B127371(022)

B. Tech. (Hon's) (Third Semester) Examination, Nov.-Dec. 2022

(AICTE Scheme)

(Data Science)

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) Given that $P(A) = 0.60, P(B) = 0.40,$ and $P(AB) = 0.24$, verify that   (Ans)

      0.24, verify that

      • $P(A|B) = P(A)$

- $P(A|B^c) = P(A)$

- $P(B|A) = P(B)$

- $P(B|A^c) = P(B)$

(b) What is Bayes Theorem. Given three identical boxes I, II and III, each containing two coins. In box I, both coins are gold coins, in box II, both are silver coins and in the box III, there is one gold and one silver coin. A person chooses a box at random and takes out a coin. If the coin is of gold, what is the probability that the other coin in the box is also of gold?

(c) What is variance and standard deviation? What does they signify. Let a pair of dice be thrown and the random variable X be the sum of the numbers that appear on the two dice. Find the variance and standard deviation of X.

(d) What are mutually exclusive events and mutually exhaustive events. Explain with examples and with reference to the figure given, answer the following:

- $P(A/B) \cdot P(A \cap B/C) \cdot P(A/B \cup C)$.

- $P(A/B \cap C) \cdot P(B/A^c)$
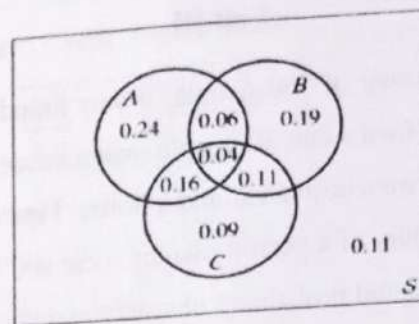
Unit-II

2. (a) What is Binomial Distribution. What is the probability density function of getting r success in random experiment of n trials. What is its mean and variance.

(b) If a fair coin is tossed 10 times, find the probability of getting:

- exactly six heads

- at least six heads

- at most six heads

(c) What is Geometric Distribution. Write its probability density function, mean and standard deviation.

(d) Write the conditions under which a random variable is said to be Poisson Distributed. Write the probability density function, its mean and variance.

Unit-III

3. (a) In a survey of 100 people, it was found that 40 people own a car, 30 people own a house, and 20 people own both a car and a house. Find the joint probability of a person owning a car and a house, the marginal probability of a person owning a car, and the conditional probability of a person owning a house given that they own a car.

(b) One shot is fired from each of the three guns E1, E2, and E3, denote the event that the target is hit by the first, second, and third guns, respectively. If $p(E1)=0.5$, $P(E2)=0.6$, and $P(E3)=0.8$, and E1, E2, and E3 are independent events, find the probability that

(i) The exact one hit is registered.

(ii) At least two hits are registered.

(c) A group of students conducted a survey to see if there's a connection between the number of comic books read and the level of awesomeness. The survey data is given below:

Students	Comic Books Read	Awesomeness Level (on a scale of 1-10)
1	10	9
2	5	7
3	8	8
4	12	10
5	6	6

Find the covariance and correlation between the number of comic books read and awesomeness level.

(d) A group of students conducted a survey to study the relationship between the number of hours spent studying and their corresponding exam scores. The survey data is given below:

Students	Hours Spent Studying	Exam Score (Out of 100)
1	8	90
2	5	70
3	7	80
4	9	95
5	6	75

Use regression to predict the exam score of a student who has spent 10 hours studying.

Unit-IV

4. (a) Explain Type 1 Error and Type 2 Error in Hypothesis testing.

(b) Explain the following terms :

   (i)   Critical Region,

   (ii)   Point Estimation,

   (iii) Interval Estimation,

   (iv) Two Tailed Test,

   (v)   Right Tailed Test,

   (vi) Left Tailed Test,

   (vii) Null Hypothesis,

   (viii) Alternate Hypothesis.

(c) The mean breaking strength of cables supplied by a manufacturer is 1,800 with a standard deviation of 100. By a new technique in the manufacturing process it is claimed that the breaking strength of the cables has increased. In order to test this, claim a sample of 50 cables is tested. It is found that the mean breaking strength is 1,850. Can you support the claim at 0.01 level of significance? (Z(Tab)=2.32).

