



## Cochin University of Science And Technology

### Department of Computer Science

Eighth Semester M.Sc (Five Year Integrated) in Computer Science  
(Artificial Intelligence and Data Science)

First Series Examination - February 2025

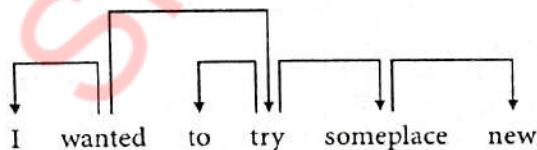
21-805-0807: Natural Language Processing with Deep Learning

Duration: 2 Hours

Maximum Marks: 20

**Answer all questions.**

1. Discuss the difference between statistical and neural approaches to processing natural language using the example of sentiment classification. [4 marks][CO2, DL-2, BTL-2]
2. Draw a computation graph for the function  $L(x,y,z) = (x + 3y) * z$  and demonstrate backward differentiation of the function using the computation graph. [4 marks][CO1, DL-2, BTL-2]
3. Demonstrate the Arc-standard scheme for Transition-based dependency parsing using the example “I want to try someplace new” to generate the parse tree below. List configurations at each step. [4 marks][CO1, DL-2, BTL-3]



4. Word2Vec is an embedding algorithm that can be applied in various contexts. Suppose in a recommender system for online shopping, we have information about co-purchased items (e.g. Bread and butter are bought together). Explain how you can apply the idea of Word2Vec to learn *item embeddings* and recommend similar items to users who have shown interest in any one of the items. [4 marks][CO2, DL-3, BTL-3]
5. Suppose you are using an RNN to do the Named Entity Recognition (NER) task with tags:- PERSON, ORG, LOC, and NONE. Specify:- (a) the number of time steps and inputs to be fed at each time step to produce output, (b) how many outputs i.e. number of times the softmax is called from your RNN, (c) what each output vector  $y(t)$  is a probability distribution over, and (d) Number of learnable parameters of the network if word embedding and hidden state are of 250 D and 50 D respectively. [4 marks][CO2, DL-3, BTL-3]



**COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY  
DEPARTMENT OF COMPUTER SCIENCE**

**Programme: VIII Semester Five Year Integrated M.Sc in Computer Science (Artificial Intelligence & Data Science)**

**Course Code & Title: 21-805-0802: Probabilistic Graphical Models**

|                               |                   |   |
|-------------------------------|-------------------|---|
| Name of Examination: Series I | Max. Marks: 20    | Semester: VIII                            |
| Batch: 2021-26                | Duration: 2 Hours | Date: 11.02.2025 Time: 9:00 AM – 11:00 AM |

**Answer all questions**

1.

- a) Prepare a short note on graphical model. (2 marks) [CO1, DL-1, BTL-2]
- b) Consider 2 random variable X and Y with joint probability distribution given in table.

Evaluate

- i.  $P(X=2, Y=5)$
- ii.  $P(X \leq 2, Y \leq 4)$
- iii.  $P(Y=2 | X=1)$
- iv. Are X and Y independent

|     | Y=2            | Y=4            | Y=5            |
|-----|----------------|----------------|----------------|
| X=1 | $\frac{1}{12}$ | $\frac{1}{24}$ | $\frac{1}{24}$ |
| X=2 | $\frac{1}{6}$  | $\frac{1}{12}$ | $\frac{1}{8}$  |
| X=3 | $\frac{1}{4}$  | $\frac{1}{8}$  | $\frac{1}{2}$  |

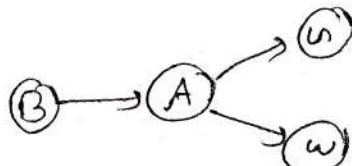
(2 marks) [CO1, DL-2, BTL-4]

2.

- a) Define Bayesian network (1 marks) [CO2, DL-1, BTL-1]
- b) Consider the following Bayesian network which represents Mr Holmes' burglary worries.  
(B)urglar, (A)larm , (W)atson,Mrs (G)ibbon.Compute

All variables are binary with states {tr, falg}. The table entries are .

$$\begin{aligned}
 P(B=tr) &= 0.01 \\
 P(A=tr | B=tr) &= 0.99 \\
 P(W=tr | A=tr) &= 0.9 \\
 P(G=tr | A=tr) &= 0.7 \\
 P(A=tr | B=falg) &= 0.05 \\
 P(W=tr | A=falg) &= 0.5 \\
 P(G=tr | A=falg) &= 0.2
 \end{aligned}$$



- i.  $P(A=tr, B=tr, G=tr, W=tr)$  (Round off to three decimal places) (2 marks) [CO2, DL-2, BTL-4]
- ii.  $P(A=tr)$  (2 marks) [CO2, DL-2, BTL-4]

3.

- a) Suppose  $(A \perp\!\!\!\perp B) \in I(P)$ , and  $G$  is a I-map of  $P$ , where  $G$  is a Bayesian network and  $P$  is a probability distribution. Is it necessarily true that  $(A \perp\!\!\!\perp B) \in I(G)$ ? Justify your answer with an example. (4 marks) [CO<sub>2</sub>, DL-3, BTL-2]

- b) Define Minimal I map (1 mark) [CO<sub>2</sub>, DL-1, BTL-1]

4. The chest clinic network concerns the diagnosis of lung disease (tuberculosis, lung cancer, or both, or neither). In this model a visit to Asia is assumed to increase the probability of tuberculosis.

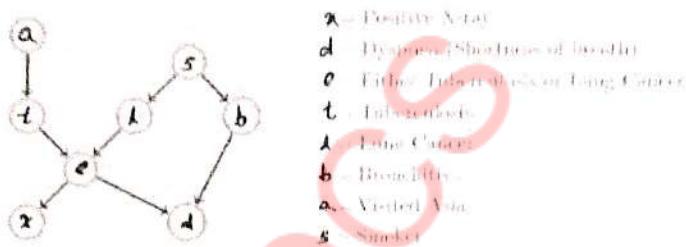


Figure 2: BN model of chest clinic

- a) Compute the number of distinct parameters( probabilities) are required to call the above Bayesian network as full joint distribution. (1 mark) [CO<sub>2</sub>, DL-2, BTL-3]
- b) Factorize the joint distribution based on this BN model (1 mark) [CO<sub>2</sub>, DL-1, BTL-2]
- c) State the following conditional independence relationships true or false . Justify your answer.[show steps]
- Tuberculosis  $\perp\!\!\!\perp$  smoking | shortness of breath
  - Lung cancer  $\perp\!\!\!\perp$  bronchitis | smoking
  - Visit to Asia  $\perp\!\!\!\perp$  smoking | lung cancer
  - Visit to Asia  $\perp\!\!\!\perp$  smoking | lung cancer, shortness of breath (4 marks) [CO<sub>2</sub>, DL-1, BTL-3]
- \*\*\*\*\*

**DEPARTMENT OF COMPUTER SCIENCE VIII SEMESTER MASTER OF SCIENCE (FIVE YEAR INTEGRATED) IN COMPUTER SCIENCE (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)**

**END SEMESTER EXAMINATION (APRIL 2025) – PROFESSIONAL COMMUNICATION**

**Time: 3hrs**

**Max marks:50**

**Q1.** Discuss the barriers to listening in detail and give suggestions to overcome each one of them. (4marks)

**Q2.** What is a project report ? Write a project report on the recent project you have done in your college. (5marks)

**Q3.** The District Collector, Jhunjhunu, is concerned about the rapid increase in the number of accidents in Pilani. The Chairman, Municipal Corporation, Pilani, has been asked to submit a report investigation the causes and suggesting measures to improve the situation. (5marks)

Prepare an outline for the above report

**Q4.** As the Sales Director of Fitness Plus Centre, Bangalore, draft a sales letter to Business Professions selling them on your 3 Wellness Packages: 1. The 3 – day Fitness Weekend 2. The 7 – day Total Fitness Program 3. The individualized Corporate Well – being Program. (5marks)

**OR**

Realizing the need of packaging services in Faridabad, Elite Professional Packers have recently started their services in the city. You, as the publicity manager of this company have the onus of promoting this service.

