

B127471(022)

B. Tech. (Hon's) (Fourth Semester) Examination,

April-May 2023

(AICTE Scheme)

(CS Engg. Branch)

COMPUTER NETWORK

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Part (a) of each question is compulsory & carries 4 marks. Attempt any two parts from (b), (c) and (d) of each question and each part carries 8 marks.

Unit-I

1. (a) Write down the difference between X.25 and Frame relay protocols.
- (b) What are the different types of network topologies? Explain in detail.

- (c) Explain about the working flow of OSI and TCP/IP model.
- (d) What is PSTN (Public Switched Telephone Network)?

Unit-II

2. (a) What is flow control in data link layer? Explain sliding window protocol methods.
- (b) Explain Hamming code with the example of 1011001.
- (c) Explain random access protocol methods.
- (d) What is Ethernet. Explain various types of ethernet in tabular form for each.

Unit-III

3. (a) What is the difference between Subnetting and Supernetting? Explain with example.
- (b) For the following IP Address :
- 1.2.3.4
 - 10.15.20.60

- 130.1.2.3
- 150.0.150.150
- 200.1.10.100
- 220.15.1.10
- 250.0.1.2
- 300.1.2.3

Identify the Class, Network IP Address, Direct broadcast address and Limited broadcast address of each IP Address.

- (c) Explain IPv4 and IPv6 header format in detail.
- (d) Explain Distance vector and Link state routing algorithm.

Unit-IV

4. (a) What is the concept of piggybacking?
- (b) Differentiate between TCP and UDP.
- (c) Explain TCP congestion control methods in detail.
- (d) Explain leaky bucket method with suitable diagram.

Unit-V

5. (a) What is DNS? Explain in detail.
- (b) Explain the working diagram of SMTP vs POP vs IMAP.
- (c) What is SNMP, explain with SNMP components, SNMP messages, SNMP security level, SNMP versions.
- (d) What is HTTP and FTP explain with detail.

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B. Tech. (Hon's) (Fourth Semester) Examination,

April-May 2023

(New Scheme)

(Inf. & Tech. Engg. Branch)

**ARTIFICIAL INTELLIGENCE : PRINCIPLES
and APPLICATION**

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Part (a) of each question is compulsory & carries 4 marks. Attempt any two parts from (b), (c) and (d) of each question and each part carries 8 marks.

Unit-I

1. (a) Define Turing test with suitable example.
- (b) Solve Water Jug Problems using production rules with state space concept.
- (c) What is Search? Explain DFS and BFS with proper

algorithms and examples.

- (d) What is Heuristic Function? Solve A* problem with proper algorithm and example.

Unit-II

2. (a) What is Predicates? Explain it with example.
(b) Explain constraint satisfaction. Solve the following :

$$\begin{array}{r} \text{S E N D} \\ + \text{M O R E} \\ \hline \text{M O N E Y} \end{array}$$

- (c) Explain Alpha and Beta cut off with proper example and algorithm.
(d) What is first order predicate logic (FOPL)? Convert the following in FOPL.
(i) Everyone is loyal to someone
(ii) All mangoes are sweet
(iii) All employees of software company are programmers
(iv) All purple mushrooms are poisonous

Unit-III

3. (a) Define probabilistic Reasoning.
(b) Explain Bayes' theorem with suitable example.
(c) Explain Hidden Markov Model with proper example.
(d) Explain Fuzzy set theory with suitable example.

Unit-IV

4. (a) What is Machine Learning?
(b) Differentiate between Supervised and Unsupervised learning.
(c) Explain K-Means Clustering.
(d) Explain Decision trees : Multivariate trees.

Unit-V

5. (a) What are the different data visualization tools available? Is MS-Excel data visualization tool?
(b) Explain Data Visualization? Explain different graphs used in data visualization.

- (c) How do you calculate over fitting and under fitting functions?
- (d) Why do we need Box Fitting Graph? Explain with proper graph and example.