(d) The mean height and the standard deviation height of 8 randomly chosen soldiers are 166.9 cm and 8.29 cm. The corresponding values of 6 randomly chosen sailors are 170.3 cm and 8.50 cm respectively. Can we conclude that there is a difference between heights? (Ttab=2.179)

Unit-V

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

(b) Apples were given under two different conditions. two random samples of size 11 and 9 showed standard deviation of 0.8 and 0.5 respectively. Test the hypothesis that population variance is equal to 10% level of significance.(Ftab=3.34)

(c) Is there a significant difference in the average number of cartwheels performed by students in three different playgrounds, using a 5% level of significance (Ftab=3.88) and the following data:

Playground X	Playground Y	Playground Z
82	75	91
100	55	89
77	100	93
114	90	92
111	90	94

(d) The AI and Data Science Department of CSVTU, Bhilai, conducts a study to compare the exam scores of four different sections of students in three different computer science courses. The data on the exam scores (out of 100) are recorded as follows:

Test for two Null Hypothesis Test Cases

(i) Sections do not differ significantly in exam scores.

(ii) Courses do not differ significantly in their impact on exam scores.

(Column(tab) = 4.76, Row(tab) = 5·14)

Courses	Section A	Section B	Section C	Section D
Data Structures	92	89	86	91
Algorithms	87	90	92	85
Computer Networks	86	84	88	90

B127375(022)

B. Tech. (Hon's) (Third Semester) Examination, Nov.-Dec. 2022

(AICTE Scheme)

(CS Engg. Branch)

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) Write the basic advantages of DBMS system over FPS.   4

(b) Explain the component modules of DBMS and their interaction, with the help of suitable diagram. 8

(c) Explain the basic concepts of ER-model in DBMS. Make an ER-diagram for banking system. 8

(d) Explain various keys, attributes and relationships in brief. 8

Unit-II

2. (a) Write the various functions of DBA. 4

(b) What is relational algebra? Explain different relational algebra operations with an example. 8

(c) Explain relational calculus with their types and example. 8

(d) Explain the basic constraints that can be specified in SQL at the time of table creation. 8

Unit-III

3. (a) Explain database language in brief. 4

(b) Create Employee table with an attributes (EmpId, EmpFname, EmpLname, Department, Project,

Address, DOB, Gender) another table Employee_Position table (EmpId, EmpPosition, DOB, Salary). 8

Write a SQL for the following questions:

(i) Find number of employees whose DOB is between 02/05/1970 to 31/12/1975 and are grouped according to gender.

(ii) Fetch details of employees whose EmpLname ends with an alphabet 'A' and contains five alphabets.

(iii) Fetch all employees who also hold the managerial position.

(iv) To retrieve the list of employees working in the same department.

(c) Explain aggregate function in DBMS with an example. 8

(d) Explain various join operations with an example. 8

Unit-IV

4. (a) Write the basic differences between B-tree and B+ tree.   4

(b) Explain functional dependency, trivial functional dependency in DBMS. Consider a relational schema R (A, B, C, D, E, H) on which the following FDs holds – {A-> B, BC->D, E->C, D->A} What are the candidate keys of R?   8

(c) Explain 2NF and 3NF with an example.   8

(d) Insert the keys 79, 69, 98, 72, 14, 50 into the Hash Table of size 13. Resolve all collisions using Double Hashing where first hash-function is $h1(k) = k$ mod 13 and second hash-function is $h2(k) = 1 + (k$ mod 11).   8

Unit-V

5. (a) Explain database crash recovery methods.   4

(b) Explain conflict and view serializability with an example.   8

(c) Write about 2PL protocol and time stamp ordering protocol with an example.   8

(d) Consider the 2 transactions T1 and T2 and four

schedules S1, S2, S3 and S4 of T1 and T2 are given below :   8

T1: R1[X] W1[X] W1[Y]

T2: R2[X] R2[Y] W2[Y]

S1: R1[X] R2[X] R2[Y] W1[X] W1[Y] W2[Y]

S2: R1[X] R2[X] R2[Y] W1[X] W2[Y] W1[Y]

S3: R1[X] W1[X] R2[X] W1[Y] R2[Y] W2[Y]

S4: R2[X] R2[Y] R1[X] W1[X] W1[Y] W2[Y]

Which schedules is/are conflict serializable?

B127372(022)

B. Tech. (Hon's) (Third Semester) Examination, Nov.-Dec. 2022

(AICTE Scheme)

(Data Science)

ANALYSIS & DESIGN of ALGORITHM

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. Include suitable header file in all your program. The figure in the right-hand margin indicates marks.

