



KEEPING MOBILE PHONE/SMART WATCH, EVEN IN “OFF” POSITION, IS TREATED AS EXAM MALPRACTICE

Answer any TEN Questions

(10 X 10 = 100 Marks)

1. Identify the PEAS and the Task Environment description for the following agents. **BL3 CO1**
Justify your answer.
 - a) Robot Soccer Player **[5]**
 - b) Autonomous Mass Rover **[5]**
2.
 - i. Elaborate the impact of the AI revolution in Healthcare. **[4] BL2 CO6**
 - ii. Enumerate the agents of AI and based on their degree of perceived intelligence, explain the architecture of model based and goal-based agents. **[6]**
3.
 - i. Compare and contrast the blind search and Heuristic search algorithm. **[4] BL3 CO4**
 - ii. Solve the 8-puzzle problem for the following current state and the target state using Greedy Best First Search (GBFS) having the heuristic function equals the number of mismatched places. Also estimate the total cost of search path. **[6]**

1	2	3
4		8
7	6	5

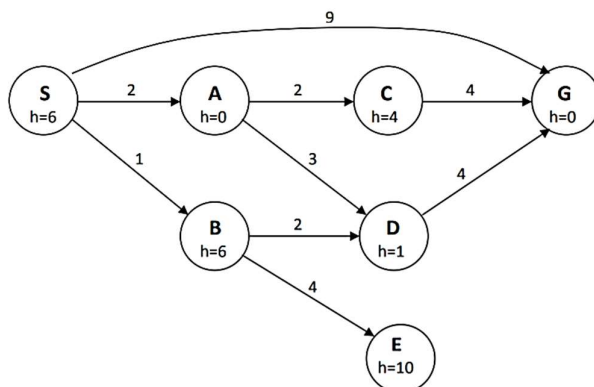
Current state

1	2	3
4	5	6
7	8	

Target

State

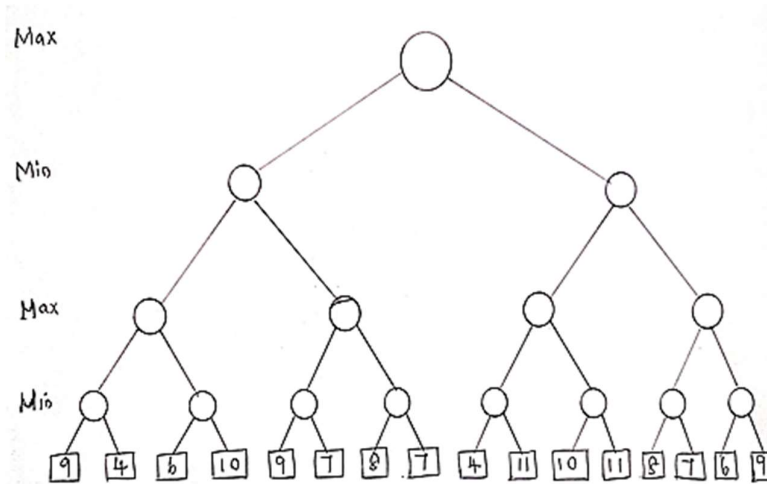
4. Consider the following state space graph where the directed arcs represent the legal successors of a node. The cost of moving to a successor node is given by the number on the arc. The value of a heuristic function, h , if computed at a state, is shown inside each node. The start state is S and the goal is G . **BL3 CO4**



Find the path cost and solution path using uniform cost search and A* search.

5. Consider the following game tree in which the root corresponds to a MAX node, children are visited left to right, and the values of the static evaluation function are given at the leaves.

