

Feb 28, 2023, Slot: 8:30 AM – 9:30 AM

Course Code: CS AI2002	Course Name: Artificial Intelligence
Instructor Name:	Dr Fahad / Saeeda Kanwal / Dr.Waheed Ahmed/ Dr Muhammad Farrukh
Student Roll No:	Section No:

- Return the question paper.
- Read each question completely before answering it. There are **4 questions and 2 pages**.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict with any statement in the question paper.
- All the answers must be solved according to the sequence given in the question paper.
- Be specific, to the point while coding, logic should be properly commented, and illustrate with diagram where necessary.

Time: 60 minutes.

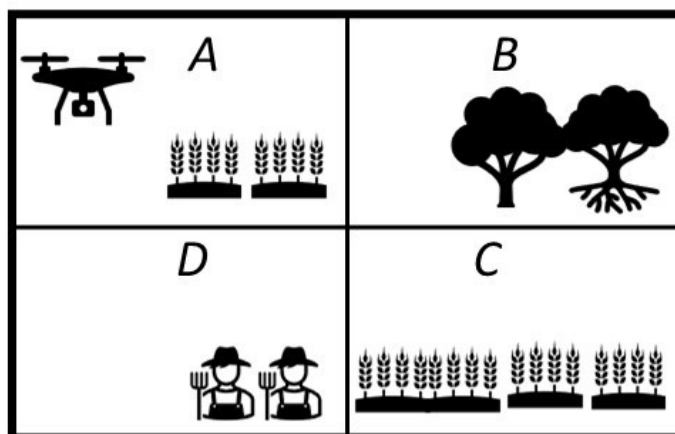
Max Marks: 50 points

Question No. 1

[Time: 20 Min] [Marks:(10+4)]

- A)** Explain the following in one or two statements.
- 1) Why does Self-Awareness consider an important property of the AI agent?
 - 2) What is the concept of rationality in the AI? And how is it distinct from the Omniscience?
 - 3) What are the properties of task environment?
 - 4) Is it necessary agent structure must contain programming part?
 - 5) What are the problems occurred in the hill climbing local search algorithm?
 - 6) What is the difference between stochastic hill climbing and first-choice hill climbing?
 - 7) Can you differentiate between hill climbing methods and simulated annealing algorithms? Which of the two is better for large scale optimization tasks?
 - 8) Define in your own words the following terms: state space, search tree, and transition model.

- B)** An UAV is being deployed in an agriculture farm field to perform various tasks based on its perceived inputs from the field. The UAV uses its camera to monitor the farming land and perform tasks. The UAV system is equipped with AI technology, which can determine crop quality, the number of farmers working in the field, and any kind of disease that is found there. The UAV is assumed to begin at location A and move to locations B, C, and D. It can't move to any location randomly. When the UAV camera perceives crops in the field, it detects any disease in the crops. If it captures trees, it finds out tree quality.



When the UAV camera detects farmers, it predicts the number of farmers working in the field. Develop or build a table that list percept sequence and corresponding actions of the UAV. Note that: UAV can move from **A to B**, **B to C**, **C to D** and **C to A** but can't go in the reverse direction. Allowed movements. **Left to Right, Up to Down, right to left.**

Question No. 2**[Time: 15 Min] [Marks: (12)]**

Suppose you have a transportation network with 8 cities as shown in the adjacency matrix below:

1. Using BFS, what is the shortest path from City A to City H?
2. Using DFS, what is the longest path from City A to City H?
3. How is Bi-Directional Search better than BFS and DFS?

	A	B	C	D	E	F	G	H
A	0	1	1	0	0	0	0	0
B	1	0	0	1	1	0	0	0
C	1	0	0	0	0	1	1	0
D	0	1	0	0	0	0	0	1
E	0	1	0	0	0	0	0	0
F	0	0	1	0	0	0	0	0
G	0	0	1	0	0	0	0	0
H	0	0	0	1	0	0	0	0

Question No. 3**[Time: 15 Min] [Marks: (12)]**

Consider our Robo is standing at some point in a grid consisting of $n \times m$ cells. Robo is standing at start state (1,1) and needs to find a path to the goal state (5,1). Our Robo can only move **DIAGONALLY** one cell at a time. There are some cells with a blockage, so the Robo has to detour around these cells. Consider the following example grid where states can be represented with digits:

S							
G							

Each cell has a unique (i,j) , considered as a node for exploration in search space.

Give the sequence of cells explored (search path) if our Robo perform A* search in this scenario. Assume that the greedy sense is the minimum Midpoint distance. Midpoint distance can be used as the heuristic function. That is, $h(n)$ for any cell (i,j) is the Midpoint distance from cell (i,j) to cell $(i^*,j^*)=G$. The Midpoint distance between two points is the distance in the x-direction plus the distance in the y-direction.

$$\text{Midpoint distance} = ((x_2 - x_1)/2)^2 + ((y_2 - y_1)/2)^2$$

Question No. 4**[Time: 10 Min] [Marks: 12]**

Solve the following 8-puzzle problem using hill climbing or greedy best first search. State the heuristic used and show all steps.

2	3	
1	8	4
7	6	5

Initial State

1	2	3
8		4
7	6	5

Goal State