Draft a sales letter to be sent to the prospective users.

**Q5.** Discuss the important points to be considered while drafting a cover letter to accompany a resume. (3marks)

**Q6.** Answer the following questions:( $2 \times 3 = 6$  marks)

- a. Explain the role of eye contact in communication.
- b. What are the four different space zones according to Hall?
- c. Proxemics play a prominent role in communication. Justify?

**Q7.** Identify the communication barrier that describes each of the following situations:( $1 \times 5 = 5$ marks)

- a. 'Every time I have a meeting with Mr Gupta, I end up disagreeing with him about a particular issue.'
- b. Teacher: 'Students, why have you not submitted the report within the fortnight?' Students: 'But you asked us to submit it bimonthly.'
- c. 'This room is horrible to work in. I am able to hear everyone around, and there is no scope for privacy.'
- d. 'It is quite tedious to manually work on the students' records, but I fear using the computer as it might corrupt all our data.'

- e. 'If you want some more information from me, ask only the specific questions and do not waste my precious time!'

Q8. Read each sentence and fill in the blank, choosing the correct homophone. (2 marks)

- Please \_\_\_\_\_ our sincere apologies. (except, accept)
- Your opinion will not \_\_\_\_\_ my decision. (affect, effect)
- He's a man \_\_\_\_\_ opinion I respect. (who's, whose)
- I would \_\_\_\_\_ extreme caution. (advice, advise)

Q9. Fill in the blanks with suitable prepositions. (2 marks)

- She was born \_\_\_\_ a hamlet called Pilani.
- Ramesh comes to work by car, but I prefer to come \_\_\_\_ foot.
- He held his breath \_\_\_\_ seven minutes.
- He usually travels to Chennai \_\_\_\_ train.

Q10. Join the following pairs of sentences with the suitable conjunctions. Make necessary changes wherever required. (2 marks)

- You must be quiet. You must leave the room.
- Soldiers fought for the country. Soldiers died for the country.
- I have a cricket bat. I have a set of stumps.
- The captive fell down on his knees. The captive pleaded for mercy.

Q11. Select the correct form of the verb below and write it in the space. (2marks)

- All that glitters \_\_\_\_ not gold. (is/are)
- Two and two \_\_\_\_ four. (make/makes)
- The general with all his soldiers \_\_\_\_ killed. (was/were)
- She is one of those people who \_\_\_\_ calm in an emergency. (keep/keeps)

Q12. The following formal letter is ineffective. Rewrite it keeping the principles of business letter writing in mind: (5 marks)

11 may,2014

Avy trading Corporation

Daryagunj, vijay Nagar,

New Delhi – 110005

Telephone: 011-2345678

Mr. Ravi Malhotra

Sales manager, Reva computers

Ajmer road, Jaipur – 302006

Dear mr. Malhotra

We saw your advertisement in the Times of India about one of your important products. The advertisement caught our attention because we are interested in this product..In fact, we want to equip our corporate office with modern facilities and we would like to buy this product.

However, we cannot send the purchase unless we know more about this product. Send us more information about the product as soon as possible. We want to know many things, which include product specification and special features of this model of the product, details of discount for bulk purchase, an estimate for the cost of the product, and details regarding terms of business and delivery dates.

Respond to this letter as early as possible.

Yours Sincerely

Amit Jain

Q13. What do you understand by the term technical proposals? What is the structure of proposals? (4 marks)

SFI-DCS



Lib

Cochin University of Science and Technology  
Department of Computer Science

Eighth Semester M.Sc. (Five-Year Integrated) in Computer Science  
(Artificial Intelligence & Data Science)

Second Series Examination - March 2025

21-805-0808:Digital Image and Video Coding

Maximum Marks : 20

Duration : 2 Hrs

All questions are compulsory.

1. Design a Golomb code for  $m=7$  for numbers 1 to 15

[5 marks][CO1, DL-3, BTL-3]

2. For the probability model in the following Table decode a sequence of length 10 using Arithmetic coding with the tag 0.63215699.

| Letter | Probability |
|--------|-------------|
| a      | 0.2         |
| b      | 0.3         |
| c      | 0.5         |

[5 marks][CO1, DL-3, BTL-3]

3. Explain minimum perimeter polygon algorithm with an example

[5 marks][CO4, DL-2, BTL-2]

4. Comment on the types of spatial and temporal Scalability in video coding

[5 marks][CO4, DL-2, BTL-2]

Library Copy



## Cochin University of Science And Technology Department of Computer Science

Eighth Semester M.Sc (Five Year Integrated) in Computer Science  
(Artificial Intelligence and Data Science)

Second Series Examination - March 2025

21-805-0807: Natural Language Processing with Deep Learning

Duration: 2 Hours

Maximum Marks: 20

Answer all questions.

- Explain the limitation of a basic Recurrent Neural Network (RNN) based encoder-decoder architecture addressed by the attention mechanism. Using machine translation as an example, describe how the attention mechanism resolves this problem.  
[4 marks][CO2, DL-2, BTL-2]
- With a neat diagram and an example, compare how recurrent neural networks (RNN) and recursive neural networks (TreeRNN) process textual data.  
[4 marks][CO2, DL-1, BTL-2]
- Suppose you have a sentence, represented as a matrix  $X$  of shape  $(5, 4)$  i.e. 5 words with each word embedded as a 4-dimension vector. What is the shape of the output feature map  $F$  on applying 1D convolution using the two filters  $W_1$  and  $W_2$  given below? Use  $stride = 1$  and  $padding = 0$ . Also, compute the values at the 2nd row of the output feature map  $F$ .

$$X = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 7 \\ 5 & 6 & 7 & 8 \end{bmatrix} \quad W_1 = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}, \quad W_2 = \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix}$$

[4 marks][CO2, DL-3, BTL-3]

- Describe the three gates used in LSTM architecture and their role in modeling long-term dependencies while processing lengthy sentences.  
[6 marks][CO2, DL-2, BTL-2]
- Explain how the *temperature* and *top-p* settings affect the text generated by a Natural Language Generation (NLG) model?  
[2 marks][CO2, DL-1, BTL-2]



## Cochin University of Science And Technology Department of Computer Science

### VIII Semester Five Year Integrated M.Sc in Computer Science (Artificial Intelligence & Data Science)

End Semester Examination - April 2025

21-805-0803: Algorithms for Massive Datasets

Duration: 3 Hours

Maximum Marks: 50

**Answer all questions. From each question fully answer either (a) or (b)**

- 1) (a) i) Write MapReduce functions for one-pass matrix multiplication and apply them to the following matrices A and B.

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix} \quad [7 \text{ marks}][\text{CO1, DL-2, BTL-3}]$$

- ii) Define Reducer size and replication rate. Analyse MapReduce functions for one pass Matrix Multiplication and find reducer size and replication rate. [3 marks][CO1, DL-1, BTL-3]

OR

- (b) i) Write the importance of MapReduce function. [1 mark][CO1, DL-1, BTL-1]

- ii) Write MapReduce functions for the relational algebra operations Difference, Grouping and Aggregation on R and S. Apply these functions to the following relational tables to find Difference of R and S and sum of scores for each student in table R.

| Name  | Score |
|-------|-------|
| John  | 200   |
| Tom   | 100   |
| Smith | 500   |
| Mike  | 300   |
| John  | 100   |
| Smith | 200   |
| Tom   | 400   |

R

| Name  | Score |
|-------|-------|
| Tom   | 100   |
| Mike  | 400   |
| Don   | 600   |
| Smith | 200   |

S

[9 marks][CO1, DL-2, BTL-3]

- 2) (a) i) Differentiate k-Shingles built from characters and built from words for a document? Construct first four 8-Shingles for the sentence given below where stop words are in italics.

