Roll No. : .....

B127371(022)

B. Tech. (Hon's) (Third Semester) Examination, Nov-Dec 2024

PROBABILITY and STATISTICS

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Each question contain four parts. Part (a) of each question is compulsory of 04 marks. Attempt any two parts from (b), (c) and (d) of question carry 08 marks each.*

Unit-I

1. (a) What is the difference between mutually exclusive and equally likely events? 4

(b) (I) A random variable X has the following probability function : 8

X	0	1	2	3	4	5	6	7
P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + k$

(i) Find the value of the k.

(ii) Evaluate $P(X < 6)$ and $P(X \geq 6)$

(II) If the probability density function :

$$f(x) = \begin{cases} kx^3 & 0 \leq x \leq 3 \\ 0 & \text{elsewhere} \end{cases}$$

Find the value 'k' and find the probability between $x = \frac{1}{2}$ and $x = \frac{3}{2}$.

(c) Find the mean, variance, 3rd moment.3rd central moments for the probability mass function of discrete random variable : 8

$$(i)\ P(X) = \begin{cases} \frac{1}{2}, & \text{if } x = 1 \\ \frac{1}{3}, & \text{if } x = 2 \\ \frac{1}{6}, & \text{if } x = 3 \\ 0, & \text{otherwise} \end{cases} \qquad (ii) P(X) = \begin{cases} \frac{3}{4}, & \text{if } x = 1 \\ \frac{1}{4}, & \text{if } x = 2 \\ 0, & \text{otherwise} \end{cases}$$

(d) State and prove Baye's Theorem. A dice is thrown twice and the sum of the numbers appearing is observed to be 6. What is the conditional probability that the number 4 has appeared at least once. 8

Unit-II

2. (a) Define exponential distribution with an example of its application. 4

(b) (i) The probability that a man aged 60 will live to be 70 is 0.65. What is the probability that out of 10 men aged 60 now, at least 7 would live to be 70. 8

(ii) Six dice are thrown together at a time, the process is repeated 729 times. How many times do you expect at least 3 dice to have 4 or 6.

(c) Define the normal distribution and prove that normal distribution is a limiting form of Binomial distribution. 8

(d) i) Prove that mean & var are equal for poisson distr

ii) if a random var X follows a poisson distr such that

$$P(X=2)=9P(X=4)+90P(X=6),$$

find the mean, variance and standard deviation.

Unit-III

3. (a) X and Y are two random variable having joint function $\frac{1}{27}(2x+y)$, where x and y can assume only integer values 0, 1 and 2. Find conditional distri bution of Y for $X=x$. 4

(b) The joint probability distribution of X and Y is given in the following table.

X ↓ \ Y →	1	2
2	$\frac{1}{3}$	0
3	$\frac{1}{3}$	$\frac{1}{3}$

(i) Find the joint discrete density distribution of X and Y.

(ii) Find the conditional distribution of Y given X=2.

(iii) Find covariance of X and Y.

(c) From the given data obtain the two regression equations using the method of least squares. 8

X	2	4	6	8	10
Y	5	7	9	8	11

(d) Calculate the coefficient of correlation between the age of husband and wife from the following data : 8

Age of husband	35	34	40	43	56	20	38
Age of wife	32	30	31	32	53	20	33

Unit-IV

4. (a) What is F-test. Explain in brief. 4

(b) Explain the following terms with examples- 8

(i) Z-test, (ii) Chi-Square Test, (iii) Null Hypothesis, (iv) Alternate Hypothesis,

(c) Intelligent test of two groups of boys and girls gave the following results : 8

	Mean	S.D	Size
Girls	84	10	121
Boys	81	12	81

(i) Is the difference in mean scores significant?

(ii) Is the difference between the standard deviations significant?

(the significant value of Z at 5%=1.96)

(d) If the time taken by workers in performing a job by method I and method II is given below :

M-I 20 16 26 27 23 22

M-II 27 33 24 35 32 34 38

Show that the variance of time distribution from population from which samples are drawn do not differ significantly? (Use F(6, 5) at 0.05 = 4.95)

Unit-V

5. (a) What is Latin Square design in the field of statistics and experimental design? 4

(b) The following figures relate to the number of units sold

in five different areas by four salesman : 8

Area	Number of units			
	A	B	C	D
I	80	100	95	70
II	82	110	90	75
III	88	105	100	82
IV	85	115	105	88
V	75	90	80	65

Is there a significant difference in the efficiency of these salesman?

