Qn. Set Code-1

*Semester: 5th*
*Programme: B.Tech*
*Branch: CSE, CSCE, CSSE*

# AUTUMN END SEMESTER EXAMINATION-2022

**5th Semester B.Tech**

## ARTIFICIAL INTELLIGENCE

## CS3011

**(For 2021 (L.E), 2020 & Previous Admitted Batches)**

Time: 3 Hours Full Marks: 50

***Answer any SIX questions.***
***Question paper consists of four SECTIONS i.e. A, B, C and D.***
***Section A is compulsory.***
***Attempt minimum one question each from Sections B, C, D.***
*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.*

## SECTION-A

1. Answer the following questions. [1 × 10]

(a) What are the various disciplines that AI is founded on?

(b) Which agent deals with the happy and unhappy states?

(c) If h1 and h2 are two admissible heuristics, then which of the following will give a heuristic which dominates both h1 and h2

(a) Min(h1,h2)

(b) Max(h1,h2)

(c) (h1+h2)/2

(d) $(h1+h2)^{0.5}$

(d) Consider a problem of preparing a schedule for a class of students. State the type of problem.

(e) Suppose, you are creating a chatbot which takes a sentence as an input and gives an equivalent sentence with positive emotions as an output. What will be the output of the agent for the following input sentence:

"Let us protest against the war between Russia and Ukraine".

(f) Given 3 literals a, b, and c, ho w many models are there for the sentence?

$a \vee \neg b \vee \neg c$.

(g) Explain the basic concept of Turing test.

(h) Convert the sentence into predicate logic.

"Everyone has a friend or an enemy".

(i) Explain cooperative multi agent and competitive multi agent through a suitable example.

(j) Describe the term shoulder, global maxima, local maxima, and current state with a neat sketch.

## SECTION-B

2. (a) Define rationality. List the difference between omniscience and rationality. State four state of art applications of AI. [4]

(b) What is task environment? How is it specified? Provide the PEAS description in a tabular form for the following agents– [4]

(i) Interactive English tutor
(ii) Medical diagnosis system
(iii) 8-puzzle problem
(iv) Vacuum cleaning agent

3. (a) Explain a learning agent with suitable diagram. Describe its various components with an example for each of these components. [4]

(b) Given that b is the branching factor, n is the maximum depth of the search space and d is the depth of the minimum path goal state, derive the Space and Time Complexity of Depth First Search and Breadth First Search approaches. [4]

## SECTION-C

4. (a) Consider the following sentences [4]

1. If the unicorn is mythical, then it is immortal, but if it is not mythical then it is a mortal mammal.
2. If the unicorn is either immortal or mammal, then it is horned.
3. The unicorn is magical if it is horned.

a) Model the above statements in the propositional logics.

b) Prove/disprove that the unicorn is magical.

c) Prove/disprove that the unicorn is horned.

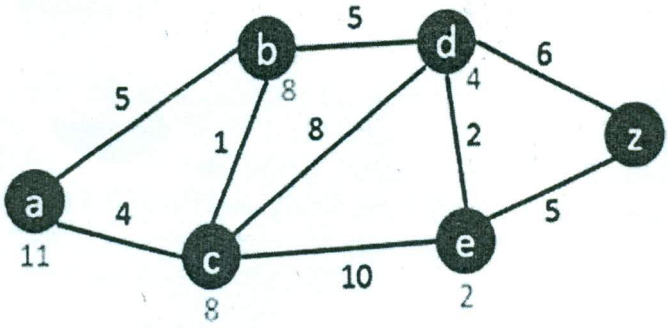
(b) Find the order of expansion of nodes for the following search graph by applying [4]

i) Uniform cost search (UCS)

ii) Greedy best first search

iii) A* search

Assume start node to be **a** and goal node to be **z**. 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 is zero.



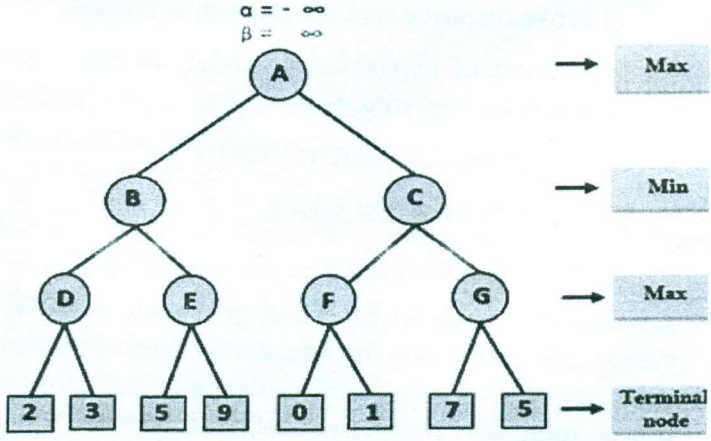

5. (a) Explain the following uninformed search strategies diagrammatically with examples: [4]

   i. Uniform Cost Search (UCS)

   ii. Depth Limited Search(DLS)

   iii. Iterative Deepening Search (IDS)

   (b) Write the concept of Alpha-Beta pruning. What do the parameters Alpha and Beta mean? Solve the following example and analyze how alpha-beta pruning helped in pruning the search tree. [4]



6. (a) Suppose, you are responsible for allocating classrooms for different CSE courses. There are 4 classrooms and 4 courses. The properties and constraints of these entities are defined below. [4]

- The seating capacity of rooms 1, 2, 3, and 4 are 60, 60, 60, and 40 respectively.
- Rooms 3 and 4 are soundproof.
- Rooms 1 and 3 are equipped with multimedia presentation tools
- The courses and their enrolment are as follows: CSL452 – 60, CSL201 – 60, CSL417 – 40, CSL407 – 40.
- A course is assigned to only one classroom.
- CSL452 is a very noisy class and requires sound proofing. Further the instructor teaching CSL452 uses multimedia tools.
- CSL201 should be allotted rooms 1 or 2.

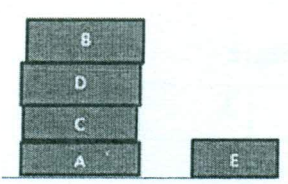
Using above constraints, allocate the classrooms to the different subjects.

(b) (a) If KANSAS + OHIO = OREGON, then find the value of G + R + O + S + S (apply constraint satisfaction rules). [4]

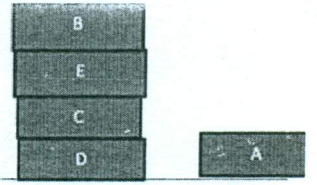
(b) Suppose, HERE = COMES - SHE(Assume S = 8) Find the value of R + H + O (apply constrain satisfaction rules).

## SECTION-D

7. [4+4]




(i)




(g)

In the above figure, (i) is the initial state and (g) is the final state. Apply hill climbing algorithm and/or its versions to achieve the goal. (Note: You can remove/put only one tile from one place to another at a time.)

Take the following heuristics

h(x) = +1, if the tile *x* is at the correct position

h(x) = -1, otherwise.

a) Which problem do you face while reaching the goal with this heuristic? How can you solve this type of problems?

b) Solve this problem with any heuristic.

8. (a) Elaborate PDDL in classical planning. Give PDDL description for any one of the following examples: [4]

i) Air cargo transport.

ii) The spare tire problem.

(b) In the following 8-puzzle problem, initial and final states are given: [4]

**Initial State**

| | | |
|---|---|---|
| 1 | 2 | 3 |
| | 4 | 6 |
| 7 | 5 | 8 |

**Goal State**

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | |

Construct 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.]

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