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**SRM Institute of Science and Technology**

**Set - A**

**College of Engineering and Technology**

**School of Computing**

**Department of Networking and Communication**

SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamil Nadu

**Academic Year: 2023-24 (EVEN)**

**Test: CLA-T3** **Date: 07.05.2024**

**Course Code & Title: 18CSC305J – Artificial Intelligence**  **Duration:** 50 minutes

**Year & Sem: III Year / VI Sem** **Max. Marks:** 25

**Course Articulation Matrix:**

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| S. No | Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| 1 | CO1 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - |
| 2 | CO2 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - |
| 3 | CO3 | 2 | 3 | 3 | - | - | - | - | - | - | - | - | - |
| 4 | CO4 | 2 | 3 | 2 | - | - | - | - | - | - | - | - | - |
| 5 | CO5 | 2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - |

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| **Answer all Questions**  **(1 x 10 = 10 Marks)** | | | | | | |
| Q. No | Question | Marks | BL | CO | PO | PI Code |
| 1. | \_\_\_\_\_\_\_\_\_\_\_\_ is represented as Problem-Solving Agents + Knowledge-based Agents  Ans: Planning Agents | 1 | 3 | 2 | 2 | 2.1.3 |
| 2. | Clustering is a common task in unsupervised learning where the algorithm groups similar data points together. Say True or False  Ans: True | 1 | 4 | 2 | 3 | 2.1.3 |
| 3-5 | Match the Following sentences to different learning strategies   1. Speedup Learning 2. Ensemble Learning 3. Distributed Learning   A. Learning approach that divides the training process across multiple machines or devices to reduce computation time.  B. Techniques that combine the predictions of multiple models to improve overall performance.  C. Methodologies that aim to accelerate the learning process by optimizing algorithms or hardware.  Ans: A- Distributed Learning  B-Ensemble Learning  C-Speedup Learning | 3 | 4 | 3 | 3 | 2.1.3 |
| 6,7. | In reinforcement learning, during the initial stages of learning, the agent emphasizes \_\_\_\_\_\_\_\_\_\_\_ to discover the environment, while later it shifts towards \_\_\_\_\_\_\_\_\_\_\_ to maximize rewards.  Ans: Exploration, Exploitation | 2 | 4 | 3 | 3 | 2.2.3 |
| 8. | SVM aims to find the \_\_\_\_\_\_\_ that best separates the data points into different classes or groups.  Ans: Hyperplane | 1 | 4 | 3 | 3 | 2.1.3 |
| 9. | \_\_\_\_\_\_\_\_\_ is a popular ensemble learning technique that combines multiple decision trees (weak learners) to create a robust and accurate classifier.  Ans: Random Forest | 1 | 3 | 3 | 2 | 2.2.3 |
| 10. | \_\_\_\_\_\_\_\_ component of an expert system stores the rules and knowledge.  Ans: Knowledge base | 1 | 3 | 3 | 2 | 2.1.3 |