(Table value of F at 5% level for V_1=3 and V_2=16 is 3.24).

(c) Explain analysis of variance with suitable examples. How to use ANOVA Table for one way and two way classification. 8

(d) To study the performance of three detergents and three water temperatures, the following witness reading were obtained with specially designed equipment. 8

PTO

water temperatures, the following witness reading were obtained with specially designed equipment. 8

Water Temperature	Detergent A	Detergent B	Detergent C
Cold Water	57	55	67
Warm Water	49	52	68
Hot Water	54	46	58

Perform a two way analysis using 5% level of significance (Given F at 5%=6.94).

B0127372(022)

B. Tech. (Hon's) (Third Semester) Examination, Nov.-Dec. 2024

(Computer Science)

(Data Science)

(Part Time)

ANALYSIS & DESIGN of ALGORITHM

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Attempt all questions. Part (a) of each question is compulsory carring 4 marks. Attempt any* ***two*** *part from (b), (c) or (d) carrying 8 marks each.*

Unit-I

1. (a) Define best case, worst case and average case complexity in algorithm analysis.

(b) Solve the following recurrence equation by using master method :

(i) $T(n) = 9T(n/3) + n$

(ii) $T(n) = 3T(n/4) + n \log n$

(c) Explain all types of asymptotic notations and their properties used in designing algorithms.

(d) Find Big oh (o) notation for following equation :

(i) $f(n) = 10n^2 + 7$

(ii) $f(n) = 2^n + 6n^2 + 3n$

Unit-II

2. (a) Differentiate between linear time counting sort and radix sort.

(b) Discuss insertion sort algorithm with example.

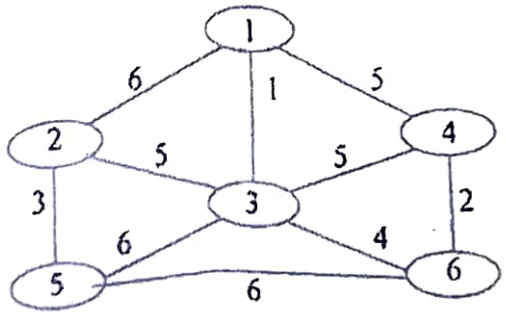
(c) Explain and analyse the merge sort algorithm in context of best case and worst case.

(d) Explain heap and its heapify operations with example.

Unit-III

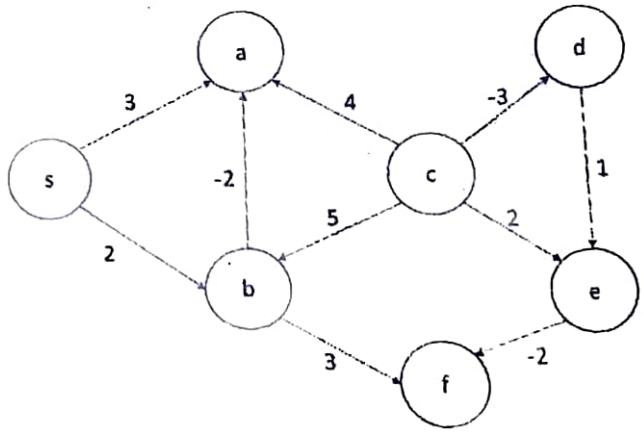
3. (a) Discuss greedy method with example.

(b) Find the minimum spanning tree for the given graph by using prim's algorithm.



(c) Explain Huffman algorithm with suitable example.

(d) Find the shortest path using Bellman-Ford algorithm from s to f of the given problem.



Unit-IV

4. (a) Write steps used for development of dynamic programming.

   (b) Explain the travelling salesman problem with example.

   (c) Write short notes on :

      (a) Matrix-chain multiplication

      (b) 0/1 Knapsack

   (d) Design an algorithm for graph colouring problem, considering back tracing technique.

Unit-V

5. (a) Define P class and NP class.

   (b) Explain binary search tree with its tree traversal steps using an example.

   (c) Discuss the following with suitable example :

      (i) B-Trees

      (ii) String matching

   (d) Analyse NP-hard and NP-complete with an example.

