Invigilator's Signature and Date

Set-1

KIIT DEEMED TO BE UNIVERSITY

Spring End Semester Examination-2022

Roll No.	
Registration No.	
Name	
Date of Exam	

ARTIFICIAL INTELLIGENCE (CS3011)

6th Semester B.Tech

SECTION-A

(Answer All Questions)

Time: 30 Minutes **Full Marks = 2 × 7 = 14 Marks**

Question No	Question	Write the correct option here.
Q.No:1	Acting humanly approach and Thinking rationally approach of AI respectively deal with: A. Logic and Rationality B. Cognitive Science and Logic C. Turing Test and Logic D. Rationality Cognitive Science	
Q.No:2	Which statement below is a correct one? A. Rationality maximizes expected performance, while perfection maximizes actual performance. B. Rationality maximizes actual performance, while perfection maximizes expected performance. C. An omniscient agent does not know the actual outcome of its actions. D. A rational agent knows the actual outcome of its actions.	
Q.No:3	Uniform-cost search (UCS) expands the node with the: A. Lowest Heuristic cost B. Lowest path cost C. Highest path cost D. Average path cost	

Q.No:4	For solving 8-queen problem through GA, the objective function is stated as "Maximizing number of non-attacking pairs of queens". In the goal state, this number is maximum. What is this value in the goal state? A. 25 B. 26 C. 28 D. 30	
Q.No:5	Which is an example of Global constraint? A. K-consistent *B. Alldiff* C. *Between* (X, Y, Z) D. {(X1, X2), X1≠X2}	
Q.No:6	Which of the following options is true towards the meaning of the FOL sentence "$\exists y \forall x$ *Loves(x, y)*"? A. For every person, there is someone that person loves. B. There is someone who is loved by everyone. C. Both A. and B. D. Neither A. nor B.	
Q.No:7	For a given finite branching factor, b and depth of shallowest goal node, d, let the number of nodes generated through IDS be N(IDS) and that generated through BFS be N(BFS). Then: A. N(IDS) extremely large as compared to N(BFS). B. N(IDS) < N(BFS). C. N(IDS) = N(BFS). D. N(IDS) moderately large as compared to N(BFS).	

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SECTION-B

(Answer Any Three Questions.)

Time: 1 Hour and 30 Minutes **Full Marks = 12 × 3 = 36 Marks**

Q.No:8

Name the four approaches of AI. Briefly explain Turing Test. State six capabilities a computer system should have to qualify for this test.

What is task environment? How is it specified? Provide the PEAS description in a tabular form for the following agents:
(i) Satellite image analysis system
(ii) Refinery controller
(iii) Soccer playing agent
(iv) High jump performing agent

Briefly state the five components of problem formulation for a problem-solving agent. Formulate each of the following problems by stating these five components:

i) 8-queen problem
ii) Airline travel planning problem
iii)

Q.No:9

Mention six properties of a task environment. For each of the following agents, characterize environment of each one in terms of the six properties (preferably in tabular forms):

i) Automated Taxi driving agent
ii) Chess playing agent (with a clock)
iii) Part-picking Robot

What are the common four measures to measure the performance of any search strategy? Give in a tabular manner, the comparison of performance measures of following five uninformed search strategies:

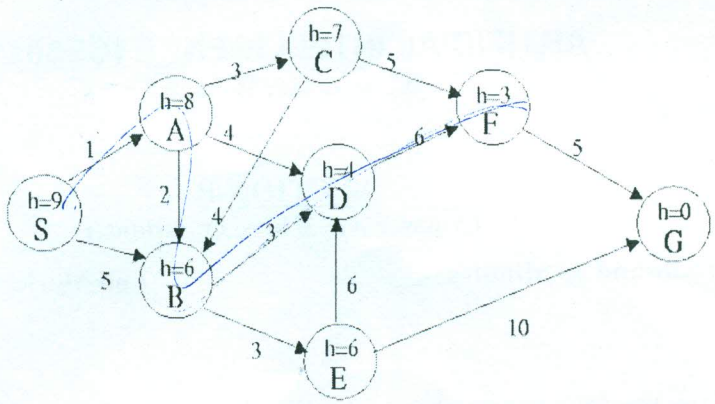
i) Breadth first search (BFS)
ii) Uniform cost search (UCS)
iii) Depth first search (DFS)
iv) Depth limited search (DLS)
v) Iterative deepening search (IDS)
vi) Bi-directional search (BDS)

Explain briefly Hill climbing approach. Why is it considered as a beyond classical approach? Write about its three important issues and their remedial measures.

Q.No:10

a) Briefly explain the Minimax algorithm stating about its time and space complexities.
b) How is CSP different from standard search strategies?

Find the order of expansion of nodes for the following search graph using Greedy Best First search. Assume start node to be **S** and goal node to be **G**. The values indicated along the connecting lines represent step costs or transition costs and values indicated inside the nodes represent heuristic values.



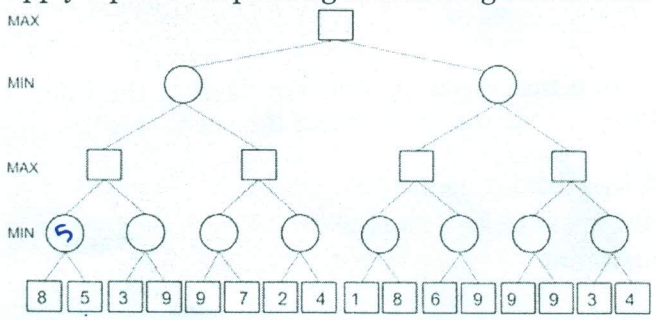
Suppose GA is applied to 8-Queen problem. Following four real numbered chromosomes are initially selected in the population pool as parents:

1) 24415124
2) 24748552
3) 32543213
4) 32752411

If the fitness function is considered to be "The number of non-attacking pairs of queens", then evaluate their fitness values in terms of their percentage of contribution and suggest with justification which of these chromosomes may be considered to be a relatively weak parent.

