| Reg. No. | | | | | | | | | | | | | | | |
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| Question Paper Code | 14372 |
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026**

Sixth Semester

**Computer Science and Engineering (AIML)**

**20AIPC403 - ADVANCED MACHINE LEARNING**

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

**PART – A (i) (MCQ)**
**(16 × 1 = 16 Marks)**

Answer ALL Questions

| | | *Marks* | *K – Level* | *CO* |
|---|---|---|---|---|
| 1. | In a Directed Graphical Model, probability distributions are represented using:<br>a) Trees b) Matrices only<br>c) Nodes and directed edges d) Flowcharts | *1* | *K1* | *CO1* |
| 2. | The process of expressing a joint distribution as products of smaller functions is called:<br>a) Classification b) Factorization<br>c) Clustering d) Optimization | *1* | *K2* | *CO1* |
| 3. | Feature-based potentials in CRFs are useful for:<br>a) Hardware design b) Data compression only<br>c) Flexible deployment in applications d) Database normalization | *1* | *K3* | *CO1* |
| 4. | Variable elimination is a technique used for:<br>a) Data cleaning b) Feature extraction<br>c) Probabilistic inference d) Clustering | *1* | *K1* | *CO2* |
| 5. | The sum-product algorithm is mainly based on:<br>a) Gradient descent b) Message passing<br>c) Backpropagation d) Regression | *1* | *K2* | *CO2* |
| 6. | Which method removes variables one by one during inference?<br>a) Clustering b) Classification<br>c) Variable Elimination d) Sampling | *1* | *K3* | *CO2* |
| 7. | GAN stands for:<br>a) General Adversarial Network b) Generative Adversarial Network<br>c) Gradient Artificial Network d) Graphical Adaptive Network | *1* | *K1* | *CO3* |
| 8. | Importance sampling improves:<br>a) Memory usage b) Sampling efficiency<br>c) Network speed d) Hardware design | *1* | *K2* | *CO3* |
| 9. | Which sampling method uses Markov chains?<br>a) Importance Sampling b) MCMC Sampling<br>c) Forward Sampling d) Random Forest | *1* | *K3* | *CO3* |
| 10. | Bayesian Neural Networks are mainly used for:<br>a) Data compression b) Uncertainty estimation<br>c) Sorting data d) Database management | *1* | *K1* | *CO4* |
| 11. | Real NVP is mainly used for:<br>a) Density estimation b) Feature selection<br>c) Data sorting d) Signal filtering | *1* | *K2* | *CO4* |
| 12. | Flow-based models are mainly used for:<br>a) Classification only b) Density estimation<br>c) Image resizing d) Data deletion | *1* | *K3* | *CO4* |
| 13. | Time series forecasting is used to:<br>a) Predict future values b) Compress signals<br>c) Delete datasets d) Sort records | *1* | *K1* | *CO5* |

14. High-dimensional forecasting mainly deals with: *1 K3 CO5*
    a) Few features b) Large-scale multivariate data
    c) Single image processing d) Data compression only
15. Probabilistic forecasting provides: *1 K2 CO6*
    a) Exact fixed outputs only b) No predictions
    c) Prediction along with uncertainty information d) Random classifications
16. Sequential data is commonly analyzed using: *1 K3 CO6*
    a) Time series models b) Sorting algorithms
    c) Relational databases d) Compression methods

**PART – A (ii) (Short Answer Questions)**
**(6 × 3 = 18 Marks)**
Answer ALL Questions

17. Distinguish between directed and undirected graphical models. *3 K4 CO1*
18. Apply Inference by enumeration and determine the number of addition and multiplication operations do we need to perform to evaluate the following expression? *3 K3 CO2*

$$P(B \wedge w \wedge g) = \sum_e \sum_a \sum_r P(B)P(e)P(r|e)P(a|B \wedge e)P(w|a)P(g|a).$$

19. Construct the ARIMA model for temperature forecasting with necessary equations. *3 K3 CO3*
20. Identify the challenges and improvements of using a Variational Autoencoder as a generative model. *3 K3 CO4*
21. Examine DeepAR models. *3 K4 CO5*
22. Compare univariate and multivariate forecasting. *3 K4 CO6*

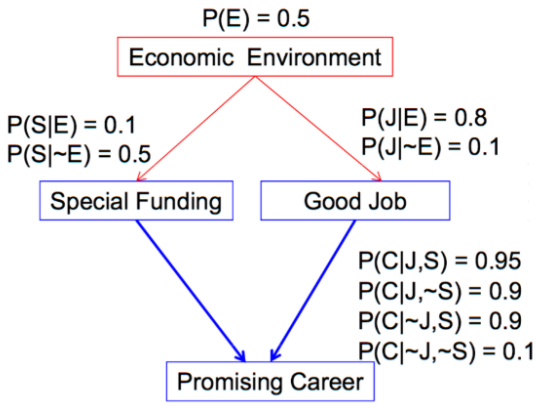
**PART - B (Descriptive Answer Questions)**
**(6 × 11 = 66 Marks)**
Answer ALL Questions

23. a) Identify the most probable class label for the index (2,2) in the segmented image using Ising Model. *11 K3 CO1*

$$A = \begin{pmatrix} -1 & -1 & -1 \\ -1 & 1 & -1 \\ -1 & -1 & -1 \end{pmatrix}$$

**OR**

b) For the given Bayesian Network, solve to determine the probability of having a promising career (C=1) GIVEN the economic environment is positive (E=1)? *11 K3 CO1*



| | | | | | |
|---|---|---|---|---|---|
| 24. | a) | Examine the structure and working of Junction Trees and evaluate their importance in inference of graphical models. | *11* | *K4* | *CO2* |
| | | **OR** | | | |
| | b) | Analyze the role of inference techniques in solving real-world problems using graphical models. | *11* | *K4* | *CO2* |
| 25. | a) | Design a Generative Adversarial Network (GAN) model for image generation and justify the role of generator and discriminator in improving output quality. | *11* | *K6* | *CO3* |
| | | **OR** | | | |
| | b) | Propose a hybrid sampling technique combining importance sampling and MCMC methods, and justify its advantages for high-dimensional inference problems. | *11* | *K6* | *CO3* |
| 26. | a) | Build the architecture and working of Bayesian Neural Networks with suitable examples. | *11* | *K3* | *CO4* |
| | | **OR** | | | |
| | b) | Apply Markov Chain Monte Carlo (MCMC) sampling to construct a Markov chain and demonstrate how successive samples are generated from the target distribution. | *11* | *K3* | *CO4* |
| 27. | a) | Identify the impact of correlated time series analysis in multivariate forecasting systems. | *11* | *K3* | *CO5* |
| | | **OR** | | | |
| | b) | Make use of different probabilistic forecasting methods used for time series prediction in real-world applications. | *11* | *K3* | *CO5* |
| 28. | a) | Design and develop a probabilistic forecasting model using Gaussian Processes for temporal data analysis. | *11* | *K6* | *CO6* |
| | | **OR** | | | |
| | b) | Design an integrated forecasting architecture combining Gaussian Processes and DeepAR models for temporal prediction. | *11* | *K6* | *CO6* |