

B127371(022)**B. Tech. (Hon's) (Third Semester) Examination,
Nov.-Dec. 2023****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. The figure in the right-hand margin indicates marks.

Unit-I

1. ~~(a)~~ Define conditional probability and its properties. If a pair of dice is rolled, find $P(A/B)$ if 4

A : 2 appears on at least one dice.

B : sum of numbers appearing on dice is 6.

[2]

- (b) (i) A random variable X has the following distribution:

X	-2	-1	0	1	2
$P(X)$	0.1	k	0.2	$2k$	0.3

Determine : (i) k , (ii) Mean, (iii) Variance.

- (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

$$\text{between } x = \frac{1}{2} \text{ and } x = \frac{3}{2}.$$

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

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

B127371(022)

[3]

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

- (d) Players A and B throw a pair of dice. A wins if he throws 6 before B throws 7 And B, if he throws 7 before A throws 6. If A begins, show that his chance

$$\text{of winning is } \frac{30}{61}.$$

Unit-II

2. (a) Define a normal distribution and give an example of its application.

- (b) (i) If the sum of the mean and variance of binomial distribution of 5 trials is 4.8, Find the distribution.

- (ii) 8 coins are tossed simultaneously, find the probability of getting at least 6 heads.

- (c) Define Gamma and Exponential distribution and also

PTO

B127371(022)

[4]

find mean and variance for both the distributions.

- (a) Prove that mean and variance are equal for Poisson distribution. Find a Poisson distribution on the following :

x	0	1	2	3	4
$f(x)$	192	100	24	3	1

(Given that $e^{-0.5} = 0.6065$)

Unit-III

- (a) For the following bivariate probability distribution of X and Y :

$X \downarrow \diagup Y \rightarrow$	1	2	3	4	5	6
0	0	0	$\frac{1}{32}$	$\frac{2}{32}$	$\frac{2}{32}$	$\frac{3}{32}$
1	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
2	$\frac{1}{32}$	$\frac{1}{32}$	$\frac{1}{64}$	$\frac{1}{64}$	0	$\frac{1}{64}$

B127371(022)

[5]

Find :

(i) $P(X \leq 2, Y = 3)$

(ii) $P(X < 2, Y \leq 3)$

(iii) $P(X \leq 1)$

(iv) $P(Y \leq 5)$

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

$X \downarrow \diagup Y \rightarrow$	1	2	3
0	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{24}$
2	$\frac{1}{4}$	$\frac{1}{4}$	0
6	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{24}$

- (a) Find the marginal probability distribution of Y .
 (b) Find the conditional distribution of Y given $X=4$.
 (c) Find covariance of X and Y .
 (d) Are X and Y independent?

B127371(022)

PTO

[6]

- (c) Calculate linear regression coefficients from the following:

x	1	2	3	4	5	6	7	8
y	3	7	10	12	14	17	20	24

8

- (d) Ten Competitors in a power point presentation competition are ranked by three judges in the order:

1 st Judge	1	6	5	10	3	2	4	9	7	8
2 nd Judge	3	5	8	4	7	10	2	1	6	9
3 rd Judge	6	4	9	8	1	2	3	10	5	7

Use the correlation coefficient to determine which pair of judges has the nearest approach to common taste in beauty.

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Unit-IV

- (a) What is Chi-Square Test? Explain in Brief.

4

- (b) Explain the following Terms with examples:

8

(i) Z-test,

(ii) F-test,

(iii) Null Hypothesis,

(iv) Alternate Hypothesis

B127371(022)

[7]

- (c) From the following table regarding the colour of eyes of father and son, test if the colour of son's eye is associated with that of the father.

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		Eye colour in son	
		Not Light	Light
Eye colour in father	Not light	50	89
	Light	79	782

(Given $\chi^2_{0.05}$ for 1 d.f. = 3.84)

- (d) The nine items of a sample had the following values:

45, 47, 50, 52, 48, 47, 49, 53, 51

Does the mean of nine items differ significantly from the assumed population mean of 47.5.