Unit-I

1. (a) What is an algorithm? How it differ from flowchart?   4

   (b) What do you mean by Asymptotic Notations? Explain all.   8

(c) Explain why analysis of algorithms is important? Explain :

WorstCase, Best Case & Average Case Complexity. 8

(d) Briefly explain Time Complexity and Space Complexity. 8

Unit-II

2. (a) Difference between Recursive and Non-recursive algorithms. 4

(b) Explain the heap sort with suitable e.g. and its complexity. 8

(c) Describe Insertion sort with suitable example and complexity. 8

(d) Explain Radix Sort with given example. 8
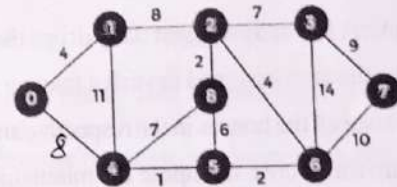
| 181 | 289 | 390 | 121 | 145 | 736 | 514 | 212 |

Unit-III

3. (a) Define MST and write the difference between Prim's and Kruskal Algorithm. 4

(b) Briefly explain Huffman Codes with given example. 8

	a	b	c	d	e	f	Total
Frequency	45	13	12	16	9	5	100

(c) Define Dijkstra's Algorithm and find minimum cost from source vertex (0). 8

(d) Explain fractional knapsack problem and find out maximum profit by all three approaches. 8

Objects : 1 2 3 4 5 6 7

Profit (P) : 5 10 15 7 8 9 4

Weight(w) : 1 3 5 4 1 3 2

W (Weight of the knapsack) : $15n$ (no of items). 7

Unit-IV

4. (a) Define 0/1 Knapsack 4

[4]

(b) Explain Matrix-Chain Multiplication with given example   8
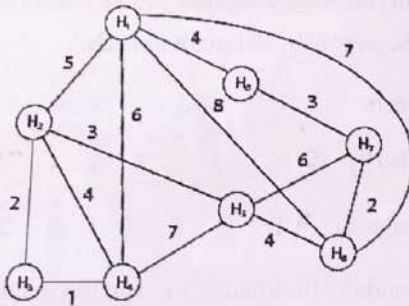
Given the sequence {4, 10, 3, 12, 20, and 7}

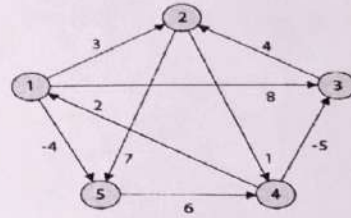(c) Explain Travelling Sales Person Problem with given example.   8

Example: A newspaper agent daily drops the newspaper to the area assigned in such a manner that he has to cover all the houses in the respective area with minimum travel cost. Compute the minimum travel cost.

(d) Explain All-pair shortest path Algorithm-Floyd's Warshall algorithm.   8

[5]

Unit-V

5. (a) Describe Binary Tree Traversal with suitable examples. 4

(b) Difference between Approximation Algorithm and Randomized Algorithms.   8

(c) Explain NP-completeness with applications.   8

(d) Define B-Tree and perform following operation in a given B Tree of order 5.   8

5-Way Search Tree

Insert 4, 5, 58, 6 in the order

B0127373(022)

B. Tech. (Hon's) (Third Semester) Examination, Nov.-Dec. 2022

(New Scheme)

(CS Engg. Branch)

COMPUTER ORGANIZATION and ARCHITECTURE

(Data Science)

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) in all questions.*

Unit-I

1. (a) Solve this using   4

    (i) Zero addresses instructions.

    (ii) Two address instructions.

where $X = (A + (B + C)) \neq (C - D)$

(b) Describe different types of addressing mode with example where the content of processor register Ri=300, Index register XR=100 and program counter PC =150.   8

(c) Explain Look-ahead carry generator.   8

(d) Explain stack organization. Also explain type of operation can be performed with stack.   8

Unit-II

2. (a) Explain overflow and underflow condition.   4

(b) Explain 2's complement multiplication algorithm and also perform Booth multiplication algorithm for -177 * 17.   8

(c) Write the hardware algorithm for adding or subtracting any two numbers. Also explain its hardware implementation.   8

(d) Draw division algorithm for unsigned numbers and prove its significance for 126 divide by 11.   8

Unit-III

3. (a) Explain CACHE memory and its mapping.   4

(b) Difference between IDE, SCSI and RAID, DVD.   8

(c) Discuss address sequencing inside control unit and breaking of a instruction into microinstruction in detail with example.   8

