

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical and Computer Engineering



057

Study Programme	: Bachelor of Science Honours in Engineering/ Bachelor of Software Engineering Honours
Name of the Examination	: Final Examination
Course Code and Title	: EEX7340 AI Techniques and Agent Technology : EEX6340 AI Techniques and Agent Technology
Academic Year	: 2022/23
Date	: 15 th February 2024
Time	: 1330-1630hrs
Duration	: 3 hours

General Instructions

1. Read all instructions carefully before answering the questions.
 2. This question paper consists of **Five (5) questions** in **Four (4) pages**.
 3. Answer ALL questions. All questions carry equal marks.
 5. Answer for each question should commence from a new page.
 6. This is a Closed Book Test (**CBT**).
 7. Answers should be in clear hand writing.
 8. Do not use Red colour pen.
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Q1

The table below contains the states in a search domain, along with the transitions available from that state. Assume that the start state is always A and the goal state is always K.

A → B, C	G → H, K
B → E	H → L
C → D, G	I →
D → F	J → K
E → I, J	K →
F →	L →

- (a) Assuming that there is a cost of 1 (unit cost) to move from one state to another, draw a search tree of explored states using breadth-first search mechanism. (6 marks)
- (b) The heuristic values for each state are given below. Using the A* search algorithm (the path cost is still a unit cost) draw the search tree of explored states. Indicate the calculated cost at each node in the tree.

A: 9	G: 3
B: 4	H: 5
C: 5	I: 8
D: 7	J: 2
E: 3	K: 0
F: 10	L: 7

(6 marks)

- (c) What is the shortest path from node A to node k and give the minimum uniform path cost. (2 marks)
- (d) Write the following predicate logic sentences in simple English.
- (i) $\forall x [\exists y \text{ father}(y,x) \wedge \exists z \text{ mother}(z,x)] \rightarrow \text{husband}(y,z).$
- (ii) $\forall x [\forall y \text{ eligible_in}(x,y) \wedge \text{subject}(y)] \rightarrow \text{can_sit_exam}(x,y).$ (3×2=6 marks)

Q2

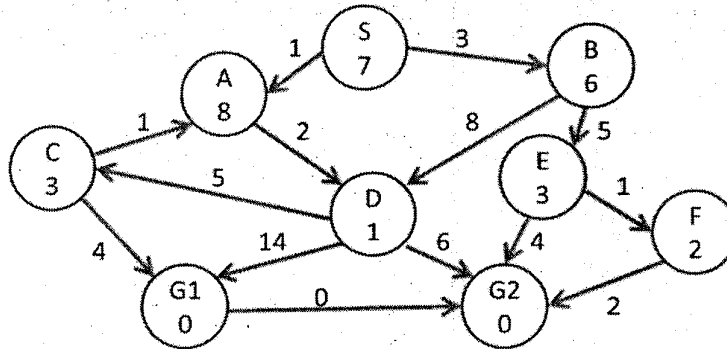
Consider the below given sentences.

- (a) All people who are not poor and are smart are happy.
- (b) Those people who read are smart.
- (c) John can read and is not poor.
- (d) Happy people have exciting lives.
- (e) Can anyone be found with an exciting life?
- (a) Write the above given sentences in predicate logic, using appropriate predicates. (5 marks)
- (b) Convert each of the sentences written above to Conjunctive Normal Form. (2×5=10 marks)

- (c) Use resolution with refutation to prove that John has an exciting life. (5 marks)

Q3

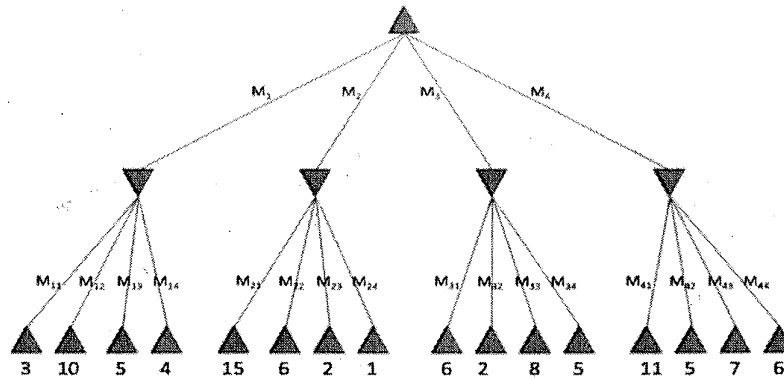
Consider the following search space, where S is the initial state and G1 and G2 are goal states, where the cost of the operator between states is given along the edge connecting the concerned states. The value of the heuristic evaluation function h applied to the state is the number written inside the state. In cases of ties pick the state that comes earlier in the alphabet.



- (a) Give the sequence of states that depth-first search visits. (4 marks)
- (b) Give the sequence of states that iterative deepening visits. (4 marks)
- (c) Give the sequence of states that hill climbing with $f(s) = g(s) + h(s)$ visits. (4 marks)
- (d) Assume that you are tasked with designing a knowledge representation system for a virtual AI assistant that helps users plan their vacations. The system should be able to store and manipulate various types of information related to destinations, accommodations, activities, and preferences. Based on this scenario answer below questions.
- (i) Describe the key components of the knowledge representation system for the vacation planning AI. (4 marks)
- (ii) Discuss the methods available for reasoning and inference within the knowledge representation system to generate personalized vacation recommendations. (4 marks)

Q4

- (a) Critically analyze the statement "The minmax algorithm cannot handle some games even-with alpha-beta pruning". (3marks)
- (b) Consider the game tree given below in which the static scores are from the first player's point of view. Suppose the first player is a maximizing player. Apply the min-max algorithm and clearly indicate the backed-up values in the tree. (5 marks)



- (c) Cross out the branches that do not need to be examined by alpha-beta pruning in order to find the minimax value of the top node, assuming that moves are considered in the non-optimal order shown. (5 marks)
- (d) Briefly explain with an example how you would formulate a problem as a search problem integrating Artificial Intelligence. (3 marks)
- (e) Describe how AI can be integrated to optimize traffic flow in urban areas? (4 marks)

Q5

Assume that you are part of a team developing a multi-agent system for coordinating the transportation of goods in a busy metropolitan area. The system aims to optimize the delivery process by efficiently allocating resources and coordinating the activities of multiple autonomous agents, including delivery drones, autonomous vehicles, and warehouse robots.

- (a) Identify two (02) different types of agents that can be integrated in the above scenario and describe two (02) features of each type of agent. (4 marks)
- (b) For each agent type describe the task environment based on the PEAS representation system. (4×2= 8 marks)
- (c) What are the different types of communication that can be used in the above multi-agent system. You need to give reason/s for your choice. (3 marks)
- (e) Design a communication diagram for the above scenario with proper labelling. (5 marks)

End of the Paper