

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



Study Programmes	: 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	: 2024/25
Date	: 16, February 2026
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 **Five (5) 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

- (a) A Hospital has integrated an advanced conversational system called Chathospitaly. It can communicate fluently in multiple languages, answer questions, translate text, and engage in human-like dialogue. During testing, human evaluators used a text-only interface and were often unable to distinguish it from a human respondent. However, critics argue that although Chathospitaly appears intelligent, it does not truly understand the language it uses, but merely manipulates symbols based on predefined rules. Based on this scenario, answer the following questions.
- (i) Explain whether Chathospitaly can be considered as an intelligent system according to the Turing Test by identifying limitations and strengths of the system. (3 marks)
 - (ii) Using the Chathospitaly system, explain how the Chinese Room Argument challenges the claim that Chathospitaly truly understands language. (3 marks)
 - (iii) Compare and contrast the conclusions drawn from the Turing Test and the Chinese Room Argument regarding machine intelligence. (3 marks)
- (b) A metropolitan council is implementing a "Smart Intersection" system. Instead of fixed timers, every autonomous vehicle (AV) acts as an agent that communicates with a "Smart Traffic Light" agent at each intersection. These agents must cooperate to minimize traffic congestion, prioritize emergency vehicles (like ambulances), and ensure pedestrian safety. The system must handle unpredictable weather, sensor noise, and occasional communication delays between vehicles.
- (i) Define the PEAS profile for a single Autonomous Vehicle (AV) agent within this multi-agent traffic system. Provide one specific example for each category based on the scenario. (4 marks)
 - (ii) Describe the characteristics of "Smart City" environment based on the features of observability, determinism, continuity and temporal dynamics. (4 marks)
 - (iii) Assume that an Ambulance Agent is approaching at an intersection at the same time as several Commuter Vehicle Agents. Describe how a Utility-based approach would allow the agents to reach a consensus on who goes first. Mention what "Utility" might represent in this specific case. (3 marks)

Q2

- (a) Assume that a university maintains a simple Prolog knowledge base to manage **student enrollments in courses**. Each fact is represented as enrolled(Student, Course).

Hence, the following entries are in the knowledgebase.

enrolled(amali, ai).	enrolled(amali, prolog).
enrolled(binura, ai).	enrolled(binura, databases).
enrolled(chamila, prolog).	enrolled(chamila, ai).
enrolled(disna, databases).	

Based on the above knowledgebase answer the following questions.

- (i) Write a Prolog query that constructs a list of all courses taken by Amali, allowing duplicates if any. (2 marks)
- (ii) Define a predicate `student_course_count(Student, Count)` that returns the number of courses a given student is enrolled in. (3 marks)
- (iii) Write a Prolog query using `bagof/3` to retrieve a list of students enrolled in the course AI. Explain briefly why `bagof/3` is suitable for this query. (3marks)
- (b) Assume that an autonomous robot must navigate inside a **5 × 5 warehouse grid** to deliver a package. The robot can move Up (U), Down (D), Left (L), or Right (R). Each move has a cost of 1. Some grid cells are blocked due to obstacles.

The warehouse layout is shown below:

Row\Col	1	2	3	4	5
1	S		X		
2		X		X	
3					
4	X		X		
5				X	G

Where:

- **S** = Start position at (1,1)
- **G** = Goal position at (5,5)

Based on the above grid answer the below questions.

- (i) Using Depth First Search (DFS) algorithm, indicate one possible path from S to G if the robot expands neighboring cells in the order Right → Down → Left → Up. (3marks)
- (ii) Using Breadth First Search (BFS) algorithm, indicate the nodes traversed from S to G. (2 marks)
- (iii) Compare and contrast the suitability of using DFS and the BFS for the above grid. (2 marks)
- (iv) Assume that the robot uses the A* Search Algorithm with Manhattan distance as the heuristic.
1. Write the A* evaluation function. (1 mark)
 2. Compute the heuristic value $h(n)$ for the start node S (1,1). (1 mark)
 3. Write the nodes travelled from S to G using A* algorithm. (3 marks)

Q3

Assume that a university uses an **intelligent supervisor allocation system** to assign supervisors to undergraduate final-year projects. The system operates on the following conditions:

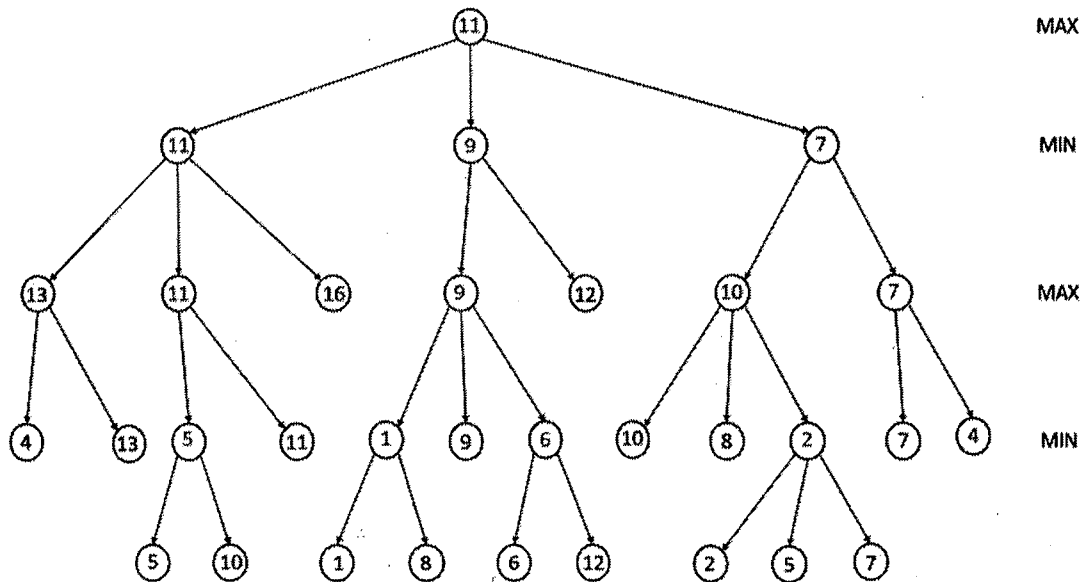
- Every undergraduate student must have a supervisor.
- Anyone who supervises students is a Lecturer.
- All Lecturers are academics.

- All academics can supervise undergraduate students.
- Dr. Perera is an academic.
- Supun is an undergraduate student.

- (a) Write the above given conditions in predicate logic. First you need to define the predicates appropriately. (8 marks)
- (b) Convert each of the sentences written above to Conjunctive Normal Form (CNF). (6 marks)
- (c) Use resolution with refutation to prove that Dr. Perera can supervise the student Supun. (6 marks)

Q4

- (a) Explain how the Alpha-Beta algorithm improves decision-making efficiency compared to the standard Minimax approach in a two-player zero sum game. (3 marks)
- (b) Consider the game tree given below in which the static scores are from first player's point of view. Suppose the first player is a maximizing player.



- (i) Apply the min-max algorithm and clearly indicate the alpha beta values at each node. (8marks)
- (ii) Apply the alpha-beta pruning algorithm to the search tree created in part(i). Clearly indicate where the alpha and beta cuts are applied, and which parts of the search tree are pruned as a result. (6 marks)
- (c) Explain the conditions under which Alpha-Beta pruning can achieve maximum pruning efficiency. (3 marks)

Q5

A financial services company uses an AI-powered customer support system. The system uses rule-based logic, predefined workflows, and historical customer data for model training and perform various tasks such as automatically approving or rejecting loan eligibility requests, respond to customer inquiries via a chat-based interface, escalate selected cases to human officers etc. However, after deploying the system the company observes several issues such as certain demographic groups experience a higher rejection rate, customers are not informed when decisions are made by the AI system, engineers are unable to clearly explain how some decisions were reached due to complex rule interactions etc.

Based on this scenario, answer the following questions.

- (a) Identify three ethical issues raised by the deployment of this AI system. Briefly justify each. (3 marks)
- (b) Explain how bias can arise in a rule-based or skill-based AI system, even when no explicit discriminatory rules are programmed. (3 marks)
- (c) Explain why transparency and explainability are important ethical requirements in AI systems used for decision-making and suggest one method to improve explainability in the given system. (4 marks)
- (d) Discuss the pros and cons of replacing a machine for a human considering a practical example.

End of the Paper