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Question Paper Code	12975
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024**

Fourth Semester

**Artificial Intelligence and Data Science**

**20AIPC403 - ADVANCED MACHINE LEARNING**

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

**PART - A (MCQ) (20 × 1 = 20 Marks)**

Answer ALL Questions

	<i>Marks</i>	<i>K- Level</i>	<i>CO</i>
1. What type of graph is used in Directed Graphical Models? (a) Undirected cyclic graph (b) Directed acyclic graph (c) Undirected acyclic graph (d) Directed cyclic graph	1	K1	CO1
2. What type of edges are used in Undirected Graphical Models? (a) Directed edges (b) Undirected edges (c) Weighted directed edges (d) No edge	1	K1	CO1
3. What is the main component used to define the joint probability distribution in UGMs? (a) Transition probabilities (b) Potential functions (c) Marginal probabilities (d) Conditional probabilities	1	K1	CO1
4. Belief propagation works exactly and efficiently on which type of graphical model? (a) Graphs with cycles. (b) Directed acyclic graphs (DAGs) (c) Fully connected graphs (d) Tree-structured graphs	1	K1	CO2
5. During conditional likelihood training, what optimization method is typically used? (a) Dynamic programming (b) Expectation-Maximization (EM) (c) Gradient-based optimization, such as stochastic gradient descent (SGD) (d) Belief propagation	1	K1	CO2
6. In approximate inference, which method uses samples to estimate probabilities? (a) Variational inference (b) Belief propagation (c) Markov Chain Monte Carlo (MCMC) (d) Dynamic programming	1	K1	CO2
7. Which of the following is a commonly used MCMC algorithm? (a) Support Vector Machine (SVM) (b) Metropolis-Hastings (c) Backpropagation (d) Naive Bayes	1	K1	CO3
8. What is the primary objective of a Generative Adversarial Network (GAN)? (a) Image classification (b) Image generation (c) Text summarization (d) Text translation	1	K1	CO3
9. Which component of a GAN is responsible for generating synthetic samples? (a) Generator (b) Discriminator (c) Encoder (d) Decoder	1	K1	CO3
10. Which component of Real NVP is responsible for ensuring invertibility? (a) Gaussian noise (b) Coupling layers (c) Recurrent neural networks (d) Skip connections	1	K1	CO4
11. What type of transformation does Masked Autoregressive Flow (MAF) apply to its data? (a) Non-invertible transformation (b) Affine transformation (c) Recurrent transformation (d) Symmetric transformation	1	K1	CO4

12. Which neural network architecture is designed to estimate complex distributions by using invertible transformations? 1 K1 CO4  
 (a) Masked Autoregressive Flow (MAF) (b) Real NVP (Non-Volume Preserving)  
 (c) Variational Autoencoder (VAE) (d) Generative Adversarial Network (GAN)
13. Which of the following techniques is often used to approximate the posterior distribution of parameters in Bayesian Neural Networks? 1 K1 CO5  
 (a) Gradient Descent (b) ReLU Activation  
 (c) Monte Carlo Dropout (d) Variational Inference
14. Which technique can be used to estimate epistemic uncertainty in neural networks? 1 K1 CO5  
 (a) Monte Carlo Dropout (b) Data augmentation  
 (c) Bayesian Neural Networks (d) Both a and c
15. The type of uncertainty in neural networks reflects the lack of knowledge about the true model parameters is 1 K1 CO5  
 (a) Epistemic uncertainty (b) Aleatoric uncertainty  
 (c) Statistical uncertainty (d) Parametric uncertainty
16. What type of uncertainty refers to the uncertainty in the data or the environment in which the model operates? 1 K1 CO5  
 (a) Model uncertainty (b) Data uncertainty  
 (c) Epistemic uncertainty (d) Aleatoric uncertainty
17. Which of the following is a commonly used kernel in Gaussian Processes? 1 K1 CO6  
 (a) Linear kernel (b) RBF (Radial Basis Function) kernel  
 (c) Polynomial kernel (d) All of the above
18. What metric is typically used to evaluate the performance of time series forecasting models like DeepAR? 1 K1 CO6  
 (a) Root Mean Squared Error (RMSE) (b) Accuracy  
 (c) Cross-entropy loss (d) Average Precision
19. Which of the following methods is used to capture complex dependencies between correlated time series in deep learning models? 1 K1 CO6  
 (a) Linear Regression (b) Recurrent Neural Networks (RNNs)  
 (c) Naive Bayes (d) Decision Trees
20. In multivariate time series analysis, which technique can be used to handle multiple correlated variables with different temporal behaviors? 1 K1 CO6  
 (a) Dynamic Time Warping (b) Multivariate Dynamic Linear Models (DLM)  
 (c) Lasso regression (d) Convolutional Neural Networks (CNNs)

**PART - B (10 × 2 = 20 Marks)**

Answer ALL Questions

21. Differentiate interpolation and extrapolation with a neat diagram. 2 K2 CO1
22. When does Underfitting and Overfitting will occur? 2 K1 CO1
23. Point out the trade-off faced in representation learning problems. 2 K2 CO2
24. List the parameters of graphical model. 2 K1 CO2
25. What do you mean by GAN? 2 K1 CO3
26. Write the role of latent space. 2 K1 CO3
27. In Tensor Flow Distributions, how can normalizing flows like Real NVP be implemented for density estimation? 2 K2 CO4
28. How to modify the auto encoder to satisfy the autoregressive property? 2 K2 CO4
29. Define causality in the context of machine learning and how it differs from correlation. 2 K1 CO5
30. Why is it important to consider cross-correlations when forecasting correlated time series? 2 K2 CO6

**PART - C (6 × 10 = 60 Marks)**

Answer ALL Questions

31. a) Explain the Bayesian networks and illustrate the concept of occurrence of burglary with its probabilities. 10 K2 CO1
- OR**
- b) Design and explain the directed graphical model with an example. 10 K2 CO1
32. a) Illustrate the fact regarding Learning with partially observed data and Learning conditional graphical models. 10 K3 CO2
- OR**
- b) Determine how to eliminate the variable while computing the marginal probability. 10 K3 CO2
33. a) Summarize the concept of GAN with suitable examples. 10 K2 CO3
- OR**
- b) Discuss the significant role of MCMC sampling. 10 K2 CO3
34. a) Explain the key idea behind Masked Autoregressive Flow (MAF) for density estimation. How does it combine autoregressive models with normalizing flows? 10 K2 CO4
- OR**
- b) Compare and contrast the role of TensorFlow Distributions in probabilistic programming and density estimation tasks. How do TensorFlow Distributions simplify the implementation of probabilistic models? 10 K2 CO4
35. a) Demonstrate how can counterfactual predictions be made using neural networks, and what are the limitations of this approach? 10 K3 CO5
- OR**
- b) Sketch the Bayesian Network. How can a Bayesian Neural Networks be applied in counterfactual reasoning to predict the outcome of hypothetical interventions with uncertainty? 10 K3 CO5
36. a) Illustrate how does the copula model is used to improve the ability to handle non-linear dependencies in high-dimensional time series data? 10 K3 CO6
- OR**
- b) Distinguish the DeepAR model with traditional multivariate forecasting methods, such as Vector Autoregressive (VAR) models, in terms of flexibility, scalability, and handling uncertainty. 10 K3 CO6