"*A* researcher from **the** GlowTech Institute announced yesterday *that* experiments indicate *it is* beneficial **for** individuals **to** use GlowTech devices." [4 marks][CO2, DL-2, BTL-3]

- ii) Compute Jaccard similarity for the six pairs of columns using Minhash signatures for the following data, with  $h_1 = 2x+4 \bmod 5$  and  $h_2 = 3x-1 \bmod 5$ .

| Element | S1 | S2 | S3 | S4 |
|---------|----|----|----|----|
| 0       | 0  | 1  | 0  | 1  |
| 1       | 0  | 1  | 0  | 0  |
| 2       | 1  | 0  | 0  | 1  |
| 3       | 0  | 0  | 1  | 0  |
| 4       | 0  | 0  | 1  | 1  |
| 5       | 1  | 0  | 0  | 0  |

[6 marks][CO2, DL-2, BTL-3]

OR

(b) i) Define the distance measures Manhattan Distance and Hamming Distance and explain how to compute each one with an example. [2 marks][CO2, DL-1, BTL-2]

ii) Calculate the Edit distance between the strings "Intention" and "Execution" based on longest common subsequence for the following pair of strings. [2 marks][CO2, DL-1, BTL-3]

iii) Define and explain the family of Locality Sensitive Hashing (LSH) functions for Cosine distance, Euclidian distance and Hamming distance. [6 marks][CO2, DL-1, BTL-2]

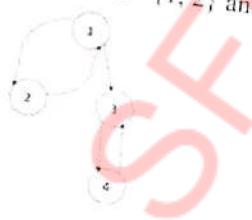
- 3) (a) Write the Flajolet-Martin Algorithm. Find the number of distinct elements in the stream of integers 4, 1, 7, 4, 2, 7, 6, 5, 3, 2, 4, 7 and 1 by using the Flajolet-Martin Algorithm, where the hash function is defined as  $h(x) = x + 6 \bmod 32$ . Analyze and derive the probability of not finding a stream element with as many as  $r$  0's at the end of its hash value.

[10 marks][CO3, DL-2, BTL-3]

OR

- (b) Write the algorithm for Bloom filtering method. Explain the working of the algorithm with suitable example. Analyze and derive the probability of false positives. [10 marks][CO3, DL-1, BTL-2]

- 4) (a) Write Topic Specific Page rank Algorithm. Apply Topic Specific Page rank Algorithm in the web graph given below with  $S = \{1, 2\}$  and  $\beta = 0.8$  and find page rank score after three iterations.



- (b) Explain Adwords problem in online web advertising and balance algorithm for it. Analyze competitive ratio for balance algorithm. [10 marks][CO4, DL-2, BTL-3]

- 5) (a) Write the Park-Chen-Yu algorithm and explain how it improves the Apriori Algorithm. Determine the frequent item pairs among six items (1 through 6) for the following 12 baskets using a support threshold of 4 and a hash function defined as  $i \times j \bmod 11$ . [10 marks][CO5, DL-1, BTL-2]

{1, 2, 3}, {2, 3, 4}, {3, 4, 5}, {4, 5, 6}, {1, 3, 5}, {2, 4, 6}, {1, 3, 4}, {2, 4, 5}, {3, 5, 6}, {1, 2, 3}, {1, 2, 3, 5} and {3, 4, 6}

OR [10 marks][CO6, DL-2, BTL-3]

- (b) Write the Multistage algorithm. Determine the frequent item pairs among six items (1 through 6) for the following 12 baskets using a support threshold of 4 and the hash function defined as  $i \times j \bmod 11$  for the first pass and  $i + j \bmod 9$  for the second pass. [10 marks][CO6, DL-2, BTL-3]

{1, 2, 3}, {2, 3, 4}, {3, 4, 5}, {4, 5, 6}, {1, 3, 5}, {2, 4, 6}, {1, 3, 4}, {2, 4, 5}, {3, 5, 6}, {1, 2, 4}, {2, 3, 5} and {3, 4, 6}

[10 marks][CO6, DL-2, BTL-3]



COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY  
DEPARTMENT OF COMPUTER SCIENCE

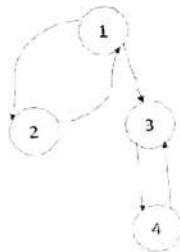
Programme: VIII Semester Five Year Integrated M.Sc in Computer Science (Artificial Intelligence & Data Science)

Course Code & Title: 21-805-0803: Algorithms for Massive Datasets

|                                |                   |  |
|--------------------------------|-------------------|--|
| Name of Examination: Series II | Max. Marks: 20    | Semester: VIII                             |
| Batch: 2021-26                 | Duration: 2 Hours | Date: 12.03.2025 Time: 09:00 AM – 11:00 AM |

**Answer all questions**

1. Write algorithm for Bloom filtering method. Explain the working of the algorithm with suitable example. Analyze and derive the probability of false positives. (4 marks) [CO3, DL-1, BTL-2]
2. Write Flajolet-Martin Algorithm. Suppose a stream consists of the integers 1, 3, 2, 1, 2, 3, 4, 3, 1, 2, 3, 1 and treating the result as a 5-bit binary integer. Estimate the number of distinct elements if the hash function is  $h(x) = 6x + 1 \bmod 5$  using Flajolet-Martin Algorithm. (4 marks) [CO3, DL-2, BTL-3]
3. Write the rules for Datar-Gionis-Indyk-Motwani Algorithm and give valid and invalid examples for each rule. Estimate the number of 1's in the last 19 positions for the given window below. How far off the correct value is your estimate?  
1 0 1 0 1 1 0 0 0 1 0 1 1 1 0 1 1 0 0 1 0 1 1 0 (3 marks) [CO3, DL-2, BTL-3]
4. Write Topic Specific Page rank Algorithm. Apply Topic Specific Page rank Algorithm in the web graph given below with  $S = \{1, 2, 3\}$  and  $\beta=0.8$  and find page rank score after three iterations. (5 marks) [CO4, DL-2, BTL-3]



5. Explain online advertisements matching problem and greedy algorithm to address this problem with the help of suitable examples. Analyze the algorithm and derive the general form of its competitive ratio. (4 marks) [CO5, DL-1, BTL-2]



**COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**DEPARTMENT OF COMPUTER SCIENCE**

Programme: VIII Semester Five Year Integrated M.Sc in Computer Science (Artificial Intelligence & Data Science)

Course Code & Title: 21-805-0803: Algorithms for Massive Datasets

|                               |                   |   |
|-------------------------------|-------------------|---|
| Name of Examination: Series I | Max. Marks: 20    | Semester: VIII                                |
| Batch: 2021-26                | Duration: 2 Hours | Date: 12.02.2025<br>Time: 09:00 AM – 11:00 AM |

Answer all questions

1.

- a) What is the MapReduce function and why is it important? (1 mark) [CO1, DL-1, BTL-1]
- b) Write MapReduce functions for the relational algebra operations, union and intersection. Apply the MapReduce functions for both operations on the following relational tables R and S.

| No | Code 1 | Code 2 |
|----|--------|--------|
| 1  | A      | D      |
| 2  | B      | C      |
| 3  | C      | A      |

R

| No | Code 1 | Code 2 |
|----|--------|--------|
| 1  | A      | E      |
| 4  | D      | E      |
| 2  | B      | C      |

S

(3 marks) [CO1, DL-1, BTL-3]

- c) Write MapReduce functions for the relational algebra operation, natural JOIN and apply these functions to the following relational tables R and S.

| Name   | EmpId | GroupName |
|--------|-------|-----------|
| Jens   | 1     | A         |
| Macros | 2     | B         |
| Shant  | 3     | D         |
| Lukas  | 4     | E         |

R

| GroupName | Manager |
|-----------|---------|
| A         | Jens    |
| B         | Lukas   |
| C         | Hans    |

S

(2 marks) [CO1, DL-2, BTL-3]

2.

