53 (CS 711) ARIN

2018

ARTIFICIAL INTELLIGENCE

Paper : CS 711

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* What are the *two* basic things required to organisms in the real world for surviving? And also describe the agent's movement in the cell. 5

   (b) Describe the turing test and explain the threshold logic unit based network. 8

(c) Explain the methods for searching state spaces with defining the decision tree and describe the role of backtracking in decision tree with the example. 7

2. (a) Write down all the common inference/ rules in reasoning. 6

(b) What is the difference between syntax and semantics in knowledge representation and mention the logic based *two* knowledge representation schemes ? 8

(c) What is the role of connectives in the propositional logic ? And explain the two sentences based on these connectives. 6

3. (a) Write down the steps of Hill climbing search. 8

(b) Find the shortest path from the starting state 'S' to the Goal state 'G'. The graph is shown below in the Figure (1). Apply the branch and bound (BB) search. List the nodes, after expanding and add to the extended list in order. Distances (costs) are shown next to edges. 12

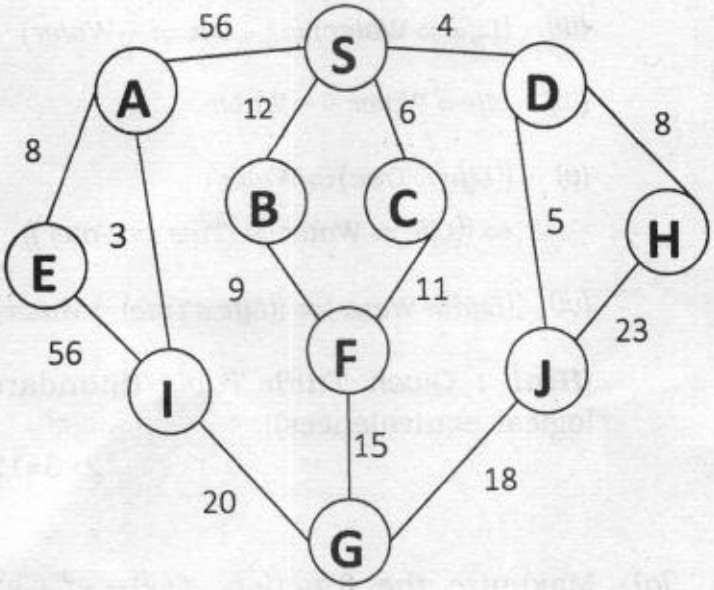

Figure (1)

4. (a) What is the need of Shallow and Deep pruning in α-β pruning and explain the use of role Max (α) and Min (β) node in α-β pruning. 8

(b) Decide whether each of the following sentences is 'VALID' or 'SATISFIABLE'. Verify your decisions using truth tables or the equivalence rules

(i) $Life \Rightarrow Life$

(ii) $Life \Rightarrow Water$

(iii) $(Life \Rightarrow Water) \Rightarrow (\neg Life \Rightarrow \neg Water)$

(iv) $Life \vee Water \vee \neg Water$

(v) $((Life \wedge Tree) \Rightarrow Water)$
$\Leftrightarrow ((Life \Rightarrow Water) \vee (Tree \Rightarrow Water))$

(vi) $(Life \Rightarrow Water) \Rightarrow ((Life \wedge Tree) \Rightarrow Water))$

(**Hint** : *Given Truth Table* (Standard logical equivalences)).

2×6=12

5. (a) Maximize the function $f(x) = x^3 + x^2$ over the range of integers from 0...7. Apply a genetic algorithm to solve this problem. Show at least the possible solution (*i.e.* near to termination criteria).

(**Note** : x represent five-digit unsigned binary integers, $f(x)$ value itself a fitness solution, Coding in binary form having 3-bit string length represent 8 numbers, Four chromosomes (101, 101, 011, 001) as initial populations, Decode individual for further evaluation like fitness *i.e.* (101=5; $5^3 + 5^2 = 125+25=150$), probability, random number, crossover and mutation). 12½

(b) Write short notes on the following : ***(any three)*** 3×2½=7½

(i) Conjunctive Normal Form (CNF)

(ii) Generalized Modus Ponens (GMP)

(iii) Artificial Neural Network (ANN)

(iv) STRIPS

(v) Iterative deepening *A** (*IDA**)

6. *(a)* Represent the following sentences in the First-Order Logic (FOL), using a consistent vocabulary (which you must define) : 10

Takes (x, cs, s) : student x takes subject CS in semester s ;

Passes (x, cs, s) : student x passes subject CS in semester s ;

Grade (x, cs, s) : the grade obtained by student x in subject CS in semester s ;

CS81, CS82 and CS83 : specific CSE subjects

$x > y$: x is greater than y ;

Student (x) : Predicates satisfies by members of the corresponding categories.

Student (x), subject (cs), & semester (s)

a) Some students took CS81 in even semester 2017.

b) Every student who takes CS82 passes it.

c) Only one student took CS83 in even semester 2017.

d) The best grade in CS82 is always higher than the best grade in CS81.

(b) Differentiate the following : ***(any two)*** 2×5=10

(i) Depth first search *Vs* Breadth first search

(ii) Forward chaining *Vs* Backward chaining

(iii) Simulated annealing *Vs* hill climbing (local search algorithm)

(iv) *A** *Vs* *AO** algorithm.