Q.No:11

Apply alpha-beta pruning to following search tree:



Explain how entailment of sentences can be done using Theorem proving by applying rules of inference directly to the sentences in the knowledge base.Cite your examples by considering the Knowledge Base (KB) from Wumpus World. Explain under what conditions, the method of Theorem proving is preferred over the method of Model checking.

What is PDDL in classical planning? Give PDDL description for any one of the following examples:

i) Air cargo transport
ii) The spare tire problem
iii) The blocks world

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SECTION-A

(Answer All Questions)

Time: 30 Minutes **Full Marks = 2 × 7 = 14 Marks**

Question No	Question	Write the correct option here.
Q.No:1	Under which category the following definition of AI belongs? *"The study of mental faculties through the use of computational models."* A. Turing Test Approach B. Cognitive Modelling Approach C. The "Laws of Thought" Approach D. Rational Agent Approach	
Q.No:2	Which conceptual element of Learning agent uses feedback from the Critic on how the agent is doing and determines how the performance element should be modified to do better in the future. A. Performance element B. Learning element C. Problem generator D. Critic	
Q.No:3	A* search is optimal: A. If its graph search version is having admissible heuristic. B. If its tree search version is having admissible heuristic while its graph search version is having consistent heuristic. C. If its tree search version is having consistent heuristic. D. None of the above.	
Q.No:4	Hill climbing has the following variant(s): A. Stochastic Hill climbing B. First choice Hill climbing C. Random restart Hill climbing D. All of the above	

Q.No:5	If a constraint is expressed as "*(AxleF + 10 ≤ AxleB) OR (AxleB + 10 ≤ AxleF)*", such type of constraint is known as: A. Preference constraint B. Precedence constraint C. Disjunctive constraint D. Global constraint	
Q.No:6	In which of the following cases, α |= βfails (i. e. sentence α does not entail the sentence β)? A. α is false and β is false. B. α is false and β is true. C. α is true and β is true. D. α is true and β is false.	
Q.No:7	With the following initial state and goal state in the 8-puzzle problem, what are the values of heuristics *h1* and *h2* respectively where *h1* = Number of misplaced tiles and *h2* = Manhattan distance: Initial State: 5 2 1 8 7 6 4 3 Goal State: 1 2 3 4 5 6 7 8 A. 6 and 11 B. 7 and 11 C. 6 and 12 D. 7 and 12	

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SECTION-B

(Answer Any Three Questions.)

Time: 1 Hour and 30 Minutes **Full Marks = 12 × 3 = 36 Marks**

Q.No:8 Briefly explain the four approaches of AI. Which of these approaches is preferred most? Justify with reasons.

Explain a Learning agent with suitable diagram. Describe its various conceptual components with an example for each of these components.

Explain the following uninformed search strategies by mentioning the significance of each one:

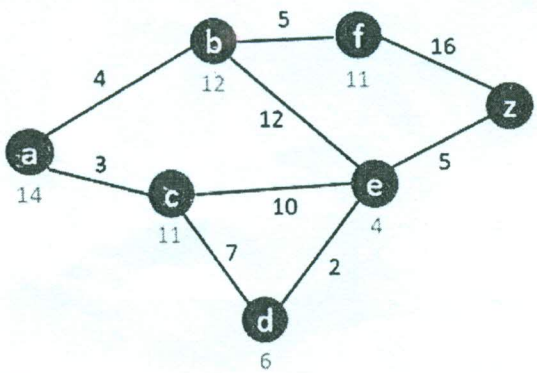
i. Depth First Search (DFS)
ii. Depth Limited Search (DLS)
iii. Iterative Deepening Search (IDS)

One of these three is the preferred uninformed search method when the search space is large and the depth of the solution is not known. Which one is this? Give justification.

Q.No:9 Explain the following terms associated with intelligent agents:

i) Agent function
ii) Agent program
iii) Performance measure
iv) Rationality

Consider the graph below with start node **a** and goal node **z**. The transition costs (or step costs) are next to the edges, and the heuristic values are indicated in red color close to the nodes. The heuristic value for goal node is zero. Apply A* search to expand the nodes systematically by drawing the corresponding tree diagrams. Find the final path and order of expansion of nodes from start node to goal node.



Q.No:10 Explain two heuristic functions associated with 8-puzzle problem through a suitable example. Justify that these two heuristics are admissible heuristics.

Enlist at least three local search algorithms. Explain the Hill Climbing approach through its algorithm. Write about local beam search and stochastic beam search.

In the following cryptarithmetic question, the value of each variable (i.e. each type of uppercase letters) is a unique integer number lying in the domain {0, 1. 2, 3, 4, 5, 6, 7, 8, 9}. Only restriction is that no leading zeroes are allowed.

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   C R O S S
 + R O A D S
-------------
D A N G E R
```

Find a solution by applying constraint satisfaction rules.

Q.No:11 Explain through examples various types of constraints associated with variables in a CSP. Also briefly explain various types of local consistency.

Give a comparison between Propositional Logic and First Order Logic (FOL). Explain the following features of FOL through suitable examples:

i) Universal quantifier
ii) Existential quantifier
iii) Nested quantifier
iv) Objects
v) Relations (including Properties and Functions)

What is PDDL in classical planning? Give PDDL description for <u>any one</u> of the following examples:

i) Air cargo transport
ii) The spare tire problem
iii) The blocks world

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