- a) Write MapReduce functions for one-pass matrix multiplication and apply them to the following matrices A and B.

$$A = \begin{bmatrix} 3 & 12 & 4 \\ 5 & 6 & 8 \\ 1 & 0 & 2 \end{bmatrix} \quad B = \begin{bmatrix} 7 & 3 & 8 \\ 11 & 9 & 5 \\ 6 & 8 & 4 \end{bmatrix}$$

(3 marks) [CO1, DL-2, BTL-3]

- b) Define Reducer size and replication rate. Analyse MapReduce functions for one pass Matrix Multiplication and find reducer size and replication rate. (1 mark) [CO1, DL-2, BTL-1]
- 3.
- a) Define Jaccard Similarity and Jaccard Distance. Calculate the Jaccard similarities from the MinHash signatures and the true Jaccard similarities for the six pairs of columns in the following data using  $h1 = 2x+1 \bmod 5$  and  $h2 = 3x+2 \bmod 5$ . Compare how close they are.

| Element | S1 | S2 | S3 | S4 |
|---------|----|----|----|----|
| 0       | 0  | 1  | 0  | 1  |
| 1       | 0  | 1  | 0  | 0  |
| 2       | 1  | 0  | 0  | 1  |
| 3       | 0  | 0  | 1  | 0  |
| 4       | 0  | 0  | 1  | 1  |
| 5       | 1  | 0  | 0  | 0  |

- b) List the benefits and challenges of computing Jaccard similarities using MinHash signatures. (4 marks) [CO2, DL-2, BTL-3]
- 4.
- a) Define the distance measures Euclidean Distance and Cosine Distance and explain how to compute each one with an example. (1 mark) [CO2, DL-1, BTL-1]
- b) Calculate the Edit distance between the strings "abcdef" and "bdaefc" based on longest common subsequence. (2 marks) [CO2, DL-1, BTL-2]
5. Define and explain the family of Locality Sensitive Hashing (LSH) functions for Jaccard distance and Hamming distance. (1 mark) [CO2, DL-1, BTL-3]
- (2 marks) [CO2, DL-1, BTL-2]



**Cochin University of Science and Technology**  
**Department of Computer Science**

**Eighth Semester M.Sc. (Five-Year Integrated) in Computer Science  
 (Artificial Intelligence & Data Science)**

End Semester Examination - April 2025

**21-805-0807: Natural Language Processing with Deep Learning**

Duration : 3 Hrs

Maximum Marks : 50

---

**Answer all questions. From each question fully answer either (a) or (b)**

1. (a) Define *distributional hypothesis* in language processing. Explain why similar words 'smart' and 'intelligent' might have similar vector representations in Word2Vec. How does this benefit NLP tasks? [10 marks][CO1, DL-1, BTL-2]  
OR  
 (b) (i) Compare the sparse and dense vector representations of words with an example of each. [6 marks][CO1, DL-2, BTL-2]  
 (ii) Describe one NLP task where dense vectors would outperform sparse vectors, justifying your choice. [4 marks][CO1, DL-2, BTL-3]
  
2. (a) With a neat architecture diagram and mathematical equations, explain Feedforward network for sentiment analysis using traditional hand-built features of the input text. [10 marks][CO2, DL-2, BTL-2]  
OR  
 (b) Explain a simple Feedforward neural language model(LM) using a neat architecture diagram and mathematical equations. Assume vocabulary size  $|V|$ , context length  $n$ , and embedding dimension  $d$  for the LM. [10 marks][CO2, DL-2, BTL-2]
  
3. (a) (i) Explain LSTM Architecture and its working with proper mathematical equations. [6 marks][CO2, DL-2, BTL-2]  
 (ii) You observe that your vanilla RNN model predicts a positive sentiment for the following passage, whereas LSTM predicts a negative one. Give reasons. [4 marks][CO3, DL-3, BTL-3]

*My flight got canceled after 3 hours on the tarmac, the hotel lost my reservation, and the airline offered me a \$10 meal voucher for my 14-hour delay. But at least I got to enjoy the breathtaking sunrise at the airport.*

OR

- (b) With a neat architecture diagram and mathematical equations, explain how Recurrent Neural Network (RNN) can be used for sequence labeling. Also, discuss the training data, loss function, and evaluation criteria involved in the task.
- [10 marks][CO3, DL-2, BTL-2]
4. (a) Explain the *sequence-to-sequence* model used for Neural Machine Translation (NMT).  
[10 marks][CO2, DL-2, BTL-3]
- OR
- (b) Explain how Convolution Neural Network (CNN) can be applied for sentence classification tasks.
5. (a) (i) Define Natural Language Generation (NLG) models with deep learning. Explain *Teacher forcing* algorithm used in training text generation models.  
[10 marks][CO2, DL-2, BTL-3]
- (ii) Explain the *exposure bias* in NLG models caused by teacher forcing. Discuss any two methods to overcome this bias.  
[6 marks][CO2, DL-2, BTL-2]
- OR
- (b) Define Coreference resolution. Discuss the steps involved in doing Coreference resolution using simple neural network.  
[4 marks][CO3, DL-2, BTL-2]
- OR
- Coreference resolution  
[10 marks][CO2, DL-2, BTL-2]



# Cochin University of Science and Technology

## Department of Computer Science

M.Sc. (Five-Year Integrated) in Computer Science  
(Artificial Intelligence & Data Science)

End Semester Examination - April 2025

21-805-0808:Digital Image and Video Coding

Duration : 3 Hrs

Maximum Marks : 50

Answer all questions. From each question fully answer either (a) or (b).

1. (a) Generate Golomb code for  $m=5$  for numbers 1 to 15

((10 marks) [CO1, DL-3, BTL-3])

OR

- (b) Consider a set of six symbols {P, Q, R, S, T, U} with the given probabilities:

| Symbol | Probability |
|--------|-------------|
| P      | 0.30        |
| Q      | 0.15        |
| R      | 0.25        |
| S      | 0.10        |
| T      | 0.10        |
| U      | 0.10        |

Table 1: Symbol Probabilities

Construct the standard Huffman code and determine the variance of codeword lengths.  
Construct the minimum variance Huffman code and compare its performance with the  
standard Huffman code.

((10 marks) [CO1, DL-3, BTL-3])

2. (a) A sequence is encoded using the LZW algorithm and the initial dictionary shown in the following table. The output of the LZW encoder is the following sequence: 6 3 4 5 2 3 4 6 2 9 11 16 12 14 4 20 10 8 23 13. Decode this sequence. ((10 marks) [CO2, DL-3, BTL-3])

OR

- (b) Build the initial dictionary and encode the string BARBARA-BARBBARRBABA-BAR  
using LZ78 algorithm ((10 marks) [CO2, DL-3, BTL-3])

| Index | Entry |
|-------|-------|
| 1     | a     |
| 2     | b     |
| 3     | h     |
| 4     | i     |
| 5     | s     |
| 6     | t     |

Table 2: 2.a Initial dictionary for the problem

3. (a) Explain any 6 distortion matrices used in compression standard.

((10 marks) [CO3, DL-2, BTL-2])

OR

- (b) Explain Scalar Quantization, Uniform Quantization, and Vector Quantization ((10 marks) [CO3, DL-1, BTL-2])

4. (a) Explain scalability in MPEG standards

((10 marks) [CO4, DL-1, BTL-2])

OR

- (b) 1. Write the 8-directional chain code of the image given in Figure1

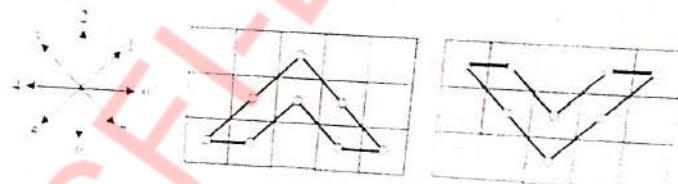


Figure 1: 4. (b)

2. Explain the working of transform coders

5. (a) Describe the steps involved in JPEG compression standard ((10 marks) [CO4, DL-1, BTL-2])

OR

- (b) Comment on the MPEG compression standard. How face and body are animated in MPEG. ((10 marks) [CO5, DL-2, BTL-2])

**DEPARTMENT OF COMPUTER SCIENCE VIII SEMESTER MASTER OF SCIENCE (FIVE YEAR INTEGRATED) IN COMPUTER SCIENCE (ARTIFICIAL INTELLIGENCE AND DATA SCIENCE)**

**END SEMESTER EXAMINATION (APRIL 2025) – PROFESSIONAL COMMUNICATION Time: 3hrs**

**Max marks:50**

Q1. Discuss the barriers to listening in detail and give suggestions to overcome each one of them. (4 marks)

Q2. What is a project report ? Write a project report on the recent project you have done in your college. (5 marks)

Q3. The District Collector, Jhunjhunu, is concerned about the rapid increase in the number of accidents in Pilani. The Chairman, Municipal Corporation, Pilani, has been asked to submit a report investigation the causes and suggesting measures to improve the situation. (5 marks)

Prepare an outline for the above report

Q4. As the Sales Director of Fitness Plus Centre, Bangalore, draft a sales letter to Business Professions selling them on your 3 Wellness Packages: 1. The 3 – day Fitness Weekend 2. The 7 – day Total Fitness Program 3. The individualized Corporate Well – being Program. (5 marks)

**OR**

Realizing the need of packaging services in Faridabad, Elite Professional Packers have recently started their services in the city. You, as the publicity manager of this company have the onus of promoting this service.

