AUTUMN MAKE-UP 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) Give at least two reasons to justify why rational agent approach is superior to other three approaches of AI.

b) Match the two columns A & B:

	A		**B**
A1	Laws of thought approach	B1	Table driven agent
A2	Example of performance measure	B2	Competitive multiagent environment
A3	Acting humanly	B3	Crossword puzzle
A4	Example of actuator	B4	Color pixel arrays (Satellite smage analysis System)
A5	Chess game	B5	Turing test approach
A6	Example of sensor	B6	Tasty and less oily food (Cooking agent)
A7	Lookup table	B7	Thinking rationally
A8	Deterministic environment	B8	Jointed arm and hand (Part-picking robot)

c) For a finite branching factor $b = 10$ and depth of shallowest goal node $d = 4$, how many nodes are generated through IDS and BFS respectively?
(*Root node is assumed to be not included in the calculation.*)

A.   12340, 11110
B.   123450, 111110
C.   12330, 11120
D.   12340, 12110

d) Evaluate both heuristic values (h1 = no. of misplaced tiles and h2 = Manhattan distance) given the following initial state and final state of 8-puzzle problem. Also justify that the given goal state is reachable from the given initial state.

Initial State

3	2	1
4	6	5
7	8	

Goal State

1	2	3
4		5
6	7	8

e) In A* search, what is consistent heuristic? Why is it also known as triangle inequality?

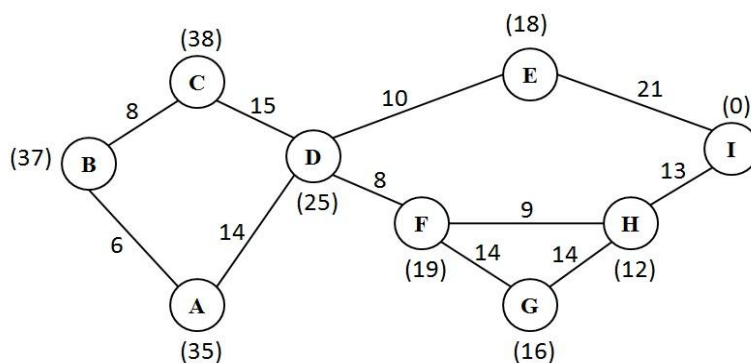2.   **[5 Marks]**

a) Name the four approaches of AI. Briefly explain Turing Test. State six capabilities a computer system should have to qualify for this test. State at least five state of the art applications of AI.

b) Explain a learning agent with suitable diagram. Describe its various conceptual components with an example for each of these components. Explain the basic differences between a rational agent and an omniscient agent.

3.   **[5 Marks]**

a) Consider the search problem below with start state **A** and goal state **I**. The transition costs (or step costs) are indicated next to the edges, and the heuristic values are indicated within round brackets very close to the states. Apply A* search to expand the nodes systematically by drawing the corresponding tree diagrams. Find the path from **A** to **I** and corresponding path cost.

b) Mention six properties of a task environment. Specify the properties of these six environments for the following agents in a tabular manner:

A. Chess playing agent (with a clock)

B. Part-picking robot

C. Automated taxi driving agent

4. **[5 Marks]**

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

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. $h(n)$ = Number of misplaced tiles.

b) Write the problem formulations for the following cases:

A) 8-puzzle problem   B) Simple two-floor vacuum cleaner

5. **[5 Marks]**

a) Find path from start node **a** to goal node **z** and corresponding path cost for the following search graph using each of these search strategies:

i) Uniform cost search (UCS)
ii) Greedy best first search

The values indicated along the connecting lines represent step costs or transition costs and values indicated close to the nodes represent respective heuristic values. Heuristic value for goal node **z** is zero.
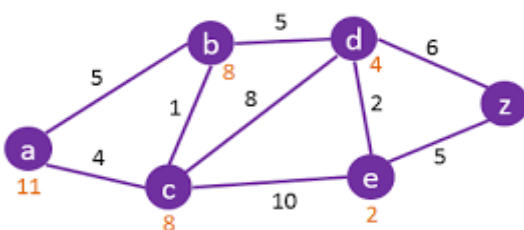
b) In the goal state of any N-queen problem, no queens attack each other. This implies that the total number of non-attacking pairs of queens is highest in the goal state. Obtain a general formula using the variable N for calculating the number of non-attacking pairs of queens in the goal state of N-queen problem. Use this formula to obtain the number of non-attacking pairs of queens in the goal state of 20-queen problem.

*** Best of Luck ***