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**B. Tech. (Hon's) (Fourth Semester) Examination,
April-May 2023**

(New Scheme)

(Computer Science Engg. Branch)

(Data Science / Artificial Intelligence)

OPERATING SYSTEM

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Part (a) of each question is compulsory & carries 4 marks. Attempt any two parts from (b), (c) and (d) of each question and each part carries 8 marks.

Unit-I

1. (a) Describe Batch Processing and Time Sharing Systems.
- (b) Explain System Calls and their types in detail.
- (c) Describe the various Operating System Services.

- (d) Explain the differences between distributed and parallel processing concepts.

Unit-II

2. (a) Describe the Process Control Block.

(b)

Process No.	Arrival Time	Priority	Burst Time
P0	0	2	25
P1	12	3	30
P2	30	1	10
P3	36	2	20

Calculate Avg. TAT and Avg. WT of each process in FCFS and Preemptive Priority.

- (c) Explain the Process Life Cycle with a neat and clean diagram.
- (d) Describe the Dining Philosophers Problem related to IPC. How can it be solved?

Unit-III

3. (a) What are the necessary conditions that must hold for a deadlock?

- (b) What is a Resource Allocation Graph? Explain in detail.
- (c) What is the Banker's Algorithm.

Check if the following snapshot of the system is in safe state?

	Allocation	Max	Availability
	A, B, C	A, B, C	A, B, C
P0	0, 1, 0	7, 5, 3	3, 2, 2
P1	2, 0, 0	3, 2, 2	
P2	3, 0, 2	9, 0, 2	
P3	2, 1, 1	2, 2, 2	
P4	0, 0, 2	4, 3, 3	

Now if the Process₁ asks for more resources as Request₁ = (1,0,2). Can this request be granted?

- (d) How we can prevent the occurrence of a deadlock? Explain.

Unit-IV

4. (a) What are the drawbacks of multiprogramming with fixed partition scheme in memory management?
- (b) Differentiate between Swapping and Paging. How do they complement each other?

(c) Explain Contiguous Memory Allocation with its advantages and disadvantages.

(d) Consider the following reference string....

1,9,9,4,0,5,2,0,2,6,6,6,6,2,2,5,5,1,2,2,3,3,8,4,5,4,3,3,
2,0,0,2,3,3,4

For three (4) frames, find the number of page faults each of the following algorithm produces.

(i) FIFO

(ii) Optimal

(iii) LRU

Unit-V

5. (a) Describe I/O Buffering.

(b) What is a file? Describe various file attributes and operations.

(c) Explain the I/O Hardware with a neat and clean PC bus structure diagram.

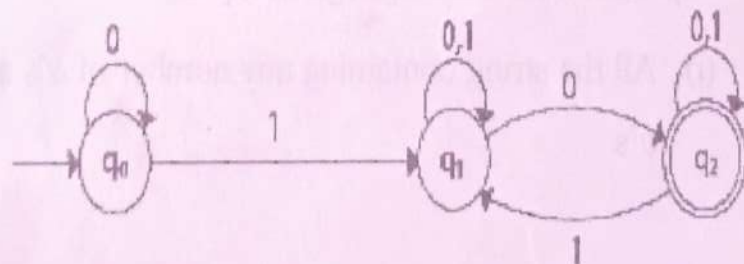
(d) What is Directory? Describe the various Directory Structure.

B127474(022)**B. Tech. (Hon's) (Fourth Semester) Examination,****April-May 2023****(Computer Science Engg. Branch)****(Data Science / Artificial Intelligence)****THEORY of COMPUTATION*****Time Allowed : Three hours******Maximum Marks : 100******Minimum Pass Marks : 35***

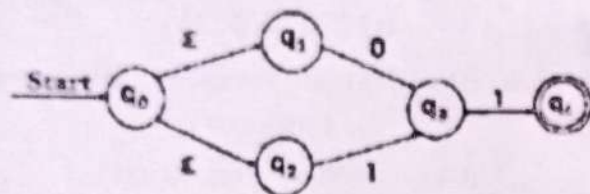
Note : Each question contains four part. Part (a) of each question is compulsory & carries 4 marks. Attempt any two parts from (b), (c) and (d) of each question and each part carries 8 marks.

