

**2010***Time : As in Programme**Full Marks : 70**The questions are of equal value.**Answer all questions.*

1. (a) Maximize  $Z = 5x_1 + 3x_2$

Subject to the constraints

$$3x_1 + 5x_2 \leq 15$$

$$5x_1 + 2x_2 \leq 10$$

$$x_1 \geq 0, x_2 \geq 0$$

Prove that for the following linear programming problem, the dual of the dual becomes primal.

(b) Write notes on the following :

(i) Artificial variables

(ii) Basic feasible solution

**OR**

- (c) Use Dual Simplex Method to solve the following L. P. P. :

$$\text{Maximize } Z = 3x_1 + x_2$$

Subject to the constraints

$$x_1 + x_2 \geq 1$$

$$2x_1 + 3x_2 \geq 2$$

$$x_1 \geq 0, x_2 \geq 0$$

- (d) Obtain all the Basic Solutions to the following system of linear equation :

$$x_1 + 2x_2 + x_3 = 4$$

$$2x_1 + x_2 + 5x_3 = 5$$

2. (a) Formulate the dual of the following linear programming problem :

$$\text{Minimize } Z = x_1 - 3x_2 - 2x_3$$

Subject to the constraints

$$3x_1 - x_2 + 2x_3 \leq 7$$

$$2x_1 - 4x_2 \geq 12$$

$$-4x_1 + 3x_2 + 8x_3 = 10$$

$$x_1 \geq 0, x_2 \geq 0$$

$x_3$  is unrestricted

- (b) Prove that a necessary and sufficient condition for the existence of a feasible solution to the general transportation problem is that :

$$\sum_{i=1}^m a_i = \sum_{j=1}^n b_j$$

OR

- (c) Obtain an initial basic feasible solution to the following transportation problem by Vogel's method :

	D	E	F	G	Available
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400

Demand 200 225 275 250

- (d) Write notes on the following :
- Loops in a Transportation Problem
  - North-West Corner Rule
3. What is an integer programming problem ?  
Explain the merits and demerits of "rounding off".

Explain also the bounded variable technique by taking a hypothetical example of your own.

**OR**

Define a dynamic programming problem. Write the principles of optimality. Discuss the basic features which characterize the dynamic programming problem.

4. (a) What do you mean by economic order quantity problem? Derive the EOQ formula.
- (b) An oil engine manufacturer purchases lubricants at the rate of Rs. 42 per piece from a vendor. The requirement of these lubricants is 1,800 per year. What should be the order quantity per order, if the cost per placement of an order is Rs. 16 and inventory carrying charge per rupee per year is only 20 paise.

**OR**

- (c) Find the optimum order quantity for a product for which the price breaks are as follows :

**Quantity      Unit Cost (Rs.)**

$$0 \leq Q_1 \leq 800 \quad \text{Re. 1.00}$$

$$800 \leq Q_2 \quad \text{Re. 0.98}$$

The yearly demand for the product is 1,600 units per year, cost of placing an order is Re. 0.5 and the cost of storage is 10% per year.

- (d) Consider a shop which produces three items. The items are produced in lots. The demand rate for each item is constant and can be assumed to be deterministic. No back orders are to be allowed. The pertinent data for the items is given in the following table :

Item	1	2	3
Holding cost (Rs.)	20	20	20
Setup cost (Rs.)	50	40	60
Cost per unit (Rs.)	6	7	5
Yearly demand rate	10,000	12,000	7,500

Determine approximately the EOQ, when the total value of the average inventory levels of these items is Rs. 1,000.

5. (a) What is a Queuing System ? Derive the steady state solution to a  $(M/M/1^\infty/FCFS)$  Queuing System.
- (b) A T. V. repairman finds that the time spent on his jobs has an exponential distribution with mean of 30 minutes. If he repairs sets in the order in which they came in, and if the arrival of sets is approximately poisson with an average rate of 10 per 8 hours day, what is the repairman's expected idle time each day ?

How many jobs are ahead of the average set / what is the expected number of T. V. sets in the system ?

**OR**

- (c) Discuss the various elements of a Queuing System.

- (d) In a railway marshalling yard, goods train arrive at a rate of 30 trains per day. Service time is exponential with an average of 36 minutes. Calculate the following :  
Mean queue size (queue length) and the probability that queue size exceeds 10.



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1. (a) Argue that the solution to the recurrence  $T(n) = T(n/3) + T(2n/3) + cn$ , where  $c$  is a constant, is  $\Omega(n \lg n)$  by appealing to a recursion tree.
- (b) (i) Is  $2^{n+1} = O(2^n)$  ?
- (ii) Is  $2^{2n} = O(2^n)$  ?
- (iii) Explain, why the statement. "The running time of algorithm A is at least  $O(n^2)$ " is meaningless.

**OR**



have the same value ? Modify PARTITION so that  $q = (p + r) / 2$  when all elements in the array  $A[p..r]$  have the same value.

3. (a) How Dynamic Programming Technique to be used to solve the matrix chain multiplication ?
- (b) Show that a full parenthesization of an  $n$ -matrix has exactly  $n-1$  pairs of parentheses.

