

(3 Hours)

[Total Marks: 80]

- N.B.: (1) Question No. 1 is **compulsory**.
 (2) Solve any **three** questions out of remaining **five**.
 (3) Figures to **right** indicate **full** marks.
 (4) Assume suitable **data** where **necessary**.

- Q1.** Attempt All questions **20**
- (a) Discuss the various DDL Commands with examples
 - (b) Discuss select, where, order SQL Commands.
 - (c) Differentiate between ER and EER Diagram.
 - (d) What is Normalization in the database, Discuss the need of normalization in details?
- Q2.**
- (a) What is JDBC, why one should use JDBC in Database discuss. **10**
 - (b) Discuss functions, procedure and cursor in SQL. **10**
- Q3.**
- (a) Draw EER diagram for Hotel management System **10**
 - (b) Write relational algebra query for(Assume data wherever needed)
 - (i) Find names of students who live in city 'Bandra' from student table **03**
 - (ii) Find Roll_no of student whose name is 'Sachin' from student Table **03**
 - (iii) Find name of students whose marks are greater than 500. **04**
- Q4.**
- (a) Explain different type of attributes with example in Entity Relational Model **10**
 - (b) Write SQL Syntax for (Assume one student enroll for only one course) **10**
 - (i) Create course table (course_id,name,staff_name,duration (in weeks),fees) .
 - (ii) Create student table (sid,name,phone_number,course_id) with course_id as foreign key.
 - (iii) Arrange courses in descending order of fees.
 - (iv) Find name of course student name 'John 'has enrolled for.
 - (v) List down names of all students whose course duration is less than 12 weeks
- Q5.**
- (a) Explain various relational Algebra operations in details with examples. **10**
 - (b) Discuss how normalization process improves the database design in detail. **10**
- Q6.** Write short note on **20**
- (a) Count and group by in SQL.
 - (b) Integrity Constraints.
 - (c) Primary key and Foreign key
 - (d) Strong entity set.

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- N.B.:** 1) Question No. 1 is compulsory.
 2) Answer any three out of remaining questions.
 3) Assume suitable data if necessary.
 4) Figures to the right indicate full marks.

- Q1. (a) Explain different types of link list. (5)
 (b) List down the applications of stack. (5)
 (c) Explain directed and undirected graph with the help of example. (5)
 (d) Explain different hash functions. (5)
- Q2. (a) Define B-tree. Step by step construct a B-tree for the following data 23, 12, 25, 01, 45, 63, 27, 29 for order 3. (10)
- Q2. (b) Write an algorithm to perform following operations on singly link list: (10)
 i) Insertion from the Beginning
 ii) Deletion from End
 iii) Display the contents of list
- Q3. (a) Write an algorithm to covert infix expression to postfix expression. Convert the following infix expression to postfix expression using stack- (10)
 $A+B*(C-D)/(P-R)$
- Q3.(b) Consider a file containing 6 unique characters and frequency of each character is given:
 $c=34$ $d=9$ $g=35$ $u=2$ $m=2$ $a=100$
 How many bits are required to store this file using Huffman Encoding? (10)
- Q4. (a) Define Minimum Spanning Tree. Construct a minimum spanning tree shown in figure 1 using Kruskal's and Prim's Algorithm and find out the cost with all intermediate steps. (10)

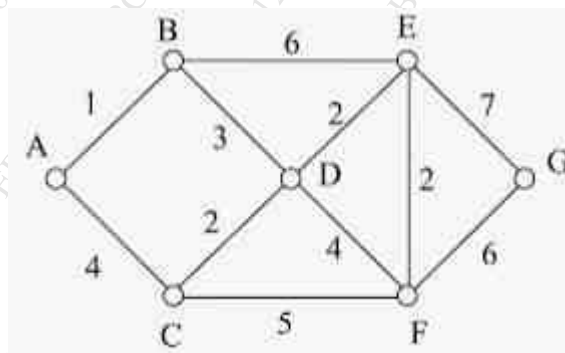


Figure 1

Q4.(b) Define AVL tree. Construct an AVL tree from the following data and mention the rotations in each step. (10)
40,30,20,25,21,50,60,70,65,22,18,15

Q5. (a) What is collision? List down the methods to resolve the collision. Consider a hash table of size 11. Using linear probing, insert keys 54, 26, 93, 17, 77, 60 and 31 into the table. (10)

Q5. (b) Define Binary Search Tree. Construct the binary search tree from following data and traverse the tree in in-order, pre-order and post-order traversal by giving its algorithm. (10)
14, 15, 4, 9 , 7, 18, 3, 5,16,20,17

Q6. Solve any Four: (20)

- a) Threaded Binary Tree
- b) Breadth First Search
- c) B-tree
- d) Graph Representation Techniques
- e) Game Tree

Max. Marks : 80

(Time: 03 hours)

- N.B. : (1) Question No.1 is **compulsory**
 (2) Attempt **any three** questions from Q.2 to Q.6
 (3) Figures to the right indicate full marks

Q. 1 (a) Find the Laplace Transform of $e^{2t} + 4t^3 - \sin 2t \cos 3t$ 05

(b) Find the Fourier series of $f(x) = x, -\pi < x < \pi$ 05

(c) Calculate Spearman's coefficient of rank correlation from the following data 05

X:	12	17	22	27	32
Y:	113	119	117	115	121

(d) Find the constants a, b, c, d, e 05

if $f(z) = (ax^4 + bx^2y^2 + cy^4 + dx^2 - 2y^2) + i(4x^3y - exy^3 + 4xy)$ is analytic

