53 (IT 715) ARIN

2016

ARTIFICIAL INTELLIGENCE

Paper : IT 715

Full Marks : 100

Time : Three hours

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

*Answer **All** questions.*

1. *(a)* What is the relation between state space graph and decision tree ? Mention the major advantages using decision tree in state space graph. 7

   (b) Describe wff's and interpretations in predicate calculus. 6

   (c) What is the role of forward and backward chaining in definite clauses ? 7

2. *(a)* Write down the uninformed search algorithm and define the depth first search algorithm with back tracking. 10

(b) Draw the diagram to define the standard procedure for Canonical genetic algorithm. 10

3. *(a)* Write down the AO* algorithm in the steps. 10

(b) Write down the branch and bound algorithm step. 10

OR

(a) What is the key role of heuristic algorithm in searching instead of uninformed searching? 6

(b) Find the shortest path from the starting state '*S*' to the goal '*G*'. The graph is shown below in *figure*. Apply the branch and bound (BB) search with an

extended list and break the ties of two equal lengths. (from the two paths, but same cost to reaching next name node) in lexicographic order.

List the nodes, after expanding and add to the extended list in order. Distances are shown next to edges.

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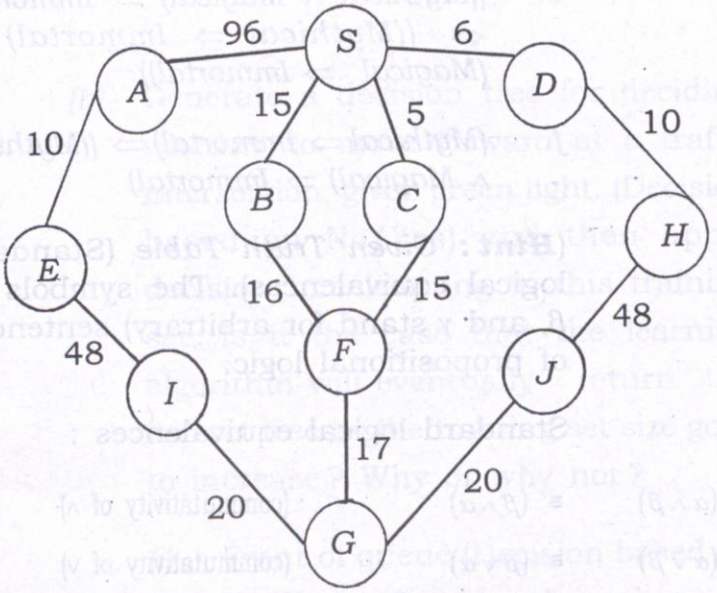

Figure

4. *(a)* Decide whether each of the following sentences are VALID, SATISFIABLE, or neither. Verify your decisions using truth tables or the equivalence rules.

a. $Mythical \Rightarrow Mythical$

b. $Mythical \Rightarrow Immortal$

c. $(Mythical \Rightarrow Immortal) \Rightarrow (\neg Mythical \Rightarrow \neg Immortal)$

d. $Mythical \vee Immortal \vee \neg Immortal$

e. $((Mythical \wedge Magical) \Rightarrow Immortal) \Leftrightarrow ((Mythical \Rightarrow Immortal) \vee (Magical \Rightarrow Immortal))$

f. $(Mythical \Rightarrow Immortal) \Rightarrow ((Mythical \wedge Magical) \Rightarrow Immortal)$

(***Hint:*** *Given Truth Table* (Standard logical equivalences). The symbols α, β, and γ stand for arbitrary) sentences of propositional logic.

Standard logical equivalences :

$(\alpha \wedge \beta)$	$\equiv (\beta \wedge \alpha)$	(commutativity of $\wedge$)
$(\alpha \vee \beta)$	$\equiv (\beta \vee \alpha)$	(commutativity of $\vee$)
$((\alpha \wedge \beta) \wedge \gamma)$	$\equiv (\alpha \wedge (\beta \wedge \gamma))$	(associativity of $\wedge$)
$((\alpha \vee \beta) \vee \gamma)$	$\equiv (\alpha \vee (\beta \vee \gamma))$	(associativity of $\vee$)
$\neg(\neg\alpha)$	$\equiv \alpha$	(double negation elimination)
$(\alpha \Rightarrow \beta)$	$\equiv (\neg\beta \Rightarrow \neg\alpha)$	(contraposition)

$(\alpha \Rightarrow \beta) \equiv (\neg\alpha \vee \beta)$ (implication elimination)

$(\alpha \Leftrightarrow \beta) \equiv ((\alpha \Rightarrow \beta) \wedge (\beta \Rightarrow \alpha))$ (biconditional elimination)

$\neg(\alpha \wedge \beta) \equiv (\neg\alpha \vee \neg\beta)$ (De Morgan's Law)

$\neg(\alpha \vee \beta) \equiv (\neg\alpha \wedge \neg\beta)$ (De Morgan's Law)

$(\alpha \wedge (\beta \vee \gamma)) \equiv ((\alpha \wedge \beta) \vee (\alpha \wedge \gamma))$ (distributivity of $\wedge$ over $\vee$)

$(\alpha \vee (\beta \wedge \gamma)) \equiv ((\alpha \vee \beta) \wedge (\alpha \vee \gamma))$ (distributivity of $\vee$ over $\wedge$)

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(b) Generate a decision tree for deciding whether to move forward at a traffic intersection, given green light. (Decision based on No/Yes) and then apply decision tree learning to this training set. Is it the case that the learning algorithm will eventually return the correct tree as the training set size goes to increase? Why or why not?

(i) Front of queue (Decision based on No/Yes) : Car ahead moving and Intersection blocked

(ii) Intersection blocked (Decision based on No/Yes) : Cross traffic, No

(iii) Cross traffic (Decision based on No/Yes) : Pedestrians, No

(iv) Pedestrians (Decision based on No/Yes) : Turning, No

(v) Turning (Decision based on Left/No/Right) : Oncoming traffic, Yes and Cyclist

(vi) Oncoming traffic (Decision based on No/Yes) : Yes and No

(vii) Cyclist (Decision based on No/Yes) : Yes and No 7

5. (a) Represent the following sentences in first order logic (FDL, Predicate Calculus) using a Consistent Vocabulary : 10

Takes (x,c,s) : student x takes course c in semester s;

Passes (x,c,s) : student x passes course c in semester s;

Grade (x,c,s) : the grade obtained by student x in course c in semester s;
RO and IP : specific and IP courses
$x>y$: x is greater than y;

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

Student (x), course (x), & semester (s)

(i) Some students took RO in even semester 2015.

(ii) Every student who takes RO passes it.

(iii) Only one student took IP in odd semester 2015.

(iv) The best grade in RO is always higher than the best grade in IP.

(v) Students can pass some of the courses all the semesters, and they can pass all of the courses some of the semester, but they can't pass all of the courses in all the semesters. 10

OR

Maximize the function $f(x) = x^2$ over the range of integers from 0...31. 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 5-bit string length (represent 31 numbers, Four chromosomes (10110, 11010, 10100, 10101) as initial populations. Decode individual for further evaluation (like fitness i.e. x^2 (11010) = 25 ; $25^2 = 625$), probability, random number, crossover and mutation). 10

(b) Write short notes on the following : ***(any four)*** 10

(i) simulated annealing (Local search algorithm)

(ii) Artificial Neural Network

(iii) Propositional Calculus

(iv) Stripes

(v) Perception-Action

(vi) Resolution