BL3 CO4



- i. What are the minimax values computed at each node in this game tree? [3]
 - ii. Identify the initial values for v , α , β at each node, conditions for updating values and alpha cut and beta cut. [3]
 - iii. Identify the leaves/branches that will be pruned by Alpha-Beta pruning. [4]
6. i. Consider the following sentence: $[(\text{Food} \Rightarrow \text{Party}) \vee (\text{Drinks} \Rightarrow \text{Party})] \Rightarrow [(\text{Food} \wedge \text{Drinks}) \Rightarrow \text{Party}]$. [6] BL4 CO2
- a) Determine whether this sentence is valid, satisfiable (but not valid), or unsatisfiable.
 - b) Convert the left-hand and right-hand sides of the main implication into CNF, showing each step, and explain how the results confirm your answer to (a).
- ii. Convert the following set of sentences to clausal form. [4] BL3 CO2
- $S1: A \Leftrightarrow B \vee E.$
 $S2: E \Rightarrow D.$
 $S3: C \wedge F \Rightarrow \neg B.$
 $S4: E \Rightarrow B.$
7. i. For each pair of atomic sentences, give the most general unifier if it exists: [4] BL3 CO2
- a) $P(A, B, B), P(x, y, z).$
 - b) $Q(y, G(A, B)), Q(G(x, x), y).$
 - c) $\text{Older}(\text{Father}(y), y), \text{Older}(\text{Father}(x), \text{John}).$
 - d) $\text{Knows}(\text{Father}(y), y), \text{Knows}(x, x)$
- ii. Consider the following sentences: [6] BL4 CO2
- a) All people who are graduating are happy
 - b) All happy people smile
 - c) Someone is graduating

Prove that "Is someone smiling" using Resolution and draw the resolution tree.

8. Consider a student who has the choice to buy or not to buy a textbook for a course. We'll model this as a decision problem with one Boolean decision node, B , indicating whether the agent chooses to buy the book, and two Boolean chance nodes, M , indicating whether the student has mastered the material in the book, and P , indicating whether the student passes the course. Of course, there is also a utility node, U . A certain student, Sam, has an additive utility function: 0 for not buying the book and -\$100 for buying it; and \$2000 for passing the course and 0 for not passing. Sam's conditional probability estimates are as follows:
- $P(p|b, m)=0.9$ $P(m|b)=0.9$
 $P(p|b, \neg m)=0.5$ $P(m|\neg b)=0.7$
 $P(p|\neg b, m)=0.8$
 $P(p|\neg b, \neg m)=0.3$
- You might think that P would be independent of B given M , but this course has an open book final—so having the book helps.
- a) Draw the decision network for this problem. [3]
- b) Compute the expected utility of buying the book and of not buying it. [7]
9. We have a bag of three biased coins a , b , and c with probabilities of coming up heads of 20%, 60%, and 80%, respectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each of the three coins), and then the coin is flipped three times to generate the outcomes X_1 , X_2 , and X_3 .
- a) Draw the Bayesian network corresponding to this setup and define the necessary CPTs. [4]
- b) Calculate which coin was most likely to have been drawn from the bag if the observed flips come out heads twice and tails once. [6]
10. i. For the given data set identify the samples to be grouped in the clusters K_1 and K_2 using K means algorithm with the initial centroids to be (185,72) and (170,56) for the K_1 and K_2 respectively. [5] **BL4** **CO5**

Sample no	Height	Weight	Cluster/Class
1	185	72	K1
2	170	56	K2
3	168	60	?
4	179	68	?
5	182	72	?

- ii. Build the decision tree with the attributes having the high information gain as root node using the following the instances, attributes and the target variables. Comment on the inference of the target variables for all the branches once the tree was built. [5]

Instance	A1	A2	A3	Classification
1	Tall	Old	High	No
2	Tall	Old	High	No
3	Short	Old	High	Yes
4	Short	New	Low	Yes
5	Short	New	Low	Yes
6	Tall	New	High	No
7	Tall	Old	High	No
8	Tall	Old	Low	Yes
9	Short	New	Low	Yes
10	Short	New	High	Yes

Predict the class to the following instances:

- i. $A_1 = \text{Tall}$ $A_2 = \text{New}$ $A_3 = \text{High}$
ii. $A_1 = \text{Short}$ $A_2 = \text{Old}$ $A_3 = \text{Low}$
11. Discuss the stages in the development of an Expert system and enumerate the applications of Expert System.

BL2 CO5