Unit-I

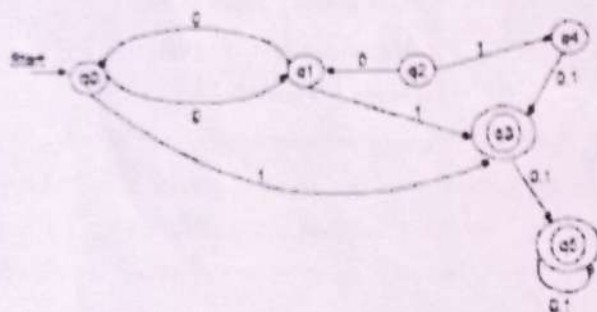
1. (a) Difference between Mealy & Moore machines.
- (b) Define NFA. Convert the following NFA to DFA.



- (c) Define Epsilon transition. Convert the NFA with ϵ into its equivalent DFA.



- (d) Explain Minimization of DFA and minimize the below DFA.

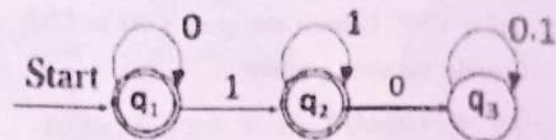


Unit-II

2. (a) Define Regular expression and write the regular expression for the language accepting
- (i) All the string containing any number of a 's and b 's

- (ii) All the string which are starting with 1 and ending with 0, over $\Sigma = \{0, 1\}$.

- (b) Construct the FA for regular expression $10 + (0 + 11)0 + 1$.
- (c) Construct the regular expression for the given DFA.



- (d) Explain pumping lemma & prove that $L = \{a^p \mid p \text{ is prime}\}$ is not regular.

Unit-III

3. (a) Define Ambiguity and show that the given grammar is ambiguous. Also, find an equivalent unambiguous grammar.

$$S \rightarrow ABA$$

$$A \rightarrow aA \mid \epsilon$$

$$B \rightarrow bB \mid \epsilon$$

- (b) Define derivation tree and derive the string "aabbabba" for leftmost derivation and rightmost derivation using a CFG given by :

$$S \rightarrow aB \mid bA$$

$$A \rightarrow a \mid aS \mid bAA$$

$$B \rightarrow b \mid bS \mid aBB$$

- (c) Define CNF. Convert the given CFG to CNF.

Consider the given grammar :

$$S \rightarrow a \mid aA \mid B$$

$$A \rightarrow aBB \mid \varepsilon$$

$$B \rightarrow Aa \mid b$$

- (d) Define GNF. Convert the given CFG to GNF.

Consider the given grammar :

$$S \rightarrow XB \mid AA$$

$$A \rightarrow a \mid SA$$

$$B \rightarrow b$$

$$X \rightarrow a$$

Unit-IV

4. (a) Design a PDA for accepting a language

$$\{a^n b^{2n} \mid n \geq 1\}.$$

- (b) Construct PDA for the given CFG, and test whether 0104 is acceptable by this PDA.

$$S \rightarrow 0BB$$

$$B \rightarrow 0S \mid 1S \mid 0$$

- (c) Define PDA & also design PDA for CFL,

$$\{wcw^r \mid w = (0+1)^* \text{ \& } w^r \text{ is reverse of } w\}.$$

- (d) Explain Pumping Lemma of Grammar, show that

$$L = \{a^i b^j \mid j = i^2\} \text{ is not CFL.}$$

Unit-V

5. (a) Explain Turing Machine.

- (b) Construct a TM for the language $L = \{0^n 1^n 2^n\}$

where $n \geq 1$.

(c) Difference between Recursive Languages and Recursively enumerable languages and application of TM.