Q.2 (a) Determine whether the function $f(z) = \frac{1}{2} \log(x^2 + y^2) + i \tan^{-1} \frac{y}{x}$ is analytic and if so, find its derivative. 06

(b) A random variable X has the following probability distribution 06

X	0	1	2	3	4	5	6
P(X=x)	k	3k	5k	7k	9k	11k	13k

Find (i) k, (ii) $P(X < 4)$ (iii) $P(3 < X \leq 6)$

(c) Evaluate $\int_0^\infty e^{-2t} t \cos t dt$ 08

Q.3 (a) Find the Fourier series of $f(x) = \frac{\pi^2}{12} - \frac{x^2}{4}, -\pi < x < \pi$ 06

(b) A continuous random variable has probability density function 06

$f(x) = k(x - x^2); 0 \leq x \leq 1$

Find (i) k, (ii) mean, (iii) variance

(c) Find the inverse Laplace transform of $\frac{s^2+2s+3}{(s^2+2s+5)(s^2+2s+2)}$ 08

Q.4(a) Find the Laplace Transform of $f(t)$, 06

where $f(t) = \cos t$, for $0 < t < \pi$ and $f(t) = \sin t$, for $t > \pi$

(b) Calculate the Karl Pearson's coefficient of correlation from the following data 06

X:	65	66	67	67	68	69	70	72
Y:	67	68	65	68	72	72	69	71

- (c) Find the Fourier series of $f(x) = \begin{cases} x, & 0 \leq x \leq \pi \\ 2\pi - x, & \pi \leq x \leq 2\pi \end{cases}$ 08

- Q.5 (a) Find the inverse Laplace transform of $\frac{s}{(2s+1)^2}$ 06

- (b) Find the Laplace transform of $t \left(\frac{\sin t}{e^t} \right)^2$ 06

- (c) Find the lines of regression for the following data 08

X:	78	36	98	25	75	82	90	62	65	39
Y:	84	51	91	60	68	62	86	58	53	47

- Q.6 (a) Find the mean and the variance of the following distribution 06

X	1	3	4	5
P(X=x)	0.4	0.1	0.2	0.3

- (b) Find the inverse Laplace transform of $\log \left(1 + \frac{a^2}{s^2} \right)$ 06

- (c) Find the analytic function $f(z) = u + iv$ whose imaginary part is 08

$$v = x^2 - y^2 + \frac{x}{x^2 + y^2}$$

(3 Hours)

(Total Marks: 80)

- N.B.:**
- 1. Question No.1 is compulsory.**
 - 2. Answer any three out of remaining questions.**
 - 3. Assume suitable data if necessary.**
 - 4. Figures to the right indicate full marks.**

- Q1.**
- Explain the difference between Declarative and Imperative Paradigms (05)
 - Explain List comprehension in Haskell with suitable examples (05)
 - What is scope and what are the scope rules? (05)
 - Write prolog code to find factorial of a number (05)
- Q2.**
- Explain database manipulation commands in Prolog with an example. (10)
 - Explain different storage allocation mechanisms. (10)
- Q3.**
- What is type checking? Also explain the difference between type equality, type compatibility and type inference with suitable programming examples. (10)
 - What is pattern matching and gated expressions in Haskell? Explain with an example. (10)
- Q4.**
- What is logic programming? Explain Facts, Rules and Query along with an example. (10)
 - Explain use of various list processing functions in the prelude environment of Haskell? (10)
- Q5.**
- Explain Type and Type classes in Haskell. (10)
 - Explain different storage allocation mechanisms. (10)
- Q6.** Short note on: (Any 4) (20)
- Lambda Function
 - Shallow v/s Deep Comparison
 - Backtracking in Prolog Programming
 - Stacking versus Dynamic scoping
 - Types of binding in Programming Languages

Time: 3 Hours

Max. Marks: 80

N.B.

1. Question No.1 is Compulsory.
2. From Remaining 5 Questions You are Required to Solve any 3 Questions.
3. Assume the data if Necessary.

- 1 Attempt Any Four: - 20
 - a) Draw Block Diagram of Analog Communication System and list its Applications.
 - b) Explain image frequency in super heterodyne receiver.
 - c) Define Fourier Transform with its properties-time and frequency shifting.
 - d) Differentiate Between Amplitude Modulation and Frequency Modulation.
 - e) Explain Need of modulation in communication.
- 2 Attempt the Following: 20
 - a) Explain in detail different Types of Noise with example.
 - b) Draw and explain Electromagnetic Spectrum with its Application
- 3 Attempt the Following: 20
 - a) Draw block diagram of Super heterodyne receiver & explain its characteristics- Sensitivity, Selectivity, Fidelity and double spotting.
 - b) Explain block diagram and waveforms of Armstrong method.
- 4 Attempt the Following: 20
 - a) Draw and explain in detail FM demodulator: Foster Seeley discriminator.
 - b) State and Explain Friss formula and define Equivalent noise temperature.
- 5 Attempt the Following: 20
 - a) Explain in detail Principle of FM with waveforms, spectrum and bandwidth.
 - b) Derive expression of AM wave with necessary sketch.
- 6 Attempt the Following (any four) 20
 - a) Compare Analog Communication system and Digital Communication System.
 - b) Explain Generation of SSB using Phase Shift Method.
 - c) What are the different Types of Communication channels, explain with applications?
 - d) Discuss Signal to noise ratio, unit step, delta and gate function of Fourier Transform.
 - e) Compare Pre- emphasis and de-emphasis in FM generation.
 - f) Draw AM Transmitter and AM Receiver Block diagrams.