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Unit-V

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

4

- (b) A manufacturing company has purchased 3 new machines (A, B, C) of different Makes and wishes to determine whether one of them is faster than the other in producing a certain item. From hourly production figures are observed at random. From each machine

B127371(022)

PTO

[8]

and results are given below:

A	B	C
20	18	25
21	20	28
23	17	22
16	25	28
20	15	32

Use analysis of variance to test whether machines differ significantly.

8

(Table value of F at 5% level for $V_1 = 2$ and $V_2 = 12$ is 3.89).

- (c) Given below are packages that was obtained by Students in LPA of three branches AI, CSE & DS respectively from normal populations with equal variances. Test the hypothesis at 5% level ($F_{tab} = 3.88$) that population mean is equal.

AI	CSE	DS
8	7	12
10	5	9
7	10	13
14	9	12
11	9	14

B127371(022)

200]

[9]

- (d) Set up two-way ANOVA table for the following per hectare yield for 4 varieties of Wheat on 3 plots.

8

Plot of land	Yield			
	A	B	C	D
I	3	4	6	6
II	6	4	5	3
III	6	6	4	7

B127371(022)

Printed Pages - 3

Roll No. :
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B0127373(022)

B. Tech. (Hon's) (Third Semester) Examination,
Nov.-Dec. 2023

(AICTE Scheme)
(CSE Branch)

COMPUTER ORGANIZATION and ARCHITECTURE

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt all questions. Part (a) is compulsory.

Attempt any two out of part (b), (c) or (d) all questions.

Unit-I

1. **(a)** Explain CPU organization and its operation.
- (b)** Explain Accumulator based CPU with architecture and instruction set.
- (c)** Evaluate the arithmetic operation $(A \times B) + (C \times C)$ using various address instructions.

[2]

- (d) What do you mean by addressing mode? Explain various addressing modes giving examples.

Unit-II

2. (a) Define Hardwired and microprogramming control unit.
(b) Draw and explain architecture of processor to implement $A = A + B$.
(c) Explain GCD processor.
(d) Draw and explain any one microprocessor.

Unit-III

3. (a) Draw a table and hardware for signed magnitude addition and subtraction.
(b) Explain booth multiplication.
(c) Explain signed magnitude multiplication.
(d) Draw hardware and flowchart for signed magnitude division process.

Unit-IV

4. (a) Explain memory hierarchy in a computer system with suitable diagram.

B0127373(022)

210]

[3]

- (b) Write short notes on serial-access memory technology.
(c) What is cache memory? Explain cache memory organization.
(d) Explain memory mapping.

Unit-V

5. (a) Write short notes on magnetic disks and magnetic tapes.
(b) Draw a block diagram of DMA controller and explanation.
(c) Explain parallel processing.
(d) Explain pipeline interrupts.

B0127373(022)

Ent Pages - 4

Roll No. : 62

B127372(022)

B. Tech. (Hon's) (Third Semester) Examination,
Nov.-Dec. 2023

(Data Science / Artificial Intelligence)

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. Attempt any two out of part (b), (c) or (d) of all questions.

Unit-I

1. ~~(a)~~ Write down the properties of asymptotic notations. 4
~~(b)~~ Write an Algorithm using recursion that determines the GCD of two numbers. Determine the time and space complexity. 8

[2]

- (a)** Explain Master's Theorem with suitable Algorithm.
Solve the following recurrence equation using Master Method :

(i) $T(n) = 2T(n/4) + \sqrt{n}$

(ii) $T(n) = 2T(n/4) + 1$

- (d)** Calculate the growth rate of the given equations

(i) $a_n - 2a_{n-1} + a_{n-2} = 0,$

where $a_0 = 7$ and $a_1 = 11$

(ii) $a_n = \begin{cases} 7, & \text{when } n = 0 \\ 11, & \text{when } n = 1 \\ a_{n-1} + 2a_{n-2}, & \text{otherwise} \end{cases}$

8

Unit-II

- 2.** **(a)** What are the real life application of Graph?
(b) Write Merge sort algorithm and calculate the Time Complexity.