(d) Explain dynamic RAM organization with suitable example and diagram.   8

Unit-IV

4. (a) How is virtual memory different from main memory?   4

(b) Write down the condition in which page fault occur. How can we overcome this situation? Describe any one method of page replacement policy.   8

(c) A digital computer has a memory unit of 64K × 16 and a cache memory of 1K words. The cache uses direct mapping with a block size of four words. (a) How many bits are there in the TAG, LINE and WORD fields of the address format? (b) How many blocks can the cache accommodate?   8

(d) If the main memory is divided such that 512 bytes are

reserved for RAM and 512 bytes are reserved for RAM and 512 bytes are reserved for ROM. The size of RAM is specified to be 128* 8 and that of ROM to be 512* 8. Find out the following :　　8

(i) How many RAM and ROM chips are needed? Also determine their hexadecimal address ranges.

(ii) What is the size of decoder?

(iii) Draw diagram for showing memory connection to CPU.

Unit-V

5. (a) Difference between isolated IO and memory mapped I/O.　　4

(b) Describe the concept of Pipelining using an example.　8

(c) Explain architecture of RISC and CISC processors.　8

(d) What is pipelining explain with flowchart? Consider two pipelines A and B, where pipeline A is having 8 stages of uniform delay of 3ns. Pipeline B is having 5 stages with respective stage delays of 2ns, 3ns, 5ns, 6ns, and 1ns. How much time is saved using the pipeline A instead of pipeline B when 100 tasks are pipelined.　　8

B127374(022)

B. Tech. (Hon's) (Third Semester) Examination, Nov.-Dec. 2022

(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

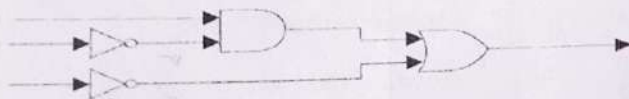   (b) Explain Define power sets of a set and find the power

set of $S = \{a, b, c, d\}$. Principle of Mathematical Induction and by using mathematical induction method prove that : 8

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

(c) Construct the truth table of the compound proposition $(p \vee \neg q) \to (p \wedge q)$. Find the output for logic circuit. Construct the truth table of logic circuit. 8

(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

2. (a) State and prove De Morgan's laws by using truth table. 4

(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 $\neg \forall x (P(x) \to Q(x))$ and $\exists x (P(x) \wedge \neg Q(x))$ are logically equivalent. 8

(c) State the Pigenhole principle : 8

(i) Prove that in a group of 50 students atleast 5 are born in same month.

(ii) If a colours are used to paint 50 bicycles show that at least 8 of them will be same colour.

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

$$a_n = 6a_{n-1} - 12a_{n-2} + 8a_{n-3}$$

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.

(b) Explain Euler's ϕ - function, Tau-function, sigma function with properties and also explain permutation group.   8

(c) State the Pigenhole principle. Prove that   8

    (i)   In a group of 50 students at least 5 are born in same month.

    (ii)   If a 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

(a)
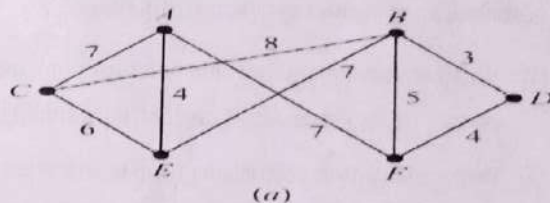
(c) Prove that :   8

    (i)   If a connected planar graph G has n vertices, e edges and r region, then $n - e + r = 2$.   4

    (ii) Show that the graph K_s is not planar graph.   2

    (iii) Show that the graph $K_{3,3}$ is not planar graph.   2

(d) Explain difference between Euler and Hamiltonian circuit.   8

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

$$(P(\mathbb{N}), *), X * Y = X \Delta Y = (X - Y) \cup (Y - X)$$

PTO

is abelian group under symmetric difference?   8

(c) (i) Write an example of non-abelian groupin which every proper subgroup is normal and explain it?

(ii) Write an example of abelian group in which every proper subgroup is normal and explain it?   8

(d) Explain semi group, monoids, group, order of element of group with examples. Write properties of group.   8

2.(c)

Show that

i. $\sim(p \to q)$ and $P \wedge \sim q$ are logically equivalent

ii) $(P \wedge q) \to (P \vee q)$ is a tautology