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| **Answer any three Questions**  **(3 x 5 = 15 Marks)** | | | | | | |
| Q. No | Question | Marks | BL | CO | PO | PI Code |
| 11. | Describe the components of a Simple Planning Agent and explain how it achieves its goal.  A Simple Planning Agent typically consists of three main components: a goal, a state representation, and a planning algorithm.  Goal: The goal represents what the agent aims to achieve. It could be a specific task to complete, a state to reach, or a condition to satisfy. This goal guides the planning process by providing a clear objective for the agent to work towards.  State Representation: The state representation defines the current situation or configuration of the environment in which the agent operates. It includes all relevant information necessary for the agent to make decisions and plan its actions. This information could include variables such as the agent's current location, the positions of obstacles or objects in the environment, and any other relevant factors that impact the agent's decision-making process.  Planning Algorithm: The planning algorithm is responsible for generating a sequence of actions that will lead the agent from its current state to the desired goal state. There are various planning algorithms that can be used, depending on the complexity of the environment and the specific requirements of the task. Common planning algorithms include:  Search Algorithms: These algorithms explore possible sequences of actions to find a path from the current state to the goal state. Examples include depth-first search, breadth-first search, and A\* search.  State-Space Planning: In state-space planning, the agent maintains a representation of the entire state space and searches through it to find a solution. This approach is often used in domains where the state space is relatively small and can be exhaustively explored.  Heuristic Search: Heuristic search algorithms use heuristics, or rules of thumb, to guide the search process towards more promising areas of the state space. A\* search is an example of a heuristic search algorithm that is commonly used in planning.  Once the planning algorithm generates a sequence of actions, the agent executes these actions one by one until the goal is achieved or a predefined termination condition is met. By iteratively planning and executing actions, the agent can navigate its environment and achieve its goal effectively. | 5 | 3 | 2 | 2 | 2.1.3 |
| 12. | Discuss the difference between supervised and unsupervised learning in machine learning. Provide examples of each type of learning approach and explain how they are used in real-world applications.  Supervised Learning:  Definition: Supervised learning involves learning a mapping from input data to output labels based on a labeled dataset. The model is trained on a dataset where each input is associated with the corresponding correct output.  Examples:  Classification: Predicting whether an email is spam or not spam based on features such as keywords, sender, and email content.  Regression: Predicting the price of a house based on features like location, size, and number of rooms.  Real-world Applications: Supervised learning is widely used in various domains, including:  Healthcare: Predicting disease diagnosis based on patient symptoms and medical history.  Finance: Credit scoring to assess the risk associated with lending money to individuals.  Natural Language Processing: Sentiment analysis to classify the sentiment of text data as positive, negative, or neutral.  Unsupervised Learning:  Definition: Unsupervised learning involves learning patterns and structures from input data without explicit supervision or labeled output. The model discovers hidden patterns or groupings in the data.  Examples:  Clustering: Grouping similar documents together based on their content without any prior labels.  Dimensionality Reduction: Reducing the dimensionality of data while preserving its structure, such as using Principal Component Analysis (PCA) or t-distributed Stochastic Neighbor Embedding (t-SNE).  Real-world Applications: Unsupervised learning finds applications in various fields, including:  Market Segmentation: Identifying distinct customer segments based on purchasing behavior for targeted marketing strategies.  Anomaly Detection: Detecting unusual patterns or outliers in network traffic to prevent cyber attacks.  Recommendation Systems: Generating personalized recommendations for users based on their historical behavior and preferences. | 5 | 4 | 2 | 3 | 3.3.1 |
| 13. | Explain the concept of Linear Regression. Describe the key assumptions made in Linear Regression modeling. How does Linear Regression differ from other regression techniques?  Linear Regression is a statistical method used to model the relationship between a dependent variable (often denoted as 𝑌) and one or more independent variables (often denoted as 𝑋) by fitting a linear equation to observed data. The equation takes the form:  *Y*=*β*0​+*β*1​*X*1​+*β*2​*X*2​+...+*βn*​*Xn*​+*ε*  Where:   * *Y* is the dependent variable (the variable being predicted). * 𝑋1,𝑋2,...,𝑋𝑛*X*1​,*X*2​,...,*Xn*​ are the independent variables (predictor variables). * 𝛽0,𝛽1,𝛽2,...,𝛽𝑛*β*0​,*β*1​,*β*2​,...,*βn*​ are the coefficients (parameters) representing the intercept and slopes of the linear relationship. * 𝜀*ε* represents the error term, which captures the difference between the observed and predicted values.   **Key Assumptions in Linear Regression:**   1. **Linearity**: The relationship between the dependent and independent variables is linear. This means that the change in the dependent variable is proportional to the change in the independent variable(s). 2. **Independence**: The observations are independent of each other. In other words, the value of one observation does not influence the value of another observation. 3. **Homoscedasticity**: The variance of the error terms is constant across all levels of the independent variables. This implies that the spread of the residuals (the differences between observed and predicted values) remains consistent. 4. **Normality of Residuals**: The residuals follow a normal distribution. This assumption ensures that the statistical inferences made about the coefficients (such as confidence intervals and hypothesis tests) are valid. 5. **No Multicollinearity**: There is no perfect multicollinearity among the independent variables, meaning that the independent variables are not highly correlated with each other.   **Differences from Other Regression Techniques:** Linear Regression is just one type of regression technique among many others. Some key differences between Linear Regression and other regression techniques include:   1. **Flexibility of Model**: Linear Regression assumes a linear relationship between the dependent and independent variables. Other regression techniques, such as Polynomial Regression or Nonlinear Regression, allow for more complex relationships between variables. 2. **Assumptions**: Linear Regression has specific assumptions, as outlined above. Other regression techniques may have different or additional assumptions depending on their underlying models. 3. **Interpretability**: Linear Regression coefficients represent the change in the dependent variable for a one-unit change in the independent variable, making it easy to interpret. Some other regression techniques may produce coefficients that are more difficult to interpret due to the complexity of the model. 4. **Performance**: Linear Regression is sensitive to outliers and may not perform well when the relationship between variables is nonlinear. Other regression techniques may offer better performance in such cases. | 5 | 3 | 2 | 3 | 3.3.1 |
| 14. | Describe the components of an Expert System. How does each component contribute to its functionality?  An Expert System typically consists of several key components that work together to simulate the decision-making process of a human expert in a specific domain. These components include:   1. **Knowledge Base**: The knowledge base is the core component of an expert system where all the relevant information and expertise about the domain are stored. It comprises two main types of knowledge:    * **Factual Knowledge**: This includes explicit facts, rules, procedures, and heuristics that represent the expertise of human experts in the domain. Factual knowledge is typically represented using formal languages such as production rules, frames, or semantic networks.    * **Meta-Knowledge**: Meta-knowledge, also known as procedural knowledge or knowledge about knowledge, guides the reasoning and inference processes within the expert system. It includes information about how to use and manipulate the factual knowledge to solve problems and make decisions. 2. **Inference Engine**: The inference engine is responsible for performing reasoning and making inferences based on the knowledge stored in the knowledge base. It applies various reasoning mechanisms, such as forward chaining, backward chaining, or a combination of both, to derive conclusions from the available information and answer user queries or solve problems. 3. **User Interface**: The user interface component provides a means for users to interact with the expert system. It accepts input from users, such as queries or problem descriptions, and presents the results of the system's reasoning process in a human-readable format. The user interface can take various forms, including text-based interfaces, graphical user interfaces (GUIs), or even natural language interfaces. 4. **Explanation Facility**: An explanation facility is an optional component of an expert system that provides explanations for the system's recommendations or decisions. It helps users understand the underlying reasoning process and builds trust in the system's capabilities. Explanations can take the form of textual explanations, visualizations, or interactive dialogues. 5. **Knowledge Acquisition Module**: The knowledge acquisition module facilitates the process of acquiring, capturing, and refining knowledge from human experts and domain sources. It typically includes tools and methodologies for eliciting knowledge from experts, organizing and structuring acquired knowledge, and integrating it into the knowledge base of the expert system.   Each component of an expert system plays a crucial role in its functionality:   * The knowledge base stores the domain expertise and serves as the foundation for reasoning. * The inference engine applies logical and probabilistic reasoning mechanisms to derive conclusions from the knowledge base. * The user interface enables users to interact with the system and access its capabilities. * The explanation facility enhances transparency and user trust by providing understandable justifications for the system's decisions. * The knowledge acquisition module ensures that the expert system remains up-to-date and relevant by continuously capturing and incorporating new knowledge from domain experts. | 5 | 4 | 3 | 3 | 3.1.6 |