(d) Write short notes on :

(i) Universal TM

(ii) Multitape TM

(iii) NFA TM

B127475(022)

B. Tech. (Hon's) (Fourth Semester) Examination,

April-May 2023

(New Scheme)

(CS Engg. Branch)

(Artificial Intelligence & Data Science)

R for DATA SCIENCE

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Part (a) of each question is compulsory & carries 4 marks. Attempt any two parts from (b), (c) and (d) of each question and each part carries 8 marks.

Unit-I

1. (a) Fill in the blanks :

R is a programming language and software environment for statistical computing and graphics. It was developed by statisticians

and in the early 1990s. The initial version of R was based on the programming language developed at.....

- (b) Explain the importance and functionality of Help Files in the R language. Provide examples to illustrate their usage.
- (c) A research team has conducted a study on the heights (in centimetres) of eight randomly selected individuals. The recorded heights are as follows: 160, 172, 178, 155, 183, 168, 175 and 165 cm. The team aims to analyse the data to gain insights into the height distribution of the individuals. They want to determine the average height, the minimum and maximum heights, and the height range (difference between the highest and lowest heights). Additionally, they wish to create a new vector to store the heights of the first four individuals and find the length of this vector using R.

Using R, perform the following tasks and suggest outputs :

1. Create a vector containing the heights of the eight

individuals.

2. Calculate the average height of the eight individuals.
 3. Determine the minimum and maximum heights.
 4. Calculate the height range.
 5. Assign the heights of the first four individuals to a new vector.
 6. Extract the length of the new vector.
- (d) Discuss the installation process of R programming language and RStudio, emphasizing the key concepts and steps involved. Explain the significance of each installation and their roles in the development and execution of R programs. Provide a step-by-step guide for installing R and R Studio, highlighting any potential challenges that users may encounter during the process. Finally, discuss how to verify the successful installation of both R and RStudio and ensure their proper functioning on the system.

Unit-II

2. (a) What is matrix transposition? Explain how to obtain the transpose of a given matrix and discuss its properties. Provide an example to illustrate the

process in R language.

(b) Perform the following operations in R, and provide the resulting matrices :

- (i) Create a new matrix 'mat1 & mat2' with dimensions 2×3 containing the numbers 1 to 6 and 6 to 12. ~~6 to 11~~ ~~or~~ ~~7 to 12~~
- (ii) Combine mat1 and mat2 vertically (row-wise) to create a new matrix.
- (iii) Combine mat1 and mat2 horizontally (column-wise) to create a new matrix.
- (iv) Find the transpose of the matrix 'mat'.
- (v) Create a 3×3 identity matrix 'identity_mat'.
- (vi) Calculate the element-wise addition of mat1 and mat2.
- (vii) Calculate the element-wise subtraction of mat1 and mat2.
- (viii) Perform matrix multiplication between mat1 and the transpose of mat2.

(c) Given two 3×3 matrices A and B :

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

$$[4, 5, 6] \quad [4, 5, 6]$$

$$[7, 8, 9] \quad [3, 2, 1]$$

- (i) Create a new matrix C by horizontally concatenating A and B.
- (ii) Extract the first row and third column of C and calculate their sum.
- (iii) Replace the diagonal elements of A with the diagonal elements of the 3×3 identity matrix.
- (iv) Calculate the transpose of the modified A.
- (v) Perform element-wise addition and subtraction of A and B, and then multiply the resulting matrices.
- (vi) Invert the resulting matrix from the previous step, if possible.
- (vii) Create a $3 \times 3 \times 2$ multidimensional array using A and B as the first and second slices, respectively.
- (viii) Extract the element in the first row, second column, and second slice of the multidimensional array.

(d) Given a square matrix of size $N \times N$, you are allowed to perform the following operation on the matrix :

- (i) Choose a submatrix within the given matrix defined by the top-left corner (row1, col1) and the bottom-right corner (row 2, col 2)
- (ii) Increase all the elements in the chosen submatrix by 1.

Your task is to find the minimum number of operations required to make all elements in the matrix equal. If it is not possible to make all elements equal, return -1.