Draft a sales letter to be sent to the prospective users.

Q5. Discuss the important points to be considered while drafting a cover letter to accompany a resume. (3 marks)

Q6. Answer the following questions:( $2 \times 3 = 6$  marks)

- a. Explain the role of eye contact in communication.
- b. What are the four different space zones according to Hall?
- c. Proxemics play a prominent role in communication. Justify?

Q7. Identify the communication barrier that describes each of the following situations:( $1 \times 5 = 5$  marks)

- a. 'Every time I have a meeting with Mr Gupta, I end up disagreeing with him about a particular issue.'
  - b. Teacher: 'Students, why have you not submitted the report within the fortnight?' Students: 'But you asked us to submit it bimonthly.'
  - c. 'This room is horrible to work in. I am able to hear everyone around, and there is no scope for privacy.'
  - d. 'It is quite tedious to manually work on the students' records, but I fear using the computer as it might corrupt all our data.'
- 
- e. 'If you want some more information from me, ask only the specific questions and do not waste my precious time!'

Q8. Read each sentence and fill in the blank, choosing the correct homophone. (2 marks)

- a. Please \_\_\_\_\_ our sincere apologies. (except, accept)
- b. Your opinion will not \_\_\_\_\_ my decision. (affect, effect)
- c. He's a man \_\_\_\_\_ opinion I respect. (who's, whose)

d. I would \_\_\_\_\_ extreme caution. (advice, advise)

Q9. Fill in the blanks with suitable prepositions. (2 marks)

- She was born \_\_\_\_\_ a hamlet called Pilani.
- Ramesh comes to work by car, but I prefer to come \_\_\_\_\_ foot.
- He held his breath \_\_\_\_\_ seven minutes.
- He usually travels to Chennai \_\_\_\_\_ train.

Q10. Join the following pairs of sentences with the suitable conjunctions. Make necessary changes wherever required. (2 marks)

- You must be quiet. You must leave the room.
- Soldiers fought for the country. Soldiers died for the country.
- I have a cricket bat. I have a set of stumps.
- The captive fell down on his knees. The captive pleaded for mercy.

Q11. Select the correct form of the verb below and write it in the space. (2marks)

- All that glitters \_\_\_\_\_ not gold. (is/are)
- Two and two \_\_\_\_\_ four. (make/makes)
- The general with all his soldiers \_\_\_\_\_ killed. (was/were)
- She is one of those people who \_\_\_\_\_ calm in an emergency. (keep/keeps)

Q12. The following formal letter is ineffective. Rewrite it keeping the principles of business letter writing in mind: (5 marks)

11 may,2014

Avy trading Corporation

Daryagunj, vijay Nagar,  
New Delhi - 110005

Telephone: 011-2345678

Mr. Ravi Malhotra

Sales manager, Reva computers  
Ajmer road, Jaipur - 302006

Dear mr. Malhotra

We saw your advertisement in the Times of India about one of your important products. The advertisement caught our attention because we are interested in this product. In fact, we want to equip our corporate office with modern facilities and we would like to buy this product.

However, we cannot send the purchase unless we know more about this product. Send us more information about the product as soon as possible. We want to know many things, which include product specification and special features of this model of the product, details of discount for bulk purchase, an estimate for the cost of the product, and details regarding terms of business and delivery dates.

Respond to this letter as early as possible.

Yours Sincerely

Amit Jain

Q13. What do you understand by the term technical proposals? What is the structure of proposals? (4 marks)



Cochin University of Science And Technology  
Department of Computer Science

VIII Semester Five Year Integrated M.Sc in Computer Science (Artificial Intelligence & Data Science)

MAKEUP EXAMINATION-April2025

21-805-0802: Probabilistic Graphical Models

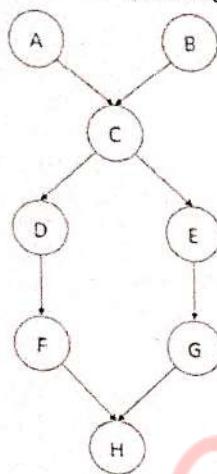
Duration: 3 Hours

Maximum Marks: 50

Answer all questions. From each question fully answer either (a) or (b)

1.

- a. Consider the following Bayesian network



- i. Are D and E necessarily independent given evidence about both A and B? Justify your answer  
ii. Are A and C necessarily independent given evidence about D? Justify your answer  
iii. Are A and H necessarily independent given evidence about C? Justify your answer  
iv. Prepare a note on P map

[6 marks] [CO2, DL-2, BTL-3]

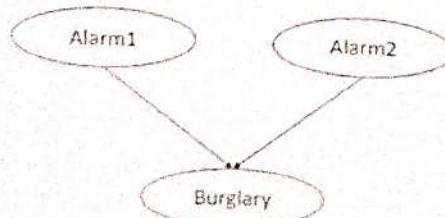
[4 marks] [CO2, DL-2, BTL-3]

OR

b.

- i. Consider the Bayesian network.

[4 marks] [CO2, DL-3, BTL-3]



Assume that:

$$P(\text{Alarm1}) = 0.1$$

$$P(\text{Alarm2}) = 0.2$$

$$\begin{aligned}
 P(\text{Burglary} \mid \text{Alarm1}, \text{Alarm2}) &= 0.8 \\
 P(\text{Burglary} \mid \text{Alarm1}, \neg \text{Alarm2}) &= 0.7 \\
 P(\text{Burglary} \mid \neg \text{Alarm1}, \text{Alarm2}) &= 0.6 \\
 P(\text{Burglary} \mid \neg \text{Alarm1}, \neg \text{Alarm2}) &= 0.5
 \end{aligned}$$

Calculate  $P(\text{Alarm2} \mid \text{Burglary}, \text{Alarm1})$ . Show all of your reasoning.

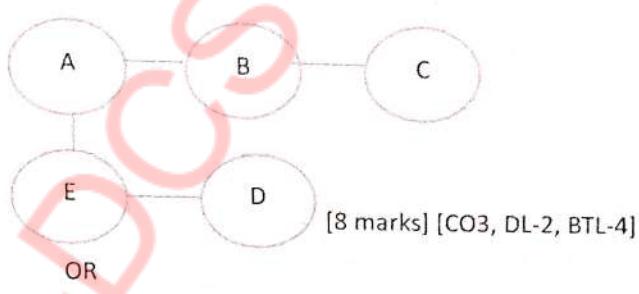
- ii. Compare Bayesian network and Markov network [6 marks] [CO2, DL-1, BTL-2]

2.

a.

- i. Define pairwise Markov network [2 marks] [CO3, DL-1, BTL-1]  
 ii. Determine whether the following conditional independence statements hold true based on the global Markov property. Justify your answers by referring to the graph structure and the concept of separation.