4

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B127372(022)

[3]

- (c)** Illustrate Quick Sort algorithm and calculate its Worst-case Time complexity. 8
(d) Differentiate between Heap sort and Radix Sort. 8
Define the algorithm for both of them.

Unit-III

- 3.** **(a)** What is Greedy approach of problem solving.
Mention all the algorithm which use Greedy Approach. 4

- (b)** Write Huffman code Algorithm and solve the given problem A : 5, B : 9, C : 12, D : 13, E : 16, F : 45. 8

- (c)** Explain Kruskal's Algorithm with proper algorithm and example. 8

- (d)** Write algorithm for Dijkstra algorithm with suitable graph and example. 8

Unit-IV

- 4.** **(a)** How dynamic programming works? Mention all the algorithm of dynamic programming. 4

B127372(022)

PTO

- (b) Explain Travelling Salesman Problem with graph and time suitable example.
- (c) How Backtracking works? Explain it with suitable algorithm and example.
- (d) Explain 0/1 knapsack algorithm with suitable graph and example.

Unit-V

5. (a) Define NP completeness and NP Hard. 4
- (b) Explain Approximation and Randomized techniques with suitable example. 8
- (c) Explain Binary Search with suitable example. 8
- (d) Explain B-Tree with proper graph and example also differentiate it with Binary Tree. 8

B127374(022)

B. Tech. (Hon's) (Third Semester) Examination,
Nov.-Dec. 2023
(New Scheme)

DISCRETE STRUCTURE

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 countable set, uncountable set, Finite set,
Inclusion - Exclusion principle. 4

(b) Explain define power set of a set and find the power
set of $S = \{a, b, c, d\}$. Principle of mathematical in-

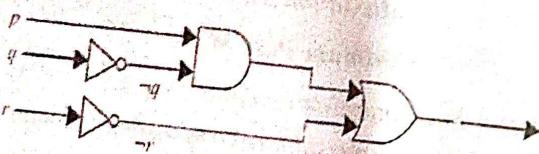
[2]

duction and by using mathematical induction method prove that :

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

(c) Construct the truth table of the compound proposition $(p \vee \neg q) \rightarrow (p \wedge q)$. Find the output for logic circuit.

Construct the truth table of logic circuit.



(d) Define Basic Logic Gate and explain NOR Gate and NAND Gate. Construct the truth table of all logic gate. Explain equivalence relation with example.

8

Unit-II

(e) State and prove DeMorgan's Laws by using truth table.

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B127374(022)

[3]

(b) Explain Quantifiers with example. What are the negations of the statements $\forall x(x^2 > x)$ and $\exists x(x^2 = 2)$? Show that $\neg \forall x(P(x) \rightarrow Q(x))$ and $\exists x(P(x) \wedge \neg Q(x))$ are logically equivalent.

8

(c) Show that

(i) $\neg(p \rightarrow q)$ and $p \wedge \neg q$ are logically equivalent

(ii) $(p \wedge q) \rightarrow (p \vee q)$ is tautology.

(d) Find an explicit formula for the Fibonacci numbers.

Solve the recurrence relation $a_n = 6a_{n-1} - 12a_n + 8a_{n-3}$ with initial conditions $a_0 = -5$ and $a_1 = 4, a_2 = 88$.

8

Unit-III

3. (a) (i) Write Chinese Remainder theorem.

4

(ii) Find the remainder when 2^{100} divided by 7.

(iii) Write the division algorithm.

(iv) Prove that the number 1571427 is divisible by

11.