Write a function `minOperations(matrix)` that takes a matrix as input and returns the minimum number of operations required.

Function signature: `minOperations(matrix: matrix)`
`> integer`

Example:

```
matrix = matrix(c(1, 2, 3, 4, 5, 6, 7, 8, 9), nrow = 3, ncol = 3)
```

```
minOperations(matrix) ==> 2
```

Explanation:

In the given example, the initial matrix is:

123

456

789

We can perform the following operations:

Choose submatrix (1, 1) to (2, 2) and increase all elements by 1. The matrix becomes:

233

566

789

Choose submatrix (2, 2) to (3, 3) and increase all elements by 1. The matrix becomes:

233

577

7810

Now, all elements in the matrix are equal to 3. It took 2 operations to achieve this, so the expected output is 2.

Note : You can assume that the input matrix will always be a square matrix of positive integers.

Unit-III

3. (a) Which of the following statements about characters in the R language are true?

(Select all that apply)

- (i) Characters can be defined using either single quotes (') or double quotes (").
- (ii) Special characters such as \n and \t can be included in character strings.
- (iii) The length of a character vector can be determined using the `length()` function.
- (iv) Characters can be concatenated using the `paste()` function.
- (v) Characters can be converted to numeric values using the `as.numeric()` function.
- (vi) Characters can be indexed using numeric or logical vectors to extract specific elements.

- (b) A fashion magazine has compiled a list of fashion trends for the upcoming season. They want to analyse the trends and extract specific information. The trends on the list are as follows.

- (i) "Floral prints are back in style."

- (ii) "Embrace oversized sweaters for a cozy look."

- (iii) "Animal prints are making a fierce comeback."

Using R, perform the following tasks:

- (i) Create strings for each of the trends.
 - (ii) Concatenate the three trends into one string, separating each trend with a newline character.
 - (iii) Extract a substring from the second trend (characters 9 to 19).
 - (iv) Check if the word "prints" is present in each of the trends.
- (c) Using R language, perform the following tasks on the given dataset and provide your code and output for each step. The dataset contains information about the favourite fruit of a group of people:

Dataset:

```
data <- c("apple", "banana", "cherry", "apple",
          "banana", "apple", "cherry", "banana", "apple",
          "cherry")
```

Tasks:

- (i) Convert the dataset into a factor and display the levels.

- (ii) Identify the unique categories in the dataset.
- (iii) Create a new factor with custom levels: "cherry", "banana", "apple", and display the levels.
- (iv) Count the frequency of each fruit in the dataset.
- (v) Cut the frequency data into two intervals: "Low" for frequencies less than or equal to 3, and "High" for frequencies greater than 3.

Provide the code and output for each step.

- (d) Explain, the concepts of defining and ordering levels, as well as combining and cutting data in the R language. Provide a brief explanation for each concept and include examples to illustrate their usage.

Unit-IV

4. (a) Which of the following options correctly describe the special values in R: Infinity, NaN, NA, and NULL? (Select all that apply.)

- (i) Infinity: Represents an infinite or extremely large numerical value.
- (ii) NaN: Represents a logical value indicating a false condition.

- (iii) NA: Indicates missing values or unavailable data.
- (iv) NULL: Denotes the absence of a value or an empty object.

- (b) Differentiate between Lists and Data Frames in the R language. Discuss their characteristics, usage, and key distinctions. Support your answer with suitable examples.
- (c) What are the advantages of using Logical Record Subsets for data manipulation in R?
- (d) Compare and contrast the usage and functionality of is-dot object checking functions and as-dot coercion functions in R. Provide examples to illustrate their differences.

