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| Roll Number: _____  |                                 |
| <b>Thapar Institute of Engineering and Technology, Patiala</b>  |                                 |
| <b>Computer Science and Engineering Department</b>  |                                 |
| BE(2 <sup>nd</sup> Year) May 28, 2022 EST   | UCS411: Artificial Intelligence |
| Time: 2 Hours   | Marks:35                        |
| Instructors: Dr. Singara Singh Kasana, Dr. Jasvinder Pal Singh, Dr. Jayendra Barua, Dr. Sujata, Dr. Seema, Ms. Swati, Dr Tanu Goyal |                                 |

**Note:** All questions are compulsory. All parts of a question must be answered in order.

| Q1 a        | Write a Prolog program to display sum of first N terms of the given series. <div><math display="block">1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots</math></div> The inputs(x and N) should be taken at run time from the user.   | [4]         |          |         |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
|-------------|---|-------------|----------|---------|--------|---------|---|-----|--------|----------|-----|---|-----|--------|----------|----|---|-----|--------|----------|-----|---|--------|--------|----------|----|---|--------|--------|----------|-----|---|--------|-----|----------|----|---|--------|-----|----------|-----|---|--------|-----|----------|----|---|-----|-----|----------|----|----|-----|--------|----------|-----|-----|
| Q1 b        | Write the prolog rules for defining the family relationships: Grandmother, Uncle, Mother-in-law, Cousin, Sister-in-law, Brother-in-law by using the relationships Male, Female, Parent, and Married.  | [3]         |          |         |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| Q2 a        | Write a user defined function in LISP to find factorial of a number and show its execution.   | [4]         |          |         |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| Q2 b        | Use the dataset below to learn a decision tree which predicts if people pass machine learning (Yes or No), based on their previous GPA (High, Medium, or Low) and whether or not they studied. <div><table><tr><th>GPA</th><th>Studied</th><th>Passed</th></tr><tr><td>L</td><td>F</td><td>F</td></tr><tr><td>L</td><td>T</td><td>T</td></tr><tr><td>M</td><td>F</td><td>F</td></tr><tr><td>M</td><td>T</td><td>T</td></tr><tr><td>H</td><td>F</td><td>T</td></tr><tr><td>H</td><td>T</td><td>T</td></tr></table></div> <div>a) What is the Entropy H(Passed)?<br/>b) What is the Entropy H(Passed GPA)?<br/>c) What is the Entropy H(Passed   Studied)?</div>  | GPA         | Studied  | Passed  | L      | F       | F | L   | T      | T        | M   | F | F   | M      | T        | T  | H | F   | T      | H        | T   | T | [3]    |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| GPA         | Studied   | Passed      |          |         |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| L           | F   | F           |          |         |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| L           | T   | T           |          |         |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| M           | F   | F           |          |         |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| M           | T   | T           |          |         |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| H           | F   | T           |          |         |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| H           | T   | T           |          |         |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| Q3          | Given dataset contains car related information with label whether car is stolen by someone. Apply Naïve Bayes approach to check whether car with attributes (Red, Domestic and SUV) will be stolen or not? <div><table><tr><th>Example No.</th><th>Color</th><th>Type</th><th>Origin</th><th>Stolen?</th></tr><tr><td>1</td><td>Red</td><td>Sports</td><td>Domestic</td><td>Yes</td></tr><tr><td>2</td><td>Red</td><td>Sports</td><td>Domestic</td><td>No</td></tr><tr><td>3</td><td>Red</td><td>Sports</td><td>Domestic</td><td>Yes</td></tr><tr><td>4</td><td>Yellow</td><td>Sports</td><td>Domestic</td><td>No</td></tr><tr><td>5</td><td>Yellow</td><td>Sports</td><td>Imported</td><td>Yes</td></tr><tr><td>6</td><td>Yellow</td><td>SUV</td><td>Imported</td><td>No</td></tr><tr><td>7</td><td>Yellow</td><td>SUV</td><td>Imported</td><td>Yes</td></tr><tr><td>8</td><td>Yellow</td><td>SUV</td><td>Domestic</td><td>No</td></tr><tr><td>9</td><td>Red</td><td>SUV</td><td>Imported</td><td>No</td></tr><tr><td>10</td><td>Red</td><td>Sports</td><td>Imported</td><td>Yes</td></tr></table></div> | Example No. | Color    | Type    | Origin | Stolen? | 1 | Red | Sports | Domestic | Yes | 2 | Red | Sports | Domestic | No | 3 | Red | Sports | Domestic | Yes | 4 | Yellow | Sports | Domestic | No | 5 | Yellow | Sports | Imported | Yes | 6 | Yellow | SUV | Imported | No | 7 | Yellow | SUV | Imported | Yes | 8 | Yellow | SUV | Domestic | No | 9 | Red | SUV | Imported | No | 10 | Red | Sports | Imported | Yes | [7] |
| Example No. | Color   | Type        | Origin   | Stolen? |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| 1           | Red   | Sports      | Domestic | Yes     |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| 2           | Red   | Sports      | Domestic | No      |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| 3           | Red   | Sports      | Domestic | Yes     |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| 4           | Yellow  | Sports      | Domestic | No      |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| 5           | Yellow  | Sports      | Imported | Yes     |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| 6           | Yellow  | SUV         | Imported | No      |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| 7           | Yellow  | SUV         | Imported | Yes     |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| 8           | Yellow  | SUV         | Domestic | No      |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| 9           | Red   | SUV         | Imported | No      |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |
| 10          | Red   | Sports      | Imported | Yes     |        |         |   |     |        |          |     |   |     |        |          |    |   |     |        |          |     |   |        |        |          |    |   |        |        |          |     |   |        |     |          |    |   |        |     |          |     |   |        |     |          |    |   |     |     |          |    |    |     |        |          |     |     |