- a)  $A \perp C \mid B$  (3 Marks)  
 b)  $A \perp D \mid \{B, E\}$   
 c)  $B \perp E \mid A$   
 d)  $\{A, E\} \perp C \mid B$



- b. Consider a Markov Network over binary variables  $X_1, X_2, X_3$  with the following potential functions:

$$\phi_1(X_1, X_2)$$

| $X_1$ | $X_2$ | $\phi_1(X_1, X_2)$ |
|-------|-------|--------------------|
| 0     | 0     | 3                  |
| 0     | 1     | 1                  |
| 1     | 0     | 1                  |
| 1     | 1     | 2                  |

$$\phi_2(X_2, X_3)$$

| $X_2$ | $X_3$ | $\phi_2(X_2, X_3)$ |
|-------|-------|--------------------|
| 0     | 0     | 2                  |
| 0     | 1     | 3                  |
| 1     | 0     | 3                  |
| 1     | 1     | 1                  |

- i. Draw the undirected graph corresponding to this Markov Network. [2 marks] [CO6, DL-1, BTL-3]  
 ii. Calculate the unnormalized joint probability distribution  $P'(X_1, X_2, X_3) = \phi_1(X_1, X_2)\phi_2(X_2, X_3)$  for all possible assignments of  $X_1, X_2, X_3$  [4 marks] [CO2, DL-1, BTL-5]  
 iii. How would you obtain the normalized joint probability distribution  $P(X_1, X_2, X_3)$  from  $P'(X_1, X_2, X_3)$ ? [2 marks] [CO2, DL-1, BTL-5]  
 iv. Are  $X_1$  and  $X_3$  conditionally independent given  $X_2$  in this network? Justify your answer based on the graph structure. [2 marks] [CO2, DL-1, BTL-4]

3.

a.

- i. Prove or disprove (by providing a counter-example) each of the following properties of independence:  $P(X, Y | Z) = P(X | Y, Z) P(Y | Z)$  [4 marks] [CO1, DL-1, BTL-3]  
ii. Prepare a note on MAP query. [4 marks] [CO1, DL-2, BTL-2]  
iii. Define probability density function [2 marks] [CO1, DL-1, BTL-1]

OR

b.

- i. Consider two discrete random variables,  $U$  and  $V$ , with the following joint probability distribution  $P(U,V)$ :

| $U \setminus V$ | -1   | 0    | 1    |
|-----------------|------|------|------|
| -1              | 0.10 | 0.05 | 0.15 |
| 0               | 0.05 | 0.20 | 0.10 |
| 1               | 0.15 | 0.10 | 0.10 |

Evaluate the following:

- i.  $P(U=0, V=1)$   
ii.  $P(U \geq 0, V \leq 0)$   
iii.  $P(U=-1 | V=1)$   
iv. Are  $U$  and  $V$  independent? Provide justification. [4 marks] [CO1, DL-1, BTL-5]  
v. Define PDAG [2 marks] [CO1, DL-1, BTL-1]  
vi. Consider the following three DAGs over variables  $A, B, C$ :

**DAG 1:**  $A \rightarrow B \rightarrow C$

**DAG 2:**  $A \leftarrow B \leftarrow C$

**DAG 3:**  $A \rightarrow B \leftarrow C$

a) Are DAG 1 and DAG 2 I-equivalent? Justify your answer by checking the conditions for I-equivalence.

b) Are DAG 1 and DAG 3 I-equivalent? Justify your answer by checking the conditions for I-equivalence. [4 marks] [CO2, DL-3, BTL-3]

4.

a.

- i. Define a Gaussian Bayesian Network. What are the key assumptions made about the variables in such a network? [4 marks] [CO3, DL-1, BTL-2]  
ii. Consider a set of three continuous variables  $X=[X_1, X_2, X_3]^T$  following a multivariate Gaussian distribution with mean  $\mu=[1, 2, 0]^T$  and covariance matrix:

$$\Sigma = \begin{bmatrix} 2 & 1 & 0 \\ 1 & 3 & -1 \\ 0 & -1 & 4 \end{bmatrix}$$

Determine the precision matrix  $K=\Sigma^{-1}$

[6 marks] [CO3, DL-3, BTL-3]

OR

b.

- i. write down the variable elimination algorithm [4 marks] [CO3, DL-2, BTL-2]
- ii. Consider a Bayesian Network with three variables:  $y_1$ ,  $y_2$ , and  $y_3$ .

The network structure is:  $y_1 \rightarrow y_2 \rightarrow y_3$ . with Gaussian Conditional Probability Distributions (CPDs)

$$P(y_1) = N(2, 1)$$

$$P(y_2 | y_1) = N(2y_1 + 1, 2)$$

$P(y_3 | y_2) = N(-0.5y_2 - 0.5, 1)$  Compute the joint Gaussian distribution  $P(y_1, y_2, y_3) = N(\mu, \Sigma)$ , where  $\mu$  is the mean vector and  $\Sigma$  is the covariance matrix.

[6 marks] [CO3, DL-3, BTL-3]

5.

- a. Write a note in details on the topic learning in Probability graphical model

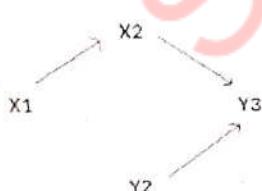
[10 marks] [CO4, DL-1, BTL-2]

OR

b.

- i. Write down three pc orientation rule [3 marks] [CO4, DL-1, BTL-1]
- ii. Write down PC algorithm and With the help of PC algorithm find out PDAG

[7 marks] [CO3, DL-3, BTL-3]



Cond. indep.:  $X_1 \perp\!\!\!\perp Y_2$ ,  $X_2 \perp\!\!\!\perp Y_2$ ,  $X_1 \perp\!\!\!\perp Y_3 | X_2$ .



## Cochin University of Science And Technology Department of Computer Science

VIII Semester Five Year Integrated M.Sc in Computer Science (Artificial Intelligence & Data Science)

End Semester Examination - April 2025

21-805-0802: Probabilistic Graphical Models

Duration: 3 Hours

Maximum Marks: 50

Answer all questions. From each question fully answer either (a) or (b)

1. (a)

- i. Prepare a note on different types of graph [5 marks] [CO1, DL-1, BTL-1]
- ii. Prepare a note on I-map [5 marks] [CO1, DL-2, BTL-2]

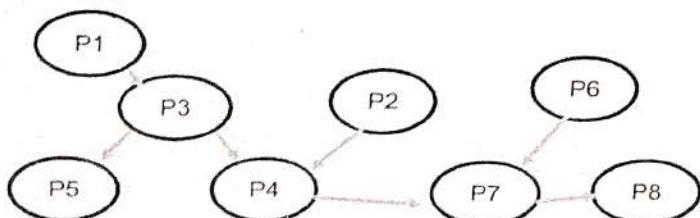
OR

(b)

- i. Prove or disprove (by providing a counter-example) each of the following properties of independence:  $P(X, Y | Z) = P(X | Y, Z)P(Y | Z)$  use Bayes rule and chain rule [4 marks] [CO1, DL-3, BTL-2]
- ii. compare probability query and MAP query [4 marks] [CO1, DL-2, BTL-2]
- iii. Define probability distribution [2 marks] [CO1, DL-1, BTL-1]

2. (a)

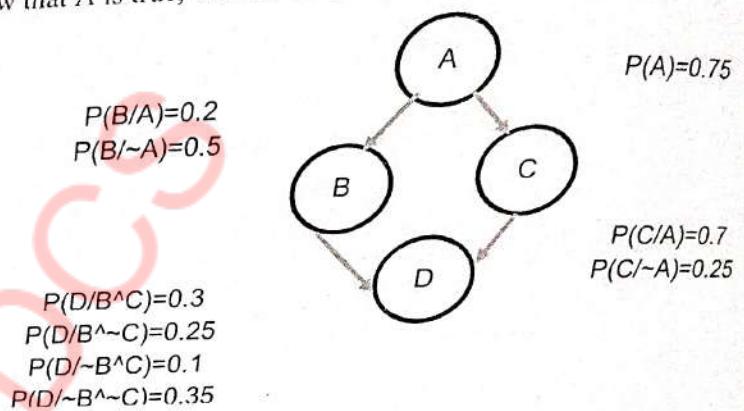
Having the network/graph shown in figure below, decide on the validity of following statements:



- i.  $P_1, P_5 \perp P_6 | P_8$ ,
- ii.  $P_1 \perp P_2 | P_8$
- iii.  $P_1 \perp P_2, P_5 | P_4$
- iv.  $P_3 \perp P_7$
- v. Draw the two other -Iequivalence graph for the above graph

[6 marks] [CO2, DL-2, BTL-2]

- vi. Consider the following Bayesian network. A, B, C, and D are Boolean random variables. If we know that A is true, what is the probability of D being true?