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B127373(022)

B. Tech. (Hon's) (Third Semester) Examination, Nov.-Dec. 2024

(Artificial Intelligence and Data Science)

COMPUTER ORGANIZATION and ARCHITECTURE

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

***Note** : Attempt all questions. Part (a) is compulsory. Attempt any two out of part (b), (c) or (d) in all questions.*

Unit-I

1. (a) Draw Accumulator Based CPU. 4

(b) What is Addressing Mode? Explain types of Addressing Mode. 8

(c) What is Instruction Format? Explain its types with example. 8

(d) Explain concept of Bus Structure in detail. 8

Unit-II

2. (a) What is ALU Sequencer? 4

(b) Explain the concept of Hardwired Control in the context of CPU Design. 8

(c) Define Microprogrammed Control and outline the components of a Microinstruction. 8

(d) Differentiate between RISC and CISC Architectures. 8

Unit-III

3. (a) What is the concept of Integer Division. 4

(b) Explain Signed Multiplication with example. 8

(c) Explain Booth's Algorithms in detail. 8

(d) Explain different types of number representation with example. 8

Unit-IV

4. (a) Write application of Associative Memory. 4

(b) Explain various Memory Technologies. 8

(c) What is Cache Memory? Explain its Mapping Techniques. 8

(d) Define Virtual Memory and explain its role in Modern Computer Systems. 8

Unit-V

5. (a) What are Pipelining Hazards. 4

(b) Explain Direct Memory Access with block diagram. 8

(c) Explain basic concept of Pipelining with its advantages. 8

(d) What is Parallel Processing? Explain its types. 8

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B127374(022)

B. Tech. (Hon's) (Third Semester) Examination, Nov.-Dec. 2024

DISCRETE STRUCTURE

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *(i) Each question contains four parts. Part (a) of each question is compulsory. Attempt any* **two** *parts from (b), (c) and (d) of each question.*

(ii) The figure in the right-hand margin indicates marks.

1. (a) What is logical equivalence and prove the statement $(P \rightarrow Q) \leftrightarrow (\neg P \vee Q)$ is a tautology. 4

(b) Define principle of Mathematical Induction method. 8

(i) Prove that $n! > 2^n$ for $n \geq 4$.

(ii) Prove that $2^{3n} - 1$ is divisible by 7 for all integer.

(c) State and prove inclusion-exclusion principle and find how many integers n, $1 \leq n \leq 1000$, are not multiples of either 3 or 7. 8

(d) Define countable set with example. Prove that countable union of countable set is countable. 8

2. (a) Explain equivalence relation and prove that a relation R defined as "aRb" is equivalence relation if and only if a-b is divisible by 5. 4

(b) Explain the Warshall's Algorithm with example. Discuss a real world scenario where the Warshall algorithm can be applied. 8

(c) Using Pegion hole principle solve the following problem. 8

(i) Suppose there are 35 different time periods during which classes at the local college can be scheduled. If there are 679 different classes,

what is the minimum number of rooms that will be needed?

(ii) Find the minimum number of students in a class to be sure that three of them are born in the same month.

(d) Solve the recurrence relation. 4×4=8

(i) $a_n = 2a_{n-1} + 3a_{n-2}$

(ii) $a_n = a_{n-1} + a_{n-2}$ with $a_0 = 0$, $a_1 = 1$

3. (a) Find each of these values. 4

(i) $(19^2 \bmod 41) \bmod 9$

(ii) $(32^3 \bmod 13)^2 \bmod 11$

(iii) $(7^3 \bmod 23)^2 \bmod 31$

(iv) $(21^2 \bmod 15)^3 \bmod 22$

(b) State Fermat's little theorem. 8

(i) Use Fermat's little theorem to compute $3^{302} \bmod 5$, $3^{302} \bmod 7$, and $3^{302} \bmod 11$.

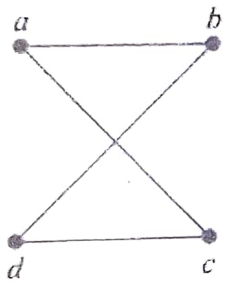
(ii) Use your results from part (i) and the Chinese re-mainder theorem to find $3^{302} \bmod 385$.

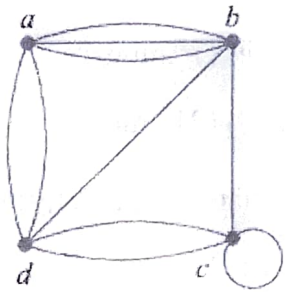
(c) (i) Write the divisibility rule for divisor 3, 5, 7, 11.

