AUTUMN MID SEMESTER EXAMINATION-2022

School of Computer Engineering
Kalinga Institute of Industrial Technology, Deemed to be University
Artificial Intelligence
[CS 3011]

Time: 1 1/2 Hours   **Full Mark: 20**

Answer any four Questions including Q.No.1 which is Compulsory.
The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1.   Answer all the questions.   **[1 x 5]**

a) I)   Mention six capabilities that a computer should posses to qualify for Total Turing Test.

II)   Are reflex actions (such as flinching from a hot stove) rational? Are they intelligent?

b) Match the two columns A & B:

A	B
Cognitive modeling approach	Rational agent
Example of Performance measure	Accelerator (Agent: Self-driven Car)
Turing Test	Laws of thought approach
Example of Environment	Accelerometer (Agent: Self-driven Car)
More amenable to scientific development	Human interrogator
Example of Actuator	Pedestrian (Agent: Self-driven Car)
Logic	Thinking like human
Example of Sensor	Legal drive (Agent: Self-driven Car)

c) I)   Which one of the four conceptual components of a learning agent improves the performance of AI agent so that it can make better decisions?

II)   Write down at least two differences between Breadth First Search (BFS) and Depth First Search (DFS) techniques as far as the performance parameters are concerned.

d) I) Fill in the blanks:
      The tree-search version of A* is optimal if h(n) is _____, while the _____ version of A* is optimal if h(n) is consistent.

II) MCQ:
      The action of the Simple reflex agent completely depends upon _____ .
         A. Percept history
         B. Current percept
         C. Learning ability
         D. Utility function

e) In the following 8-puzzle problem, the true solution cost is 8. This means that it takes minimum 8 number of steps to reach the given final state from the given initial state. Justify for this case that both the heuristics h1 (Number of misplaced tiles) and h2 (Total Manhattan distance) are admissible heuristics.

Initial State

2	4	
6	1	8
7	3	5

Goal State

2	8	
3	4	1
6	7	5

2. **[5 Marks]**

a) What is task environment? How is it specified? Provide the PEAS description in a tabular **[2]** form for the following agents:
   (i) Interactive English tutor
  (ii) Medical diagnosis system
  (iii) Mars rover
 (iv) Part-picking robot

b) (i) Mention the differences between: **[1.5 + 1.5]**
    I) Goal based agent and Utility based agent
    II) Node and State
    III) Tree search and Graph search

  (ii) Draw a Learning agent and explain briefly its four conceptual components through suitable example(s).

3. **[5 Marks]**

a) In the following graph, the numbers written on the edges represent the transition or step **[3]** costs between the nodes and the numbers written close to each node represent the heuristic value for that node. Find the most cost-effective path to reach from start state A to final state J using the A* Algorithm. What is the path cost of this path?
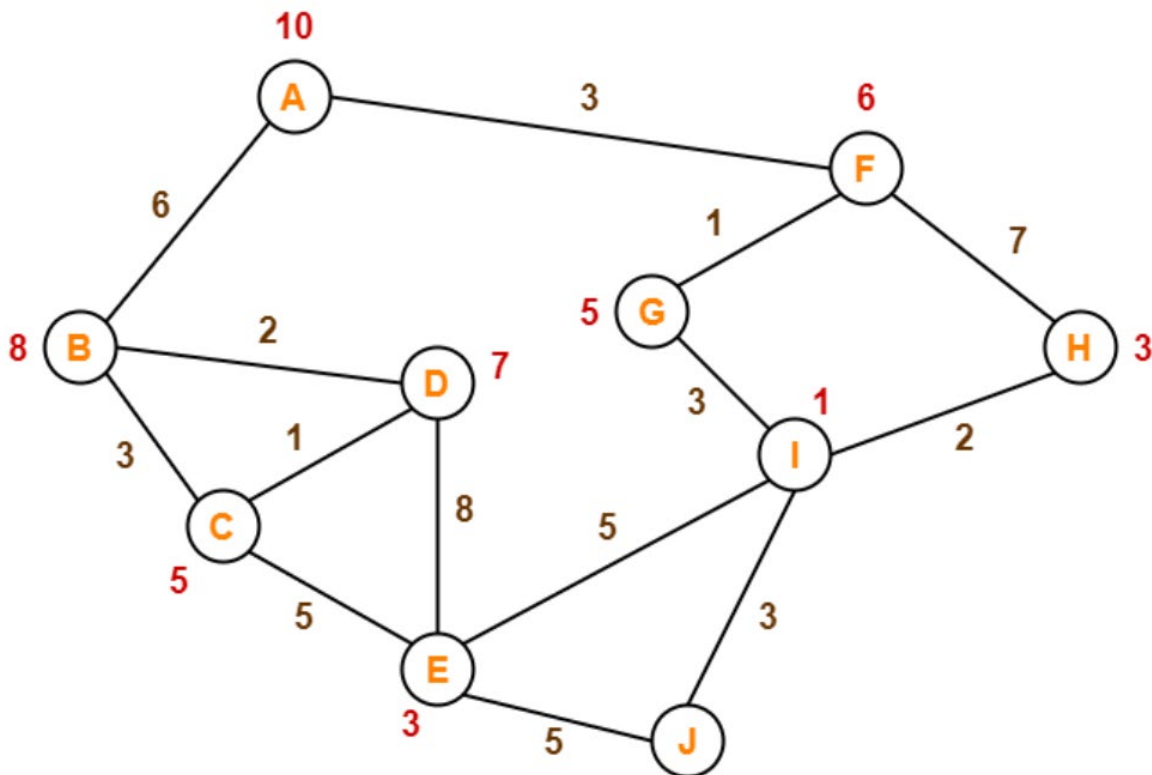
b) Consider a binary search tree where the initial node is number 1 and each node k has two   **[2]** children: numbers 2k and 2k + 1.