[4 marks] [CO2, DL-3, BTL-2]

OR

- (b) A patient goes to the doctor for a medical condition, the doctor suspects three diseases as the cause of the condition. The three diseases are  $D_1, D_2, D_3$ , which are marginally independent from each other. There are four symptoms  $S_1, S_2, S_3, S_4$  which the doctor wants to check for presence in order to find the most probable cause of the condition. The symptoms are conditionally dependent to the three diseases as follows:  $S_1$  depends only on  $D_1$ ,  $S_2$  depends on  $D_1$  and  $D_2$ .  $S_3$  depends on  $D_1$  and  $D_3$ , whereas  $S_4$  depends only on  $D_3$ . Assume all random variables are Boolean, they are either 'true' or 'false'.

- i. Draw the Bayesian network for this problem [2 marks] [CO2, DL-3, BTL-3]
- ii. Write down the expression for the joint probability distribution as a product of conditional probabilities. [2 marks] [CO2, DL-2, BTL-3]
- iii. What is the number of independent parameters that is required to describe this joint distribution? [3 marks] [CO2, DL-2, BTL-3]
- iv. What is the Markov Blanket of variable  $S_2$  [2 marks] [CO2, DL-2, BTL-3]
- v. If we observe the fourth symptom, ( $S_4 = \text{true}$ ), for which diseases do we gain information? [1 marks] [CO2, DL-1, BTL-3]

3. a)

- i. Converting a Bayesian Network to a Markov Network, a process known as "moralization," involves addressing certain structural differences that can lead to challenges. mention the two challenges [2 marks] [CO2, DL-1, BTL-1]
- ii. Define Gibbs distribution [2 marks] [CO2, DL-1, BTL-3]

- iii. Define the induced Markov network [2 marks] [CO2, DL-2, BTL-3]  
 iv. Define clique and maximal clique with an example [4 marks] [CO2, DL-3, BTL-3]

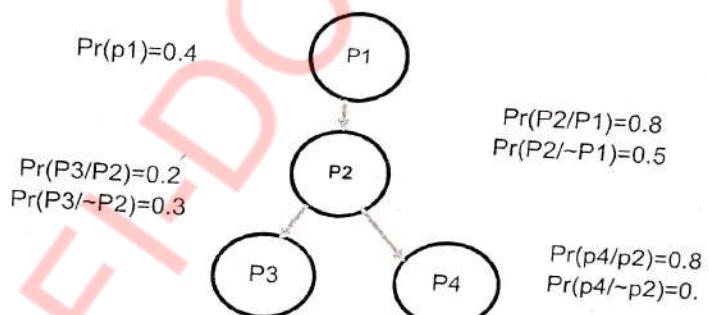
(b)

OR

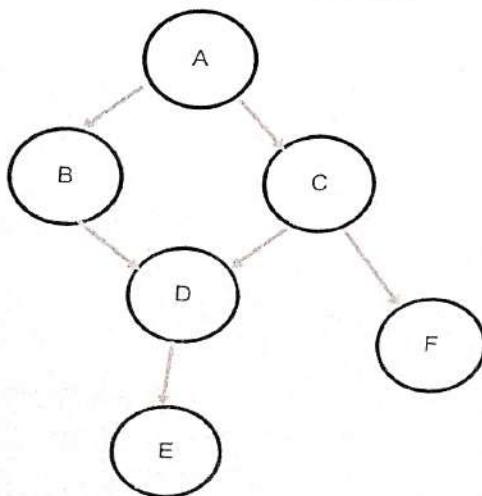
- i. Write a note factor graph. [5marks] [CO3, DL-2, BTL-3]  
 ii. prepare a note on Markov random field [5marks] [CO3, DL-2, BTL-2]

4. (a)

- i. Given the network below, calculate marginal and conditional probabilities  $\Pr(p_2|\neg p_3)$ ,  $\Pr(p_1|p_2, \neg p_3)$ . Apply the method of variable elimination.



- ii. If we perform variable elimination on the graph shown below with the variable ordering B,A,C,F,E,D what is the intermediate factor produced by the third step (just before summing out C). show the steps? [6 marks] [CO3, DL-3, BTL-2]  
 [4 marks] [CO3, DL-2, BTL-1]



OR

- (b) [2 marks] [CO3, DL-1, BTL-2]
- i. Define multivariate distribution
  - ii. Consider a Bayesian Network with three variables: A, B, and C. The network structure is:  $A \rightarrow B \rightarrow C$ . with Gaussian Conditional Probability Distributions (CPDs)  
 $P(A) = N(A | 2, 9)$   
 $P(B | A) = N(B | 0.8A + 1, 4)$   
 $P(C | B) = N(C | -0.5B + 3, 1)$

Compute the joint Gaussian distribution  $P(A, B, C) = N(\mu, \Sigma)$ , where  $\mu$  is the mean vector and  $\Sigma$  is the covariance matrix.

[8 marks] [CO3, DL-3, BTL-3]

5. (a) [5 marks] [CO2, DL-3, BTL-3]
- i. write down pc algorithm
  - ii. Write down the three goal of learning probability graphical model
- [5 marks] [CO6, DL-2, BTL-2]

OR

- (b) Prepare a note in detail on learning in probability graphical model

[10 marks] [CO4, DL-3, BTL-3]

\*\*\*\*\*

**COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**DEPARTMENT OF COMPUTER SCIENCE**

Programme: VIII Semester Five Year Integrated M.Sc in Computer Science (Artificial Intelligence & Data Science)

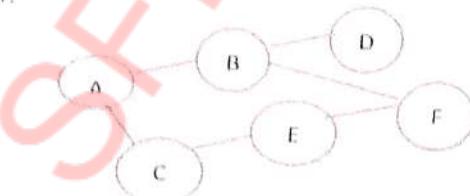
Course Code & Title: 21-805-0802: Probabilistic Graphical Models

|                                |                  |                          |
|--------------------------------|------------------|--------------------------|
| Name of Examination: Series II | Max. Marks: 20   | Semester: VIII           |
| Batch: 2021-26                 | Date: 11.03.2025 | Time: 9:00 AM – 11:00 AM |

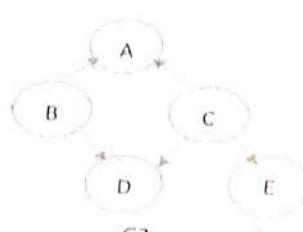
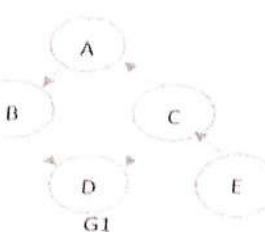
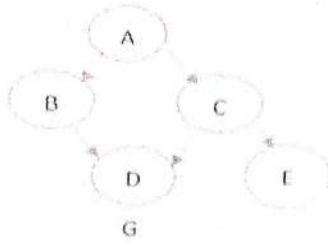
1.