B127374(022)

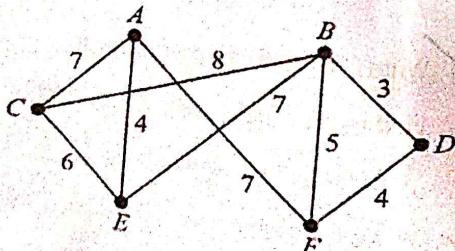
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- (b) Explain Euler's ϕ -function, Tau - function, Sigma function with properties and also explain permutation group. 8
- (c) State the Pigeonhole principle. Prove that : 8
- In a group of 50 students at least 5 are born in same month
 - If 7 colours are used to paint 50 bicycles show that at least 8 of them will be same colour.
- (d) Write application of number theory in computer science. 8

Unit-IV

4. (a) Explain complete graphs and Bipartite Graphs with examples? 4
- (b) Explain Prime's algorithm and find minimal spanning tree by using Prime's algorithm? 8



B127374(022)

[5]

8

- (c) Prove that :
- If a connected planar graph G has n vertices, e edges and r region, then $n - e + r = 2$. 4
 - Show that the graph K_5 is not planar graph. 2
 - Show that the graph $K_{3,3}$ is not planar graph. 2
- (d) Explain difference between Euler and Hamiltonian circuit. 2

Unit-V

5. (a) Prove that a set $\left\{ A = \begin{bmatrix} a & a \\ a & a \end{bmatrix} \mid a \in \mathbb{R} - \{0\} \right\}$ is a group under component wise multiplication. 4
- (b) Define abelian group. Prove that $(P(\mathbb{N}), *)$, $X * Y = X \Delta Y = (X - Y) \cup (Y - X)$ is abelian group under symmetric difference. 8
- (c) (i) Write an example of non-abelian group in which every proper subgroup is normal and explain it. 8
- (ii) Write an example of abelian group in which every proper subgroup is normal and explain it.

B127374(022)

PTO

[6]

(d) ~~Explain semi group, monoids, group, order of element of group with examples. Write properties of group.~~

Printed Pages - 4

Roll No. :

B127375(022)

B. Tech. (Hon's) (Third Semester) Examination,
Nov.-Dec. 2023

(New Scheme)

(Specialization : 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) Explain the concepts of data abstraction and data independence in the context DBMS.

4

[2]

(b) Write about relational model. Explain all the keys with the help of suitable examples.

(c) Explain three level architecture of DBMS.

(d) Describe four types of constraints used in RDBMS and provide example for each. Discuss four advantages of using DBMS over file processing system.

8

Unit-II

2. (a) Describe four types of attributes used in an ER model and provide an example for each.

4

(b) Explain the concept of integrity in DBMS and discuss types of integrity enforced to maintain data integrity.

8

(c) Design a schema diagram for "College" showing the entities, their attributes, and the relationships between them. Provide appropriate explanation for each relationship.

8

(d) (i) Define relational algebra.

8

(ii) Consider two relations, "Students" and "Courses" with the following schemas :

B127375(022)

[3]

Students (Sid, Name, Age, Department)

Courses (Course ID, Title, Instructor, Department)

Perform the following operations using relational algebra :

(a) Select all students who are enrolled in the "Database Systems" course.

8

(b) List the names of instructors who teach courses in the "Computer Science" Department.

Unit-III

3. (a) Write the advantages of SQL.

4

(b) Explain DDL and DML. Write three commands of DDL and DML with syntax.

8

(c) Describe aggregation with grouping and set membership along with suitable example.

8

(d) What is concept of stored procedures in DBMS? Explain Query-By-Example (QBE) in DBMS?

8

Unit-IV

4. (a) What is decomposition? Explain the types of decomposition.

4

B127375(022)

PTO

- (b) Define normalization. Explain 3 NF and BCNF and provide one example. 8
- (c) Discuss ordered indices. Differentiate static hashing and dynamic hashing. 8
- (d) (i) Explain B-tree.
(ii) Draw a B-tree of order 3 for the following sequence of keys :
4, 6, 11, 10, 9, 8, 5, 3, 7, 12 8

Unit-V

5. (a) Explain transaction concept in database management systems. 4
- (b) Describe deadlock prevention approaches. 8
- (c) What are the cases for conflict serializability? Explain validation protocol. 8
- (d) Describe log-based recovery. 8