Course Code : CDT 206 **QVRU/RS – 22 / 1168**

Fourth Semester B. Tech. (Computer Science and Engineering / Data Science) Examination

ARTIFICIAL INTELLIGENCE

Time : 3 Hours] [Max. Marks : 60

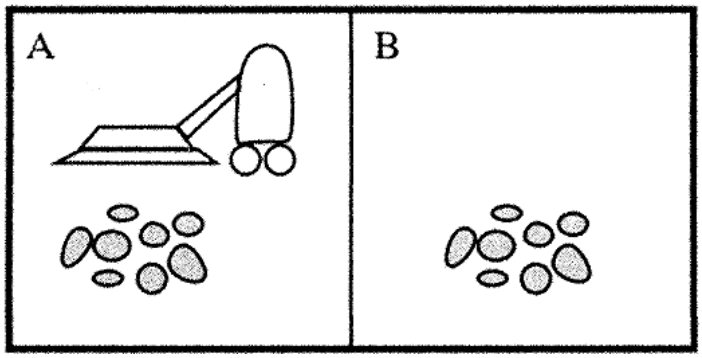
Instructions to Candidates :—

(1) Read the questions carefully.

(2) Draw neat and clean diagram wherever necessary.

1. (a) Write pseudocode for the goal - based and utility - based agents. 5 (CO 1)

(b) Specify a performance - measuring environment simulator for the vacuum - cleaner world depicted in following figure. Your specification should be modular so that the sensors, actuators and environment characteristics (size, shape, dirt placement, etc.) can be changed easily.



3 (CO 1)

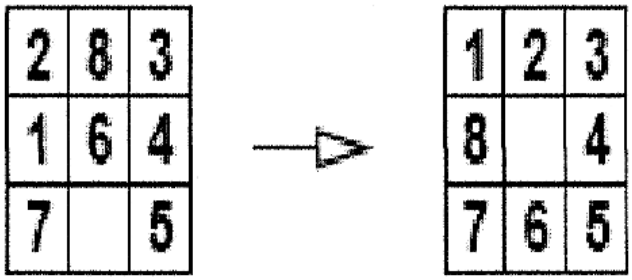
(c) Differentiate Robotics vs Softboats with example. 2 (CO 1)

2. (a) Justify following statement for true or false :

Breadth - first search is complete even if zero step costs are allowed. 2 (CO 1)

(b) Iterative lengthening search is described as follows :
An iterative analog of uniform cost search. The idea is to use increasing limits on path cost. If a node is generated whose path cost exceeds the current limit, it is immediately discarded. For each new iteration, the limit is set to the lowest path cost of any node discarded in the previous iteration. Write the pseudocode for iterative lengthening search. 4 (CO 1)

(c) Consider the following initial state and goal state for 8 - puzzle problem.



Initial State **Goal State**

Apply BFS to solve above problem up to depth 3. 4 (CO 1)

3. (a) Justify following statement :
A genetic algorithm is a variant of stochastic beam search.
Also, enlist the three operators used in genetic algorithm. 4 (CO 1)

(b) Explain admissible heuristic with example. Why we will get optimal solution during underestimation ? What would be the value of branching factor b for well - designed heuristic ? 4 (CO 1)

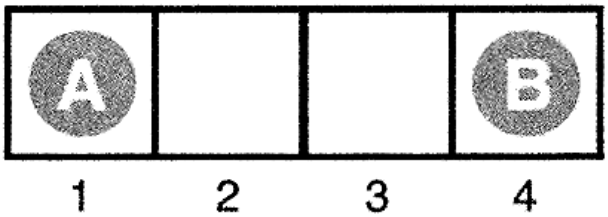
(c) Define and explain following with diagram :

(a) Local Maximum.

(b) Global Maximum. 2 (CO 1)

4. (a) Consider the two - player game described as follows :
The starting position of a simple game is shown in Figure. Player A moves first. The two players take turns moving and each player must move his token to an open adjacent space in either direction. If the opponent occupies an adjacent space, then a player may jump over the opponent to the

next open space if any. (For example, if A is on 3 and B is on 2, then A may move back to 1.) The game ends when one player reaches the opposite end of the board. If player A reaches space 4 first, then the value of the game to A is +1 ; if player B reaches space 1 first, then the value of the game to A is –1.



Draw the complete game tree, using the following conventions :

(a) Write each state as (sA, sB), where sA and sB denote the token locations.

(b) Put each terminal state in a square box and write its game value in a circle.

(c) Put *loop states (states that already appear on the path to the root) in double square* boxes. Since their value is unclear, annotate each with a "?" in a circle.

(d) Now mark each node with its backed-up minimax value (also in a circle). 6 (CO 2)

(b) Explain Min-Max algorithm with example. 4 (CO 2)

5. (a) Consider the following Facts :

All people who are not poor and are smart are happy. Those people who read are not stupid. John can read and is wealthy. Happy people have exciting lives :

(i) Convert given Fact into predicate logic.

(i) Convert given Fact into clause Form.

(iii) Prove using Resolution "Can anyone be found with an exciting life ?" 6 (CO 3)

(b) Write implication and double implication in terms of basic connectives (conjunction, disjunction and negation). Verify with the help of truth table. 4 (CO 3)

6. (a) How the basic operations like Union, Intersection and set difference are define in terms of membership function on the fuzzy sets ? Explain with an example. 5 (CO 4)

(b) In your local nuclear power station, there is an alarm that senses when a temperature gauge exceeds a given threshold. The gauge measures the temperature of the core. Consider the Boolean variables A (alarm sounds), FA (alarm is faulty) and FG (gauge is faulty) and the multivalued nodes G (gauge reading) and T (actual core temperature).

(1) Draw a Bayesian network for this domain, given that the gauge is more likely to fail when the core temperature gets too high.

(2) Suppose there are just two possible actual and measured temperatures, normal and high ; the probability that the gauge gives the correct temperature is x when it is working, but y when it is faulty. Give the conditional probability table associated with G. 5 (CO 4)