53 (IT 715) ARIN

2018

ARTIFICIAL INTELLIGENCE

Paper : IT 715

Full Marks : 100

Time : Three hours

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

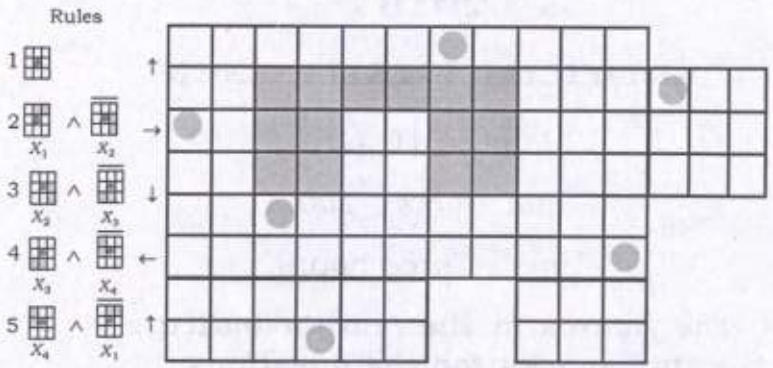
*Answer **any five** questions.*

1. *(a)* What is grid-space world ? 4

   (b) What is stationary preference and explain the *two* ways to assign utilities to sequences. 6

   (c) Define a heuristic function for the 8–puzzle game problem. How can it lead to a suboptimal solution on a particular problem ? Prove that, if h never over estimates by more than cost c, then A^* using h returns an optimal solution without exceeding cost c. 10

2. *(a)* Which one agent will move in the direction of south by using the production system based on Boolean notation ? 10



(b) Prove each of the following statements : 3

(i) Breadth-first search is a special case of uniform-cost search.

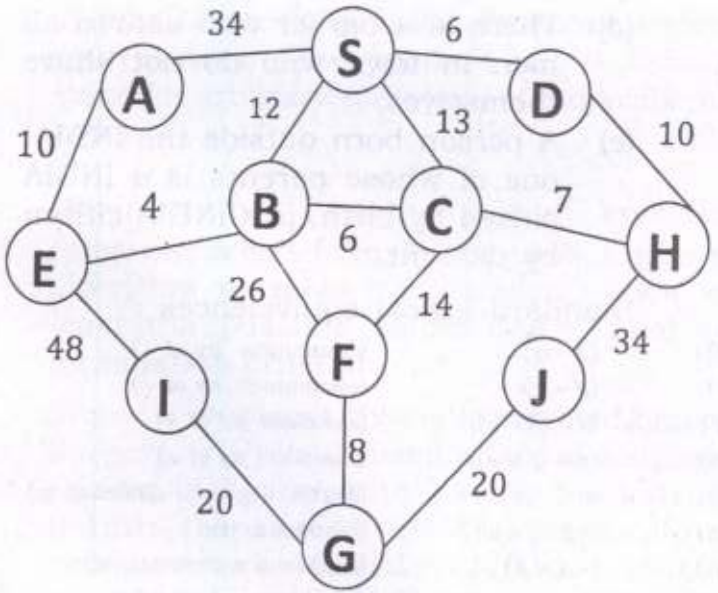
(ii) Breadth-first search, depth-first search and uniform-cost search are special cases of best first search.

(iii) Uniform-cost search is a special case of A^* search.

(c) What is the difference between Greedy based Best First Search (BFS) and A^* BFS ? 3

(d) What is Dynamic Bayesian Network (DBN) ? How is dynamic decision network (DDN) different from DBN ? Explain DDN with generic structure with its solution in diagram. 4

3. Write down the A^* Algorithm and find the shortest path from S to G using uninformed search algorithm. 20



4. *(a)* Write down the full resolution rule for sentences in implicative normal form. 5

(b) Represent the following sentences in first-order logic, using a consistent vocabulary (which you must define) : 15

(a) Every person who save money is smart.

(b) No student buys a car.

(c) There is a faculty who teaches GATE coaching only to students who are interested.

(d) There is a barber who shaves all men in town who do not shave themselves.

(e) A person born outside the INDIA, one of whose parents is a INDIA citizen by birth, is a INDIA citizen by descent.

Standard logical equivalences :

$(\alpha \wedge \beta)$	$\equiv (\beta \wedge \alpha)$	(commutativ ity of $\wedge$)
$(\alpha \vee \beta)$	$\equiv (\beta \vee \alpha)$	(commutativ ity of $\vee$)
$((\alpha \wedge \beta) \wedge \gamma)$	$\equiv (\alpha \wedge (\beta \wedge \gamma))$	(associativ ity of $\wedge$)
$((\alpha \wedge \beta) \vee \gamma)$	$\equiv (\alpha \vee (\beta \vee \gamma))$	(associativ ity of $\vee$)
$\neg(\neg \alpha)$	$\equiv \alpha$	(double negation eliminatio n)
$(\alpha \Rightarrow \beta)$	$\equiv (\neg\beta \Rightarrow \neg\alpha)$	(contraposi tion)
$(\alpha \Rightarrow \beta)$	$\equiv (\neg\alpha \vee \beta)$	(implicatio n eliminatio n)
$(\alpha \Leftrightarrow \beta)$	$\equiv ((\alpha \Rightarrow \beta) \wedge (\beta \Rightarrow \alpha))$	(biconditio nal eliminatio n)
$\neg(\alpha \wedge \beta)$	$\equiv (\neg\alpha \vee \neg\beta)$	(De Morgan' s Law)
$\neg(\alpha \vee \beta)$	$\equiv (\neg\alpha \wedge \neg\beta)$	(De Morgan' s Law)
$(\alpha \wedge (\beta \vee \gamma))$	$\equiv ((\alpha \wedge \beta) \vee (\alpha \wedge \gamma))$	(distributi vity of $\wedge$ over $\vee$)
$(\alpha \vee (\beta \wedge \gamma))$	$\equiv ((\alpha \vee \beta) \wedge (\alpha \vee \gamma))$	(distributi vity of $\vee$ over $\wedge$)

5. Decide whether each of the following sentences is VALID, SATISFIABLE, or neither. Verify your decisions using truth tables or the equivalence rules.

(a) $Disaster \Rightarrow Flood$

(b) $Disaster \Rightarrow Raining \wedge Flood$

(c) $Disaster \vee Raining \vee \neg Flood$

(d) $((Raining \wedge Disaster) \Rightarrow Flood) \Leftrightarrow ((Raining \Rightarrow Flood) \vee (Disaster \Rightarrow Flood))$

(e) $(Disaster \Rightarrow Flood) \Rightarrow ((Disaster \wedge Food\ Demand) \Rightarrow Flood)$

(**Hint :** *Given Truth Table* (Standard logical equivalences). The symbols α, β and γ stand for arbitrary sentences of propositional logic) 20

6. Maximize the function $f(x) = x^2$ over the range of integers from 0...63. Apply a genetic algorithm to solve this problem. Show *at least* the possible solution (i.e. near to termination criteria).

(Note : x represent six-digit unsigned binary integers, $f(x)$ value itself a fitness solution, Coding in binary form having 6-bit string length (represent 64 numbers, Four chromosomes 101101, 111010, 110100, 110101) as initial populations, Decode individual for further evaluation (like fitness i.e. x^2 (011001 = 25; $25^2 = 625$), probability, random number, crossover and mutation). 20
