



COMSATS University, Islamabad (CUI)

Park Road, Tarlai Kala, Islamabad 45550, Pakistan

Department of Computer Sciences

Terminal Examination SP -2025

Subject: CSC-462 Artificial Intelligence

Semester: BAI-V (A&B), BSE-V (A&B), BDS-VA, BDS-VIA, BCT-VA

Instructor: Maheen Gul, Farah Saeed, Sanam Aamir, Umar Nauman

Time (mins): 180

Marks: 50

INSTRUCTIONS: RETURN QUESTION PAPER WITH ANSWER SHEET

— CLO 1: Articulate how artificial intelligence enables the capabilities of a computer, machine, or system to mimic human Brain —

Question 1.1: (2.5 marks) /4

Imagine an Intelligent Agent is deployed in a warehouse environment to manage inventory. The agent needs to identify empty shelves and restock them efficiently.

- What type of Agent Environment (Observable/Partially Observable, Deterministic/Stochastic, Episodic/Sequential, Static/Dynamic, Discrete/Continuous) would best describe this warehouse scenario? Justify your answer.

Question 1.2: (0.5+2= 2.5 marks)

An AI Assistant is designed to predict stock market trends and suggest investments. The stock market is highly volatile and influenced by many external factors.

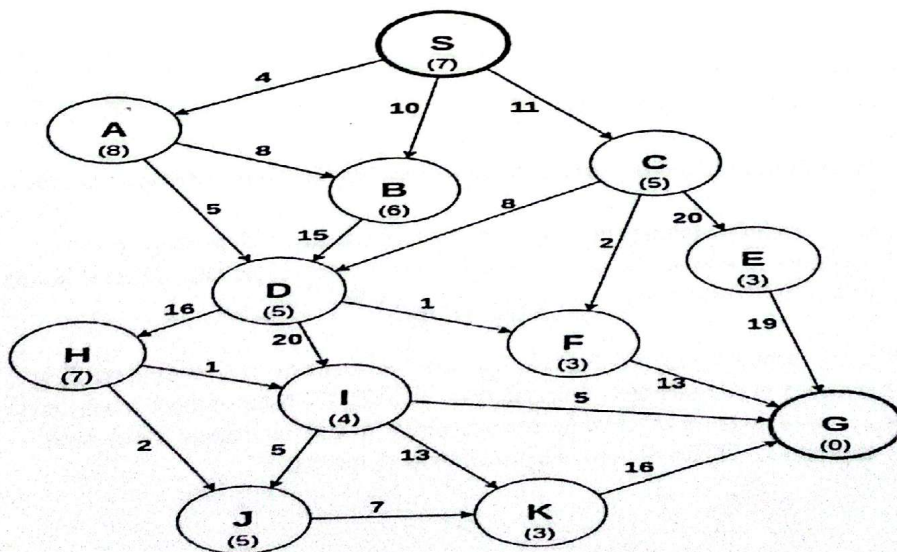
- Which type of agent design (Simple Reflex, Model-Based, Utility-Based, or Learning Agent) is most suitable for this problem?
- Discuss the agent design using diagram.

— CLO 2: Apply various AI problem solving and searching techniques to a real-world problem. —

Question 2.1: In a search problem, you know that each step has the same cost, and you aim to minimize memory usage. Which search strategy would be more memory-efficient and why? (2 Mark)

Question 2.2: (8 marks) /8

Consider the following example of trying to find the shortest path from S to G in the following graph: Each edge has an associated weight, and each node has a heuristic cost (in parentheses). (Apply A* Search)



--- CLO 3: Formulate a problem specified in natural language as a constraint satisfaction problem. ---

✓ Question 3.1 (3 marks).

A travel agency is planning trips for three families (Family A, B, and C) to three different destinations (Paris, Rome, Tokyo). Each destination can only accommodate one family, and Family A does not want to go to Tokyo.

- Express this scenario as a CSP.

✓ Question 3.2 (5 marks). /4

In the famous cryptarithmic puzzle, each letter represents a digit from 0-9. The equation is:

$$\text{SEND} + \text{MORE} = \text{MONEY}$$

The constraints are:

- Each letter represents a unique digit.
- The leftmost digit cannot be 0.
- The sum must hold true.

Model this problem as a CSP and determine the assignment of digits to each letter.

--- CLO 4: Apply resolution to a set of logic statements to answer a query. ---

✓ Question 4.1: (3 marks) /3

Translate the following English sentences to first-order logic using the following predicates: Owns ($x; y$), Dog (x), Cat (x), Cute (x), and Scary (x). For example, Owns ($x; y$) means that object x owns object y :

- Joe has a cute dog.
- All of Joe's dogs are cute.
- If Joe does not own a dog, then he is scary.

✓ Question 4.2: (3+1.5+3.5 = 8 Marks) /8

A security system uses the following rules:

1. If the alarm rings, there is either a fire or an intruder.
2. If there's smoke, there is a fire.
3. The alarm rang, and smoke was detected.

Task:

1. Represent these sentences in **Propositional Logic**.
2. Convert them into **CNF**.
3. Determine if an intruder is present using **Resolution**.

--- CLO 5: Compare various planning strategies for different applications under uncertainty. ---

✓ Question 5.1 : In a warehouse management system, robots are tasked with picking up and delivering packages from shelves to delivery stations. The environment is partially observable, and obstacles may block paths dynamically.

- Which search technique (e.g., A* Search, Dijkstra's Algorithm, or Greedy Best-First Search) would you consider most appropriate for planning the paths of these robots to ensure they efficiently deliver packages while avoiding obstacles and minimizing travel time? Briefly explain your choice and provide justification. (5 marks)

Question 5.2 :

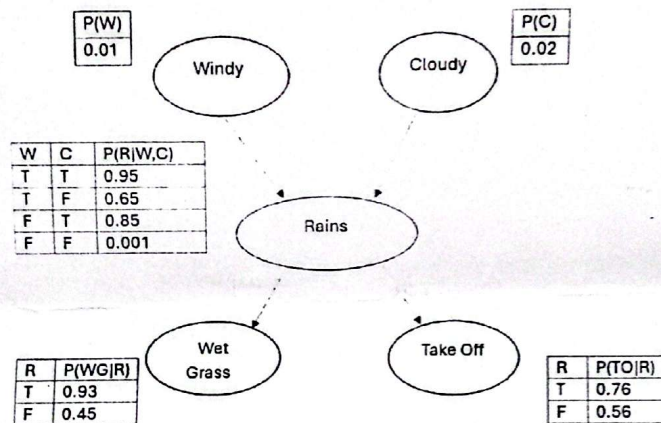
In a factory quality control scenario:

- The probability of a machine producing a defective item is $P(D)$ is 2 percent
- If an item is defective, the probability of it failing the quality test is $P(T|D)$ is (95%).
- The overall probability of an item failing the quality test is $P(T) = (6\%)$. this value has already been derived from previous calculations. (2 Marks) */2*

If an item fails the quality test, what is the probability that it was actually defective ($P(D|T)$)?

Question 5.3 :

Consider the following Bayesian Network, what is the probability that it rains without weather being windy or cloudy with wet grass and no take off. (4 Marks)



Question 5.4:

You have a budget of \$1000, and your goal is to purchase 3 items (X, Y, Z) that cost \$200, \$300, and \$500 respectively. You can Allocate, Save, or Transfer Funds in different steps. Write 3 planning strategies to successfully purchase all three items within your budget constraints. (5 Marks)