- a) Consider the distribution  $P(a,b,c,d) = \phi_{ab}(a,b) \phi_{bc}(b,c) \phi_{cd}(c,d) \phi_{da}(d,a)$  where  $\phi$  are the potentials.  
 Draw a Markov network for the distribution. (1 marks) [CO2, DL-1, BTL-2]
- b) Define Markov network (1 marks) [CO2, DL-1, BTL-1]
- c) Define separation in Markov network. (1 marks) [CO2, DL-1, BTL-1]
- d) Consider the Markov network. State whether the following independence assertions are in I(H). Justify your answer. (3 marks)[CO2, DL-2, BTL-3]

- I.  $(A \perp\!\!\!\perp E | B, C)$
- II.  $(A \perp\!\!\!\perp D | B)$
- III.  $(A \perp\!\!\!\perp F | B)$

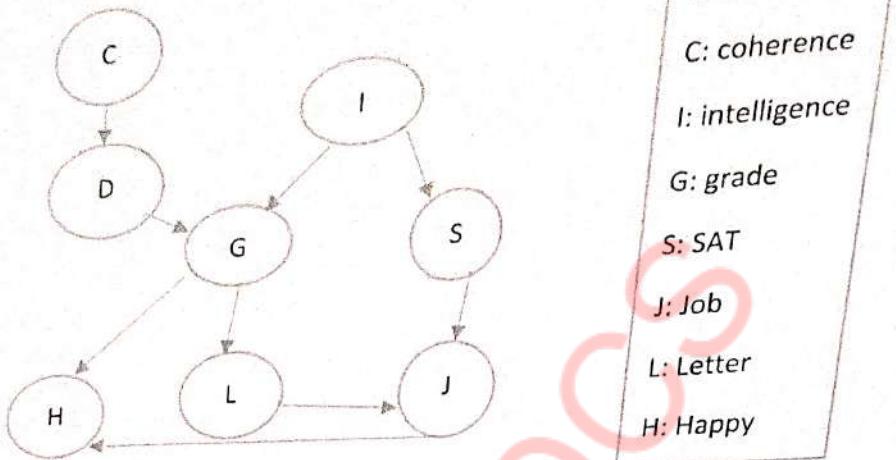


2. In the figure below, graph G state I equivalent to which other graph/graphs. Justify your answer.



- i. G is equivalent to G1 (2 marks) [CO2, DL-2, BTL-4]
- ii. G is equivalent to G2 (5 marks) [CO2, DL-2, BTL-4]
- iii. Prepare a note in detail on PDAG .

4. Consider the network demonstrated in the following figure.



|                 |
|-----------------|
| D: difficulty   |
| C: coherence    |
| I: intelligence |
| G: grade        |
| S: SAT          |
| J: Job          |
| L: Letter       |
| H: Happy        |

(1 mark) [CO2, DL-1, BTL-1]

a) Define factor.

b) Apply the variable elimination algorithm to compute  $p(J)$  use the elimination order CDIHGSL (elimination order is from Left to Right, for example first eliminate C, then eliminate D etc).

(2 mark) [CO2, DL-2, BTL-3]

5. Prove that it is not necessary that all distribution can have a p map With an example

(4 mark) [CO2, DL-3, BTL-2]

OR

6. prepare a note in detail on the topic "application of undirected graphs using an example of noise removal from a binary image"

(4 mark) [CO6, DL-3, BTL-3]

\*\*\*\*\*



## COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

### DEPARTMENT OF COMPUTER SCIENCE

Programme: Eighth Semester Five Year Integrated MSc in Computer Science (Artificial Intelligence & Data Science)

Course Code & Title 21-805-0801: Computer Vision

|                                |                   |  |
|--------------------------------|-------------------|--|
| Name of Examination: Series II | Max. Marks: 20    | Semester: VIII                               |
| Batch: 2021-26                 | Duration: 2 Hours | Date: 10.03.2025<br>Time: 9:00 AM – 11:00 PM |

#### Answer any two questions

1. Explain the different similarity measures in QBE? (5 marks) [CO4, DL-3, BTL-4]
2. Explain image subtraction algorithm? (5 marks) [CO5, DL-2, BTL-1]
3. Explain motion vector calculation? (5 marks) [CO7, DL-2, BTL-1]
4. Explain database organisation for images? (5 marks) [CO7, DL-3, BTL-2]

#### Answer any two questions

5. Explain Affine transformation? (5 marks) [CO7, DL-4, BTL-1]
6. Explain local feature focus method? (5 marks) [CO8, DL-4, BTL-1]
7. Understand the process of pose clustering with an algorithm? (5 marks) [CO8, DL-3, BTL-1]
8. Explain 2D Object Recognition via Relational Matching? (5 marks) [CO7, DL-3, BTL-1]



## COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

### DEPARTMENT OF COMPUTER SCIENCE

Programme: Eighth Semester Five Year Integrated MSc in Computer Science (Artificial Intelligence & Data Science)

Course Code & Title 21-805-0801: Computer Vision

|                               |                   |  |
|-------------------------------|-------------------|--|
| Name of Examination: Series I | Max. Marks: 20    | Semester: VIII                               |
| Batch: 2021-26                | Duration: 2 Hours | Date: 10.02.2025<br>Time: 9:00 AM – 11:00 PM |

#### Answer any two questions

1. Explain the five frames of reference? (5 marks) [CO1, DL-1, BTL-4]
2. Explain object counting algorithm? (5 marks) [CO3, DL-1, BTL-2]
3. Explain connected components labelling of binary images. (5 marks) [CO3, DL-1, BTL-2]
4. Apply different types of morphological operations to an image. (5 marks) [CO3, DL-2, BTL-3]

#### Answer any two questions

5. Explain feature detection? (5 marks) [CO5, DL-1, BTL-1]
6. Explain view-invariant local image descriptors? (5 marks) [CO5, DL-1, BTL-1]
7. Explain quantitative texture measures? (5 marks) [CO5, DL-1, BTL-1]
8. Explain corner detection? (5 marks) [CO5, DL-1, BTL-1]



## Cochin University of Science And Technology

### Department of Computer Science

**Eighth Semester Five Year Integrated MSc in Computer Science  
(Artificial Intelligence & Data Science)  
End Semester Examination - April 2025**  
**21-805-0801: Computer Vision**

Duration: 3 Hours

Maximum Marks: 50

- 1.(a) Explain the properties of a region and how do we calculate the region adjacency graph.  
[5 marks][CO4, DL-2, BTL-2]
- (b) How can we analyze and manipulate the shapes and structures of objects in a binary imagery using structuring elements  
[5 marks][CO1, DL-2, BTL-2]
- OR
- 2.(a) Explain any two algorithms for connected components labeling of binary images?  
[5 marks][CO1, DL-2, BTL-2]
- (b) Explain the five frames of references?  
[5 marks][CO4, DL-4, BTL-2]
- 3.(a) Explain the different color models and Convert RGB(29,104,215 ) to HSI  
[5 marks][CO2, DL-3, BTL-3]
- (b) Explain any two Efficient Feature Matching Algorithms  
[5 marks][CO2, DL-3, BTL-4]
- OR
- 4.(a) Explain scale invariant feature transform  
[5 marks][CO6, DL-3, BTL-4]
- (b) Explain the different stages of keypoint detection and matching?  
[5 marks][CO6, DL-3, BTL-4]
- 5.(a) How can we detect the Motion of 3D scene points by deriving motion vectors for interesting points  
[5 marks][CO7, DL-3, BTL-4]
- (b) Explain the general cases of Motion Phenomena and how we can detect an object moving across a constant background.  
[5 marks][CO7, DL-3, BTL-4]
- OR
- 6.(a) Explain Methods for indexing images in large databases?  
[5 marks][CO5, DL-3, BTL-4]

- (b) Explain the major classes of similarity measures used in QBE? [5 marks][CO5, DL-3, BTL-4]
- 7.(a) Explain 2d object registration and affine mapping function [5 marks][CO6, DL-3, BTL-4]
- (b) In the context of 2D object recognition, explain how Affine Mapping can be used to recognize and determine an object in an image where only a single model is available for matching. [5 marks][CO6, DL-3, BTL-3]
- OR
8. (a) Describe how 2D Object Recognition is done using Relational Matching [5 marks][CO6, DL-3, BTL-4]
- (b) Explain the Geometric Hashing method for object recognition, detailing both the offline preprocessing and online recognition steps. [5 marks][CO6, DL-3, BTL-5]
- 9.(a) How can line drawings from the block world be labeled to accurately represent their 3D structure while ensuring consistency in edge classifications and junction types? [5 marks][CO8, DL-3, BTL-2]
- (b) Explain the camera calibration method with an example? OR [5 marks][CO8, DL-4, BTL-2] [5 marks][CO8, DL-3, BTL-2]
- 10.(a) Explain how depth is computed in stereo vision
- (b) How do texture gradients in a 2D image provide a depth cue that helps perceive the 3D structure of a scene? [5 marks][CO8, DL-2, BTL-2]