**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, May 2021**

Course:    B.Tech CSE+AI/ML                                   Semester:    IV
Program:   Algorithm for Intelligent Systems and Robotics      Time       : 03 hrs.
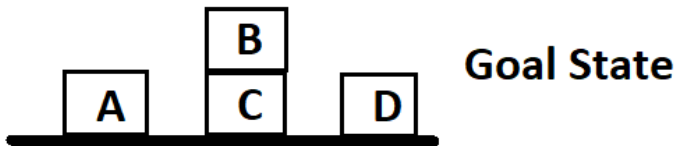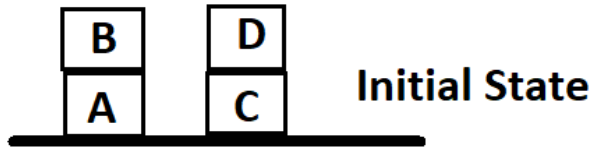Course Code:  CSAI2004                                         Max. Marks: 100

**Instructions:**

| SECTION A | | | |
|---|---|---|---|
| **S. No.** | | **Marks** | **CO** |
| Q 1 | A lock down is announced from tomorrow. You want to represent a planning problem to go to the market today and buy milk, chocolate and coffee using situation calculus. The Initial State of the problem about a situation 'S' can be represented as: <br><br> a) At(Home, S) AND ~HAVE(Milk, S) AND ~HAVE(Chocolate, S) AND ~HAVE(Coffee, S) <br> b) At(Home, S) AND HAVE(Milk, S) AND HAVE(Chocolate, S) AND HAVE(Coffee, S) <br> c) At(Home, S) OR ~HAVE(Milk, S) OR ~HAVE(Chocolate, S) OR ~HAVE(Coffee, S) <br> d) At(Home, S) AND HAVE(Milk, S) AND HAVE(Chocolate, S) AND HAVE(Coffee, S) -> ~ At(Home, S) | **5** | **CO1** |
| Q 2 | You are being asked to solve an 8 puzzle problem. You are also given a heuristic cost function F(x) which computes the total out of order numbers. For example, the Initial State is: <br> 1 2 3 <br> X 4 6 <br> 7 5 8 <br><br> Where X represent the blank cell. The goal state is: <br><br> 1 2 3 <br> 4 5 6 <br> 7 8 X <br><br> Here all values, except 4, 5, 8 are in their correct place. Hence F(x) = 3 for the initial state. Obviously we have to minimize F(x) in every step in order to reach the goal state. Which of following state will be traversed next using this simple algorithm: | **5** | **CO2** |

| | | | |
|---|---|---|---|
| | a)  1 2 3<br>    4 X 6<br>    7 5 8<br><br>b)  X 2 3<br>    1 4 6<br>    7 5 8<br><br>c)  1 2 3<br>    7 4 6<br>    X 5 8<br><br>d)  1 2 3<br>    X 4 6<br>    7 5 8 | | |
| Q 3 | For a given structure, Frame B is initially coincident with frame A. Frame B is then rotated about its Y-axis by 30 deg. Then 60 deg about X-axis and finally 30 deg about Z-axis. Which of the following represent the rotation matrix of B with respect to A?<br><br>a)<br>0.967    -0.058   0.25<br>0.25      0.433  -0.866<br>-0.058    0.9     0.433<br><br>b)<br>0.867    -0.418   0.15<br>0.25      0.133   0.866<br>-0.158    0.9     0.433<br><br>c)<br>0.967     0.058   0.25<br>0.25      0.433   0.866<br>0.058     0.9     0.433<br><br>d)<br>-0.967    0.058  -0.25<br>-0.25     -0.433  0.866<br>0.058    -0.9    - 0.433 | 5 | CO2 |
| Q 4 | State the three laws of Robotics. | 5 | CO1 |
| Q 5 | Discuss the Simultaneous Localization and Mapping problem (SLAM). | 5 | CO3 |
| Q 6 | The range of the output of the binary sigmoid function is:<br><br>a)  [-1, 1]<br>b)  (-1, 1) | 5 | CO1 |

| | | | |
|---|---|---|---|
| | c) [0, 1]<br>d) (0, 1) | | |

## SECTION B

| Q 7 | Plan the goal stack according from initial state to goal state<br><br>B D<br>A C  **Initial State**<br><br>B<br>A C D  **Goal State** | 10 | CO1 |
|---|---|---|---|
| Q 8 | Write down the algorithm of N-Queens's problem. Discuss its important in real life. | 10 | CO1 |
| Q 9 | While understanding the basic perceptron model of Neural Network; you are asked to design and represent the Boolean functions of NAND and NOR gates using the similar logic. Further put forward a discussion about the XOR function. | 10 | CO3 |
| Q 10 | Discuss ROS. Explain the file system level of ROS. | 10 | CO3 |
| Q 11 | You are hired by BCCI to represent knowledge by creating an ontology from the input given below (1 means true). Obviously you can deny the job; in that case explain Knowledge Representation and Reasoning in your own words.<br><br>| | Batsmen | Bowler | Dependable | High_earning |<br>|---|---|---|---|---|<br>| Virat | 1 | 0 | 1 | 1 |<br>| Rohit | 1 | 0 | 1 | 0 |<br>| Hardik | 1 | 1 | 0 | 0 |<br>| Jadeja | 1 | 1 | 1 | 0 |<br>| Siraj | 0 | 1 | 0 | 0 | | 10 | CO2 |

## SECTION-C

| Q 12 | A. Explain the three layer architecture of robotic system.<br>B. Discuss the Bayes statistics to design an intelligent robot. | 20 | CO2 |
|---|---|---|---|

|  | **OR**<br><br>A.  Explain the working of Sonar sensors.<br>B.  Explain architecture for intelligent control system<br><br>**OR**<br><br>Draw the architecture and elaborate the Machine Vision System. |  |  |