Unit-V

5. (a) The code snippet above intends to create a line plot using ggplot2. However, there is an error in the code. Can you identify and correct the error to generate the desired plot?

```
library(ggplot2)
```

```
data <- data.frame(x = (1, 2, 3, 4, 5), y = (3, 5, 4, 6, 8))
```

```
ggplot(data, aes(x = x, y = y)) + geom_line(col =
"red") + geom_point (col= "blue", pch=16) +
ggtitle("My Plot") + xlab("X Values") + ylab("Y
Values")
```

- (b) Explain the concepts of reading and writing external data files in R, the significance of R-Ready data sets, and the benefits of utilizing contributed data sets in R programming. Provide relevant examples where applicable.
- (c) Explain the key aspects of ggplot 2 in R for data visualization, including the basic principles, layers and aesthetics, customization and theming, as well as advanced plots and geometries. Provide examples to demonstrate the practical application of ggplot2 for creating visually appealing and informative plots in R.
- (d) Explain the purpose and importance of setting appearance constants with geoms in R for data visualization. Highlight the role of geoms in defining visual elements such as colors, shapes, sizes and line types. Provide examples demonstrating how appearance constants can be applied to geoms in R to enhance the aesthetics and interpretability of plots.

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B. Tech. (Hon's) (Fourth Semester) Examination,

April-May 2023

(New Scheme)

(Artificial Intelligence)

DATA VISUALIZATION

Time Allowed : Three hours

Maximum Marks : 100 80

Minimum Pass Marks : 35 28

Note : Part (a) of each question is compulsory & carries 4 marks. Attempt any two parts from (b), (c) and (d) of each question and each part carries 8 marks.

Unit-I

1. (a) What do you understand by curved coordinate system?
- (b) Write detailed notes on data visualization aesthetics.
- (c) Discuss different properties of color that can be

used in data visualization

- (d) Discuss different distributions that are commonly used in data visualization.

Unit-II

2. (a) Explain Quantile-Quantile plot.
 (b) How can multiple distributions be effectively visualized together in order to compare and analyze their characteristics simultaneously?
 (c) Using data set below provide a suitable visualization technique to get the best possible information

Age group	Sports	Art	Music
10-12	30	25	15
13-15	45	35	20
16-18	55	40	25

- (d) Write short notes on following :
 (any two)
 (i) Heatmaps
 (ii) Box plot
 (iii) Cumulative distribution function
 (iv) Use of secondary axis in data visualization.

Unit-III

3. (a) Write detailed notes on bar graph and its subtypes.

- (b) A teacher wants to represent the student strength in his college. Provide a nested pi-chart using data set below create a nested pi-chart.

Engg. Discipline	No. of B.Tech Hon's Students	Gender
Computer Science	80	Male : 60, Female : 20
Electrical Engg.	45	Male : 30, Female : 15
Mechanical Engg.	60	Male : 45, Female : 15
Civil Engg.	35	Male : 20, Female : 15

- (c) A retail ice-cream vendor wants to see his ice-cream sales in recent days. His sales figures are explained in the data set below :

Create a scattered chart to represent the data below :

Date	Temp. °C	Sales Revenue (\$)	Ice cream servings
1.6.2022	25	1200	80
2.6.2022	28	1500	100
3.6.2022	20	1800	120
4.6.2022	22	1000	70
5.6.2022	24	1100	75
6.6.2022	27	1400	95
7.6.2022	32	2000	150
8.6.2022	29	1600	110
9.6.2022	26	1300	90
10.6.2022	31	1900	140

(d) Write short notes on following attributes :

(any two)

(i) Mosaic plot

(ii) Correlogram

(iii) Response curve

(iv) Geo-spatial graphs

Unit-IV

4. (a) What are cartograms, explain with examples. 4

(b) Define trends? How can you visualize trends? Write principles of curve fitting. Also define goodness of fit. 4+8+4

(c) What is uncertainty in data set? Explain different techniques to explain uncertainty in a given data? 8+8

Unit-V

5. (a) Explain the use of colors in data visualization for color deficient people.

(b) How can you represent a data set with overlapping regions?

(c) Write notes on common problems associated with use of colors in data visualization techniques.

(d) Write short notes on following attributes :
(any two)

(i) Use of different line types in data visualization

(ii) Use of different markers in data visualization

(iii) Use of different transparency levels in data visualization

(iv) Use of data labels in data visualization