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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 03-01-2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOCSE | **Program:** B. Tech. (CAI) | |
| **Course Code:** CSE3208 | **Course Name:** Artificial Intelligence in Practice | |
| **Semester**: V | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **20** | **20** | **20** |  | **N/A** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*
3. *Your answers for the* ***FIRST 12 questions*** *must end by* ***PAGE #12****. You must start answering* ***QUESTION 13*** *from* ***PAGE #13****.*

**Part A**

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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** | | | | |
| **1** | Name the type of queue used in BFS and the type of queue used in Greedy BFS. | **2 Marks** | **L1** | **CO1** |
| **2** | State the number of variables in a 16x16 (Hexadecimal) Sudoku. | **2 Marks** | **L1** | **CO1** |
| **3** | State the recurrence used for calculating the time complexity of **worst ordering** in alpha-beta pruning. | **2 Marks** | **L1** | **CO1** |
| **4** | Name the data structure used in depth-first search. | **2 Marks** | **L1** | **CO1** |
| **5** | State the number of variables in the N Queens Problem, where we have to place N Queens on an NxN chessboard. | **2 Marks** | **L1** | **CO1** |
| **6** | Name the term that mentions the set of rules that are accepted in a logic. | **2 Marks** | **L1** | **CO1** |
| **7** | For 2 mutually independent events, if P(A) = a, and P(B) = b, mention the probability of P(A U B), i.e. the probability that either A or B occurs. | **2 Marks** | **L1** | **CO1** |
| **8** | A generalized heuristic search function f(n) uses the equation f(n) = a\*g(n) + b\*h(n). Mention the values of a and b for the equation to represent the Uniform Cost Search. | **2 Marks** | **L1** | **CO1** |
| **9** | Name the probability which we try to calculate using Bayes Theorem. | **2 Marks** | **L1** | **CO1** |
| **10** | Name the algorithm paradigm of the Viterbi Algorithm. | **2 Marks** | **L1** | **CO1** |

**Part B**

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| **Answer the Questions Total 80 Marks.** | | | | | |
| **11.** | **a.**  **b.** | Fermat’s Last Theorem states that: “There does not exist any set of 4 positive integers, x, y, z, and n, such that n > 2, and xn + yn = zn”. Convert this statement to First Order Logic. Use the predicate “integer(x)” to denote “x is an integer” and “pow(a,b)” to denote the function which returns the value ab.  Consider a deck of cards. Calculate the probability of each of the following events:   1. You select the **Ace of Hearts**. 2. You select **an** **Ace** OR **a Heart**. 3. You select **an Ace**, put it back, and then select **a Heart**. 4. You select the **Ace of Hearts**, given that you select **a letter card**. 5. You select the **Ace of Hearts**, given that you select **a face card**. | **10 Marks**  **10 Marks** | **L2**  **L3** | **CO2**  **CO4** |
| **Or** | | | | | |
| **12.** | **a.**  **b.** | Pythagoras Theorem implies that: “There exists any set of 3 positive integers, x, y, and z, such that x2 + y2 = z2”. Convert this statement to First Order Logic. Use the predicate “integer(x)” to denote “x is an integer” and “pow(a,b)” to denote the function which return ab.  Consider a deck of cards. Calculate the probability of each of the following events:   1. You select the **Ace of Spades**. 2. You select **an** **Ace** OR **a Spade**. 3. You select **an Ace**, put it back, and then select **a Spade**. 4. You select the **Ace of Spades**, given that you select **a letter card**. 5. You select the **Ace of Spades**, given that you select **a face card**. | **10 Marks**  **10 Marks** | **L2**  **L3** | **CO2**  **CO4** |
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| **13.** | Consider the following HMM represented as a state diagram.    Calculate the most probable state sequence to produce the observations **B G B B B**. Assume that each state has equal initial probability. You must mention the Viterbi probability and back-pointer at each and every step. | | **20 Marks** | **L3** | **CO4** |
| **Or** | | | | | |
| **14.** | Consider the following HMM represented as a state diagram.    Calculate the most probable state sequence to produce the observations **R G B G B**. Assume that each state has equal initial probability. You must mention the Viterbi probability and back-pointer at each and every step. | | **20 Marks** | **L3** | **CO4** |

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| **15.** | Construct a game tree as follows. Each node has 2 children. At every level, the sum of the utilities of the children are the same. Assume that we are building a tree of 4 moves. In other words, we are therefore having 16 leaves. Let their utilities be 1, 2, 3, …, 16. Hence, at the 4th move, the utilities of the 2 children all sum to 17, at the 3rd move, the utilities of the 2 children should all sum to 9, at the 2nd move, the utilities of the 2 children should all sum to 13. Calculate the expected value of the root. Arrange the nodes such that the pruning is maximum. | **20 Marks** | **L3** | **CO3** |
| **Or** | | | | |
| **16.** | Consider a situation where you have an 8 litre jug, a 5 litre jug and a 3 litre jug. Each state is represented in the form of a triple (x,y,z), where x is the volume of water in the 3 litre jug, y is the volume of water in the 5 litre jug, and z is the volume of water in the 8 litre jug. Initially, the 8 litre jug is full of water. Your task is to balance a pair of scales with 2 jugs containing 4 litres of water. In other words, your initial state is (0,0,8) and your final state is (0,4,4). | **20 Marks** | **L3** | **CO3** |

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| **17.** | Consider the following axioms:  Every boy or girl is a child.  Every child gets a doll or a train or a lump of coal  No boy gets any doll  No child who is good gets a lump of coal  Use the following predicates:   * Boy(x) = x is a boy * Girl(x) = x is a girl * Child(x) = x is a child. * Doll(x) = x gets a doll * Train(x) = x gets a train * Coal(x) = x gets a lump of coal * Good(x) = x is good   Prove, using First Order Resolution, that: If no child gets a train, then no boy is good. | **20 Marks** | **L3** | **CO2** |
| **Or** | | | | |
| **18.** | Consider the following axioms:   1. Every child sees some witch. 2. No witch has both a black cat and a pointed hat. 3. Every witch is good or bad. 4. Every child who sees a good witch gets some candy 5. Every witch that is bad has a black cat.   Use the following predicates:   * Child(x) = x is a child. * Witch(x) = x is a witch. * BlackCat(x) = x has a black cat * PointedHat(x) = x has a pointed hat * Good(x) = x is good * Bad(x) = x is bad * Candy(x) = x gets candy. * Has(x,y) = x has y.   Prove, using First Order Resolution, that: If every witch that is seen by a child has a pointed hat, then every child gets candy. | **20 Marks** | **L3** | **CO2** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***