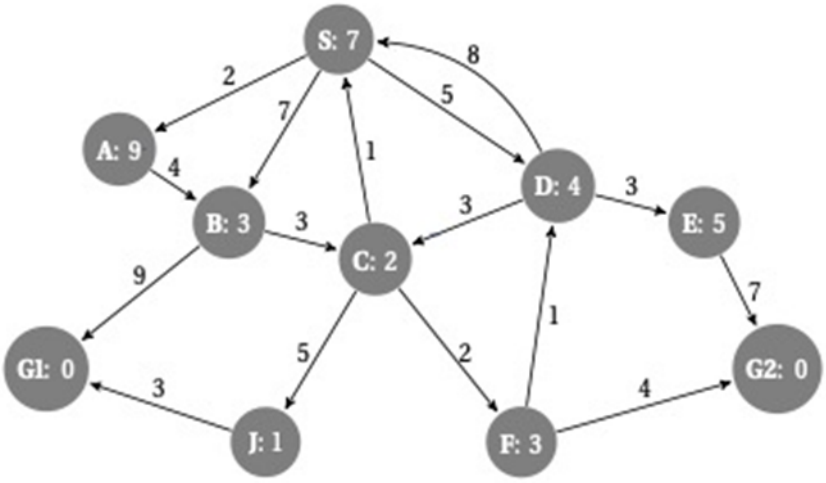
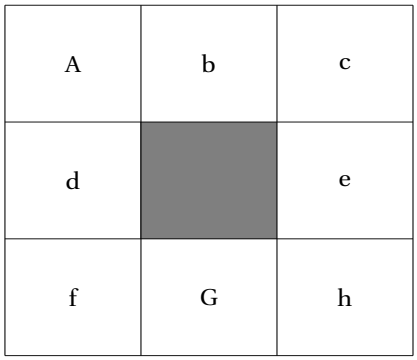
Roll Number:	
Thapar Institute of Engineering & Technology, Patiala **Department of Electrical and Instrumentation Engineering** **MID SEMESTER EXAMINATION**	
B. E. (**Third Year -EIC**): Semester-II (2023-24)	Course Code: **UCS411** Course Name: **Artificial Intelligence**
Time: **2** Hours, Marks: **25**	Name of Faculty: **Prof. Mukesh Singh**

Note: **1. All answer carry equal marks**

2. Please write answers of descriptive questions in bullet points only.

1. (a)	Let the populations of chromosomes in genetic algorithm is represented in terms of binary number. The strength of fitness of a chromosome in decimal form, x is given by $Sf(x) = \frac{f(x)}{\Sigma f(x)}$, where $f(x)=x^2$ The population is given by P where P = {01101), (11000), (01000), (10011)}. Kindly find the strength of fitness of chromosome of all the individuals.	**(3)**	**CO2**	**L3**
(b)	In a genetic algorithm (GA) optimization process, roulette wheel selection is a widely used method for selecting individuals from a population for reproduction based on their fitness values. Consider a population of candidate solutions represented by binary strings. • Explain how the roulette wheel selection process works in a genetic algorithm, and discuss its advantages over other selection methods in terms of maintaining diversity within the population. • Provide a concise explanation of the roulette wheel selection process and highlight one key advantage it offers in genetic algorithm optimization.	**(2)**	**CO2**	**L2**
2.	Consider the search space below, where **S** is the start node and **G1** and **G2** satisfy the goal test. Arcs are labelled with the cost of traversing them and the heuristic cost to a goal is reported inside nodes (so lower scores are better). For A* search, indicate which goal state is reached at what cost and list, in order, all the states popped off of the OPEN list. You use a search graph to show your work. **Note: When all else is equal, nodes should be removed from OPEN in *alphabetical* order.** 	**(5)**	**CO1**	**L2**
3.(a)	In the following grid, we want to find the fastest path from **A** to **G**. We may move from every cell to each directly neighbouring cell (up, down, left, right). The cell in the centre of the grid is unreachable. Draw the full search tree of **breadth-first search** that explores this grid. • Note that search may return to already visited cells. • The search graph must include all leaf nodes at maximum depth.	**(3)**	**CO2**	**L4**

(b)	If we use **depth-first search** and move • up, whenever possible • right, whenever possible (and up is not possible) • down, whenever possible (and up and right is not possible) • left, otherwise Again, search may return to already visited cells. Will depth-first succeed? If yes, in how many steps? If no, why not? 	**(2)**	**CO2**	**L3**
4.	Consider a football player participating in a match. Analyze their performance using the PEAS (Performance, Environment, Actuators, Sensors) framework. a) Performance: Describe the football player's primary objectives and goals during the match. How do they measure success or effectiveness in their performance? b) Environment: Discuss the environmental factors that influence the football player's actions during the match. How do elements such as weather conditions, field type, crowd presence, and opponent strategy impact their decisions and performance? c) Actuators: Identify the physical actions or movements the football player utilizes to interact with the environment and achieve their goals. How do they navigate the field, control the ball, coordinate with teammates, and execute plays? d) Sensors: Explain the sensory inputs and information sources the football player relies on to perceive the game environment. How do they gather information about the position of the ball, the movements of teammates and opponents, and the overall state of play? Using the PEAS framework, analyze the performance of a football player during a match.	**(5)**		**L3**
5.	A) Describe the components of a learning agent in artificial intelligence and discuss how each component contributes to the agent's ability to improve its performance over time with a neat diagram. In your answer, illustrate with examples how each component interacts within a learning agent to facilitate its adaptive behavior and continuous improvement. B) Define the key components of the Turing test scenario and how it determines whether a machine exhibits human-like intelligence. Additionally, discuss the limitations of the Turing test in accurately assessing AI capabilities. Provide a concise overview of the Turing test and its significance in AI evaluation, along with its drawbacks.	**(5)**	**CO3**	**L4**