     I)   Draw the portion of the search tree from node 1 to node 15.

     II)   Suppose the goal node is 13. List the order in which nodes will be visited for A) breadth first search (BFS), B) depth limited search (DLS) with Limit = 3 and C) iterative deepening search (IDS).

4.   [5 Marks]

a) In the following 8-puzzle problem, initial and final states are given: **[3]**

Initial State

2	8	3
1	6	4
7		5

Goal State

1	2	3
8		4
7	6	5

Find the most cost-effective path to reach the final state from initial state using A* Algorithm. [Consider the path cost of node n i.e. g(n) = Depth of node n and heuristic value of node n i.e. h(n) = Manhattan distance for node n.]

b) Write the problem formulations for the following cases: **[2]**

      A) 8-queens problem   B) Airline travel problem

5.   **[5 Marks]**

a) In the following search problem, S is the initial node and G is the goal node. The transition cost (i.e. step cost) is mentioned on the edge with simple font. The heuristic value of each node is mentioned on top of the concerned node using bold font. Find the path from S to G and evaluate the path cost using each of the following search strategies and also show the progress of the tree formation in each case:

    I)   Uniform Cost Search (UCS)   **[2]**

    II)   Greedy Best First Search   **[1.5]**
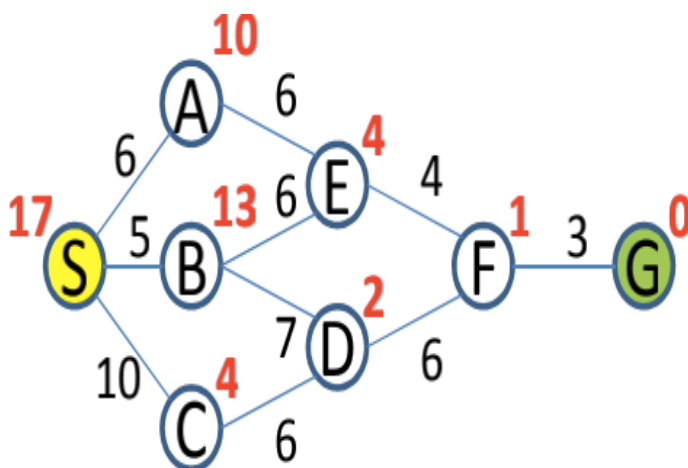
b) There are three jugs, jug A with 12 liter capacity, jug B with 7.5 liter capacity and jug C with 4.5 liter capacity. Neither has any measuring marker on it. As an initial state, jug A is filled up with water from some external source whereas jug B and jug C are maintained empty. But in the final state, jug A and jug B should contain 6 litres of water each. Show the sequence of states to reach at the final state from the given initial state. **[1.5]**

(*Note*: No further water is received from external source and no water is made to waste.)

*** Best of Luck ***