(ii) Suppose that there are 9 faculty members in the mathematics department and 11 in the computer science department. How many ways are there to select a committee to develop a discrete mathematics course at a school if the committee is to consist of three faculty members from the mathematics department and four from the computer science department? 8

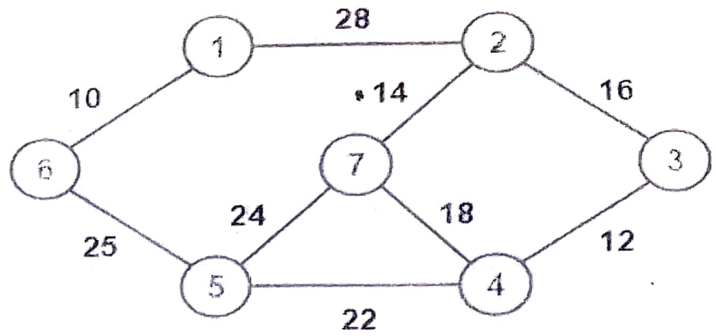
(d) Explain the Hashing functions and write the application of number theory in computer science. 8

4. (a) Write the Adjacent Matrix for following graph : 4





(b) Explain Kruskal's algorithm. Construct the minimum spanning tree (MST) for the given graph using Kruskal's Algorithm. 8



(c) Define Plannar Graph with examples and state and prove Euler formula. 8

(d) Let G be a finite graph with $n \geq 1$ vertices. Then prove the following are equivalent. 8

(i) G is tree

(ii) G is a cycle-free and has $n-1$ edges.

(iii) G is connected and has $n-1$ edges.

5. (a) Define a cyclic group with example and prove that every cyclic group is abelian. 4

(b) Define abelian group with example. Prove that Klein four group (K_4 Group) is abelian. 8

(c) Explain order of group and order of element and

find the order of each element of Quarternian group $\{\pm 1 \pm i \pm j \pm k\}$. 8

(d) Explain ring, field, Integral domain and also write difference between field and integral domain. 8

B127375(022)

B. Tech. (Hon's) (Third Semester) Examination, Nov.-Dec. 2024

(New Scheme)

(Specialization : Computer Science and Engg. Data Science)

DATABASE MANAGEMENT SYSTEM

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Each question contains four parts. Part (a) of each question is compulsory. Attempt any two parts from (b), (c) and (d) of each question. The figure in the right-hand margin indicates marks.*

Unit-I

1. (a) Define Schema. 4

(b) Explain the following terms : 8

Attribute, Entity, Entity set, Relationship, one-to-many relationship

(c) Differentiate between DBMS vs File system. 8

(d) What is an Attribute? Explain the different types of attributes by giving proper example. 8

Unit-II

2. (a) Differentiate between primary key and candidate key. 4

(b) Define join operation in relational algebra. Explain all join operations with suitable example. 8

(c) Consider a relation schema : 8

EMP (Empno, Ename, Job, Sal, Deptno)

DEPT (Deptno, Dname, Location)

Write the following queries in Relational Algebra :

(i) Display employee name of employee who works for SALES Department

(ii) Display employee name whose salary is greater than RAHUL

(iii) Display department wise minimum salary of each department.

(iv) Display department name in which RAHUL is working.

(v) Display the job title which is present in department 20 and 30.

(vi) Delete the employee whose salary is less than 15000.

(d) What is a VIEW? What are the advantages and disadvantages of using a VIEW? 8

Unit-III

3. (a) Explain GROUP BY clause with an example. 4

(b) Define following logical connectivity with example : 8

AND, OR, NOT

(c) What are various aggregate operators in SQL? Explain in brief. 8

(d) Explain the following relational operations with suitable example : 8

(i) Select

(ii) Project

(iii) Union

(iv) Intersection

Unit-IV

4. (a) What is normalization? Explain with an example. 4

(b) Define 1NF, 2NF, 3NF and BCNF 8

(c) Compute the closure for relational schema : 8

$R = \{A, B, C, D, E\}$

$A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A$

Find key attribute of R. Also find all candidate keys.

(d) Explain 2-phase locking protocol with example. 8

Unit-V

5. (a) Define system crash. 4

(b) What do you mean by Buffer Management? Explain log record buffering and Database buffering. 8

(c) Define recovery. Explain log-based recovery. 8

(d) What do you mean by Indexing? Write down the different types of Indexing. 8