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| Q4   | <p>Given Following Bayesian network with events windy, cloudy, Rains, wet grass and work holiday along with their Conditional Probability Tables (~ stands for not).</p> <div><div><div><div>Windy (W)</div><div><div>P (W) = 0.001</div><div>P (~W) = 0.999</div></div></div><div><div><div>R</div><div>P(G   R)</div></div><div><div>T</div><div>0.95</div></div><div><div>F</div><div>0.05</div></div></div></div><div><div><div>Cloudy(C)</div><div><div>P(C) = 0.002</div><div>P (~C) = 0.998</div></div></div><div><div><div>W</div><div>C</div><div>P(R   W,C)</div></div><div><div>T</div><div>T</div><div>0.95</div></div><div><div>T</div><div>F</div><div>0.95</div></div><div><div>F</div><div>T</div><div>0.29</div></div><div><div>F</div><div>F</div><div>0.001</div></div></div><div><div><div>R</div><div>P(H   R)</div></div><div><div>T</div><div>0.99</div></div><div><div>F</div><div>0.01</div></div></div></div><div><div><div>Rains(R)</div><div><div>Wet Grass(G)</div><div>Work Holiday (H)</div></div></div></div></div> <p>a) Calculate Probability of Rain.<br/>b) Calculate Probability of work holiday and wet grass, if no wind, not cloudy, but rain.</p> | [7] |
| Q5 a | <p>Consider the following sentences-</p> <div><div>1. Every child loves Santa</div><div>2. Everyone who loves Santa loves any reindeer.</div><div>3. Rudolph is a reindeer, and Rudolph has a red nose.</div><div>4. Anything which has a red nose is weird or is a clown.</div><div>5. No reindeer is a clown.</div><div>6. Scrooge does not love anything which is weird.</div></div> <p>Translate these sentences into formulas in predicate logic.</p>   | [3] |
| Q5 b | <p>Convert the following sentences in Conceptual Dependencies</p> <div><div>1. Amit was drinking juice using straw.</div><div>2. Jay drove car to Delhi from Patiala.</div><div>3. Marry took the money from Ram.</div><div>4. John spreads cheese on Pizza.</div></div>   | [4] |

\*\*\*\*\*Best of Luck\*\*\*\*\*



Roll No \_\_\_\_\_

Name \_\_\_\_\_

Group \_\_\_\_\_

Computer Science and Engineering Department

Thapar Institute of Engineering and Technology

Quiz 2 UCS-411 (Artificial Intelligence)

Time: 10 Minutes

MM: 10

**Note:** Overwritten and multiple answers will not be evaluated. Pencils are not allowed. There will be deduction of 25% marks for wrong answers.

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| Q 1 | Given three actions A1, A2 and A3, and a plan with sequence A2, A3, A1. The given plan is partially ordered if<br>(A) A1 depends on A3 and A3 depends on A2<br>(B) A2 depends on A3 and A3 depends on A1<br>(C) A2 and A3 both depend on A1<br>(D) A1, A2 and A3 are independent of each other  |
| Q 2 | The proposition is $a \wedge (\sim a \vee b)$ is<br>(A) tautology<br>(B) contradiction<br>(C) logically equivalent to $a \wedge b$<br>(D) none of the options   |
| Q 3 | Which one of the following statements is TRUE for a Decision Tree?<br>(A) Decision tree is only suitable for the classification problem statement.<br>(B) In a decision tree, the entropy of a node decreases as we go down a decision tree.<br>(C) In a decision tree, entropy determines purity.<br>(D) Decision tree can only be used for only numeric valued and continuous attributes. |
| Q 4 | If the proposition 'All thieves are poor' is false, which of the following propositions can be claimed certainly to be true?<br>A. Some thieves are poor.<br>B. Some thieves are not poor.<br>C. No thief is poor.<br>D. No poor person is a thief.   |
| Q 5 | Given the probability of weather being cloudy if it is rained is 1 and random probability of rain is $1/4$ . Also random probability of cloudy weather is $3/4$ . What is the probability of rain if given that weather is cloudy?<br>(A) $1/3$ (B) $2/3$ (C) $1/4$ (D) $3/4$   |

Good Luck

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| Q 6 | <p>The partitions in classification will be more pure</p> <p>A. When the entropy of partition is higher</p> <p>B. When the entropy of partition is very small.</p> <p>C. When the entropy of partition larger than one.</p> <p>D. None of the mentioned</p>   |
| Q 7 | <p>To extract new information from the existing one, which predicate is used?</p> <p>A. MTRANS</p> <p>B. ATRANS</p> <p>C. MBUILD</p> <p>D. None of the mentioned</p>  |
| Q 8 | <p>If a feature F1 in a dataset takes the values 'extremely dislike', 'dislike', 'neutral', 'like' and 'extremely like' representing the satisfaction status of a customer on buying an item online. Type of feature F1 is</p> <p>A. Ordinal</p> <p>B. Nominal</p> <p>C. None of these</p> <p>D. Both ordinal and nominal</p>                     |
| Q 9 | <p>Which of the inference is not associated with INGEST?</p> <p>A. PTRANS is inferred</p> <p>B. The object ceases to exist in its usual form</p> <p>C. If the object is brittle then it will become in a negative state.</p> <p>D. If the object is inedible then the actor will become sick</p>  |
| Q10 | <p>Which one is false with respect to the Expert System architecture?</p> <p>A. Knowledge base is directly connected to Inference Engine</p> <p>B. Knowledge base is directly connected to Dynamic Data.</p> <p>C. Knowledge base is directly connected to Acquisition facility.</p> <p>D. User interface is not connected to Knowledge base.</p> |