe the Halting Problem

(ii) Prove that the Halting Problem cannot be solved by a computer.

(iii) "Computers can't be intelligent because it can't solve the Halting problem". Express your opinion on this statement with valid reasons.

(50 marks)

3.

a.

(i) Mention two activation functions used in Artificial Neural Networks and sketch them.

(ii) Provide equation for output of a single neuron based on inputs. Assume neuron has a bias-input in addition to other inputs. Mention the meaning of every term of equation.

(30 marks)

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b.

(i) Give an exampie for non-liner separable problem with two inputs and one output.

(ii) Is it possible for a single neuron with suitable weights to match the following inputs and output? Explain your answer using graphical representation of inputs and output.

Input 1	Input 2	Input 3	Output
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

Table 1

(40 marks)

c.

Provide equivalent single Artificial Neuron for Artificial Neural Network (ANN) given in **Figure 3**. Activation function g(x) is 2*x+1.
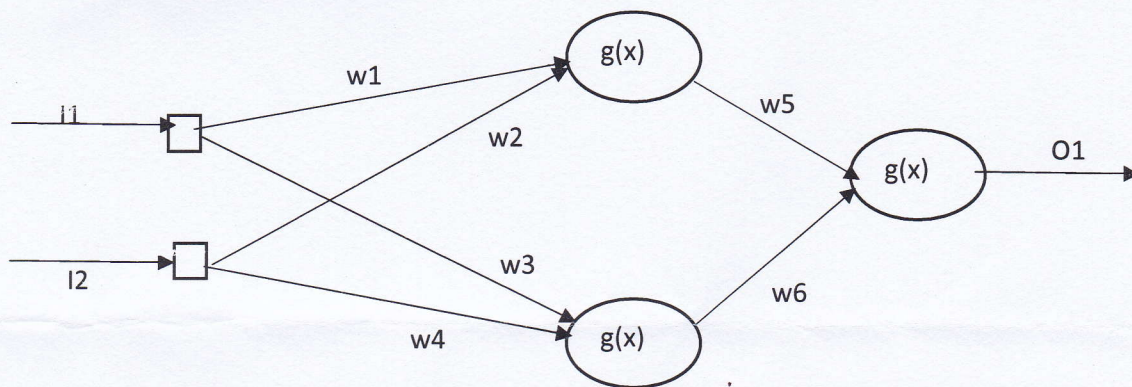

Figure 3

(30 marks)

3

4.

a.

(i) Describe important features of A* algorithm.

(ii) Why Admissible Heuristic Function is important in A* algorithm?

(Iii) Identify which of the followings are Admissible Heuristic Function. Provide one example to show that Heuristic Function is not admissible if it is not. Path costs for 8 puzzle is number of movement of tiles and path cost for rube cube (Magic cube) is number of 90 degree rotations of different planes with 8 or 9 small cubes.

- Number of misplaced tiles for 8- puzzle problem
- Manhattan distance 8- puzzle problem
- Number of misplaced squares in rube cube
- Minimum number of movement to make at least one side of the cube same color

(50 marks)

b.

(i) Explain Hill Climbing Search Algorithm.

(ii)Show that Hill Climbing Search can get stuck in local minima, using 8 puzzle problem with suitable heuristic function. You can select suitable initial sates of the puzzle.

(30 marks)

c.

Briefly describe two of the following searching algorithms.

(i) Bidirectional search

(ii) Iterative Deepening Search

(iii) Recursive best-first search (RBFS)

(iv) Simplified Memory-bounded A* (SMA*) search

(20 marks)

4

5.

a.

Identify which of following problems are suitable to solve using Genetic Algorithms (GA). If GA is not suitable technique for the problem, clearly mention the reason.

(i) There are 5 time slots and 4 different lecture series. For each lecture series need assign a separate time slot from the above time slots according to the given constraint and preferences, It will take 0.001 milliseconds to evaluate a specific assignment of 4 lecture series for constraint and preferences using a average personal computer.

(ii) There are 35 time slots and 30 different lecture series. For each lecture series need assign a separate time slot from the above time slots according to the given constraint and preferences, It will take 0.005 milliseconds to evaluate a specific assignment of 30 lecture series for constraint and preferences using an average personal computer.

(iii)Telecommunication Service Company wants to build 10 telecommunication towers to provide service for cellular phone customers. Considering factors such as population densities, geographical constraints, cost of development they need to identify more suitable places to locate telecommunication towers for Maximum coverage. For a telecommunication tower more than 100 possible locations are available.it will take .01 milliseconds to evaluate a specific configuration of towers.

(30 marks)

b.

Mention four activates in Genetic Algorithms deal with randomness. Clearly mention when randomness involved in the above mentioned activities.

(30 marks)

5

c.

Ten chromosome are given to consider as initial population:

Chromosome 1	0	1	1	0	1	1	0	0	1	1	0
Chromosome 2	1	0	0	1	1	1	1	1	0	0	1
Chromosome 3	1	1	1	0	0	1	0	0	1	1	0
Chromosome 4	0	0	0	1	1	1	0	0	1	1	1
Chromosome 5	0	1	1	0	0	1	1	1	1	0	0
Chromosome 6	1	1	1	0	0	1	0	0	0	1	1
Chromosome 7	1	0	0	1	1	1	0	0	1	1	1
Chromosome 8	1	1	1	0	0	1	1	1	0	0	1
Chromosome 9	0	0	1	1	1	1	0	1	1	0	0
Chromosome 10	1	1	0	0	1	1	0	0	1	1	1

Table 2

Assuming following chromosome is the best solution of the problem, discuss the important of mutation in GA. You can use single point crossover method.

0	1	1	0	1	0	0	0	1	1	0

(20 marks)

d.

Describe suitable crossover and mutation techniques for permutation encoding methods.

(20 marks)