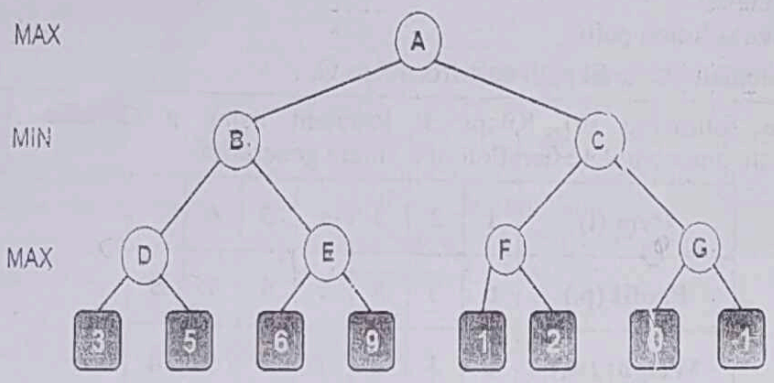
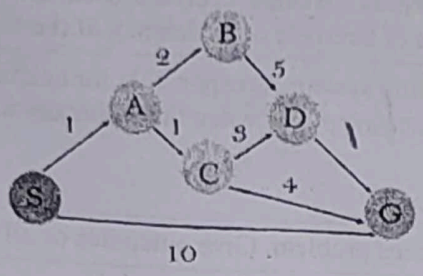
14/5/2025 (E)

SOMAIYA VIDYAVIHAR UNIVERSITY

Semester: January 2025 –April 2025		
Maximum Marks: 100 **Examination: ESE Examination**		**Duration:3 Hrs.**
Programme code: 01 **Programme: BTech Computer Engineering**	**Class:** TY	**Semester: VI(SVU 2020)**
Institute/School/Department: K. J. Somaiya School of Engineering	**Name of the department:** COMP	
Course Code: 116U01C603	**Name of the Course: Artificial Intelligence**	
Instructions: 1)Draw neat diagrams 2) All questions are compulsory **3) Assume suitable data wherever necessary**		

Que. No.	Question	Max. Marks
Q1	Solve any **Four**	20
~~i)~~	Discuss any five limitations of AI.	5
ii)	Define Heuristic. What is the Manhattan distance heuristic used in an 8-puzzle problem? Discuss the effect of choice of heuristic on efficiency of the solution.	1+2+2
~~iii)~~	Consider a scenario - A garden watering system is responsible for keeping the plants hydrated. The system must water the plants when the soil is dry and stop when it's wet. **Give PEAS analysis for this problem.**	5
iv)	Give problem formulation for N-Queens problem. Give outcomes of all steps.	5
~~v)~~	In the context of adversarial search: Define Max Define Min Define alpha value Apply MAXMIN algorithm to the following instance and compute the value at root node A.  	1+1+1 +2
vi)	What is the key difference between an AI program and an expert system? Comment on significance of this differentiating component.	5

Que. No.	Question	Max. Marks
Q2 A	Solve the following	10
i)	State and justify in one line properties of task environment for the garden watering system mentioned above in Q. 1. iii.	5
ii)	Discuss the problems in the hill climbing process, state the solutions over the same.	5
	OR	
Q2 A	Suggest and justify suitable agent architecture to design the garden watering system mentioned in Q. 1 iii. Draw appropriate standard diagram and give sample contents for all blocks in the diagram.	10
Q 2 B	Solve any **ONE**	10
i)	Consider the following graph where: each edge has an associated path cost and heuristic value h(n) is provided in the table. Start node is S and Goal node is G.	10



State	h(n)
S	5
A	3
B	4
C	2
D	6
G	0

Apply the A* algorithm starting from node **S** to reach node **G**.

a) Draw the State Space Tree for the given graph
b) Show calculation of heuristic value at every node along the path being explored.
c) Give solution path
d) Calculate the total path cost from S to G.

ii) Solve the following 0/1 Knapsack Problem using a Genetic Algorithm. Demonstrate one complete iteration of a single generation. — 10

Item (i)	1	2	3	4	5	6	7
Profit (p_i)	6	5	8	9	6	7	3
Weight (w_i)	2	3	6	7	5	9	4

Knapsack Capacity (W) = 9

Clearly state: Fitness function, crossover points, mutation, etc. i.e. details of all steps.

Que. No.	Question	Max. Marks
Q3	Solve any **TWO**	**20**
i)	Consider following set of sentences: 1. Steve only likes easy courses. 2. Science courses are hard. 3. All the courses in the basket weaving department are easy. 4. BJ301 is a basket weaving course. Convert the following sentences into First-Order Logic (FOL). Using Backward Chaining, prove the statement "Steve likes BJ301." State all inference rules used clearly.	4 + 6
ii)	Convert the following sentences into FOL and then into CNF. [Step by step conversion from FOL to CNF is not expected] 1. Everyone has birthdays on some day. 2. Good dogs are always with their masters. 3. A barber shaves all men in the city who do not shave themselves. 4. Fred is a trained dog. 5. Every boy or girl is a child.	10
iii)	Consider an agent that delivers parcels from a warehouse to a customer within a specified time window / chosen time slot. a. Identify and explain the key uncertainties the agent may encounter during the delivery process. b. Propose two alternative delivery plans that account for the uncertainties identified above. c. List and explain the major causes of uncertainty. [Clearly state assumptions, if any]	3+3+4

Que. No.	Question	Max. Marks
Q4	Solve any **TWO**	**20**
ii)	Consider a problem instance: A home security system is designed to detect burglaries. The system includes an alarm that can be triggered by either a burglary or an earthquake. Two neighbours, John and Mary, may call the homeowner if they hear the alarm. However, each may or may not call depending on whether they hear the alarm and their own reliability. John and Mary do not hear the alarm perfectly every time. John confuses doorbell with alarm and Mary listens to loud music and thereby misses the alarms sometimes. a) Draw the Bayesian Network for the above problem. b) Assign probabilities for each node. [Assume suitable data] c) What is the probability that the alarm is triggered in the absence of a burglary or earthquake, and both John and Mary make calls? d) What is the probability that the alarm is not triggered, there is absence of a	2+4+2 +2

	burglary or but earthquake occurs, and both John and Mary miss to call.	
ii)	With neat sketch explains the architecture, characteristic features and roles of the expert system. Use some example to support your answers.	10
iii)	What is Action Description Language (ADL). Give ADL for drone delivery problem where two drones stationed at distinct locations exchange packages and transport them to their respective target locations. Follow ADL syntax; give clear initial state, goal state and Action descriptions.	2 + 8

Que. No.	Question	Max. Marks
Q5	Solve any **FOUR**	20
i)	Differentiate between planning and searching in Artificial Intelligence. Provide relevant examples.	5
ii)	Explain hierarchical task planning, use example: Constructing a villa after buying a plain land.	5
iii)	Discuss four approaches of AI in brief.	5
iv)	Write a short note on Natural Language Processing.	5
v)	Describe the architecture of a knowledge-based agent using the WUMPUS World example.	5
vi)	List and explain the forms of Learning.	5