OR

- (a) Find an optimal parenthesization of a matrix-chain product whose sequence of dimension is  $\langle 5, 10, 3, 12, 5, 50 \rangle$ .
- (b) Let  $R(i, j)$  be the number of times that table entry  $m[(i, \dots, j)]$  is referenced while computing other table entries in a call of MATRIX-CHAIN-ORDER. Show that the total number of reference for the entire table is

$$\sum_{i=1}^n \sum_{j=1}^n R(i, j) = \frac{n^3 - n}{3}.$$

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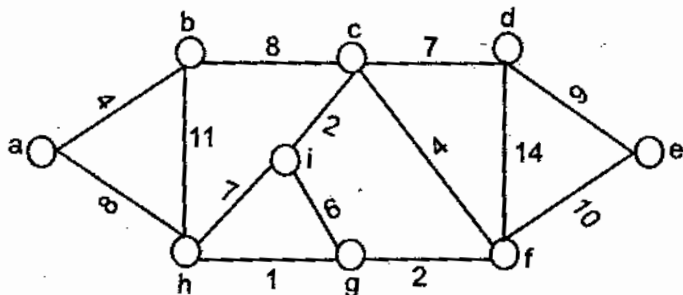
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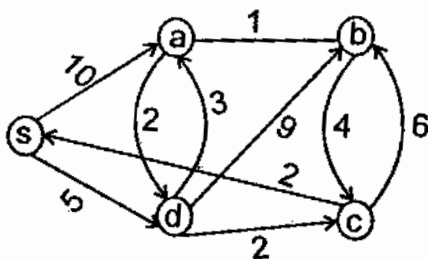
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4. (a) Compute the minimum spanning tree of the given graph using Kruskal algorithm and find its running time.

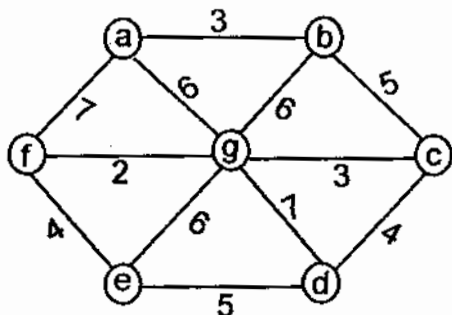


- (b) Run Dijkstra algorithm on the given graph below using vertex s as source vertex.



OR

- (a) Compute the minimum spanning tree of the given graph using Prim's algorithm and find its running time taking a as start vertex.



- (b) Suppose that the graph  $G = (V, E)$  is represented as an adjacency matrix. Give a simple implementation of Prim's Algorithm for this case runs in  $O(V^2)$  time.
5. Show that CLIQUE is NP complete problem.

OR

Define P, NP and NP-complete class problem.  
Mention problem for each class.



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*Answer all questions from all the Units.*

**Unit – I**

1. (a) Differentiate among relational database system, object relational database system and object oriented database system. 6
- (b) What is an object identifier ? Explain its advantages and disadvantages with example. 8

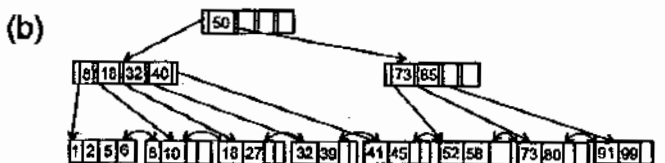
**OR**

2. (a) What is inheritance ? How is it implemented in SQL with their types ? Give example. 7

- (b) What is the purpose of using nesting and un-nesting in SQL ? Give example. 4
- (c) What is Structured Types ? Give example. 3

### Unit – II

3. (a) What is the order of a  $B^+$  tree ? Describe the format of a node in  $B^+$  tree. Why are nodes at the leaf level linked ? 5



4

Given order of tree = 5

Insert a data 9 into the above tree and show the resultant tree.

- (c) What is external merge sort ? Find out the cost of two-way merge sort ? 5

OR

4. (a) Suppose that we are using extendible hashing on a file having search key values :

- 1, 9, 32, 16, 10, 15, 7, 19, 4, 12, 20, 5, 21, 13. Show the extendible hash structure for the file by choosing an appropriate hash function. 7
- (b) In a B+ tree, during deletion, a node might go below the minimum occupancy threshold. How is this handled? 3
- (c) Write short note on Query Optimization and query evaluation plans? 4

### Unit – III

5. (a) Describe the cost of a selection operator in a relational algebraic query. Give example. 6
- (b) Given two tables having physical characteristics as follows : 8
- EMP (eid, did, name, sal)
- Dept (did, dname, address)
- The EMP table is B+ tree indexed on eid having 1000 pages and Dept table is hash indexed on dname having 500 pages.

Write a query in SQL and RA to display the

name of the employee who are getting salary above 25,000 and working in the company L & T.

Generate two plans and optimize the Query.

**OR**

6. (a) Give a brief comparison of simple nested loop join and blocked nested loop join with respect to their cost. 6
- (b) Based on the above question Q. 5(b) write a query in SQL and RA to display the information about the employee who are working in the company TCS existing at Bhubaneswar. Generate two alternate plans and optimize the query. 8

**Unit – IV**

7. (a) What is a distributed transaction ? How is it carried out in a distributed database system ? Explain through proper diagram if suitable. 6



- (b) What is transparency ? Discuss its types with example. 4
- (c) In the distributed query processing how semijoin strategy is applied on a join operation ? Give example. 4

**OR**

8. (a) What is transaction atomicity ? How atomicity is maintained in distributed database system ? Describe about 2PC. 8
- (b) Write short notes on the following :  $4+2=6$
- (i) Fragmentation
- (ii) Blocking in 2PC

**Unit – V**

9. (a) What is a Association Rule ? Use a priory algorithm to find out the frequent item set from the given data set ? 8

Given that min-sup-count = 2.

$T_{id}$	List
$T_{01}$	$I_1 I_2 I_5$
$T_{02}$	$I_2 I_5$
$T_{03}$	$I_1 I_3$

$T_{id}$	List
$T_{04}$	$I_2I_3$
$T_{05}$	$I_1I_3$
$T_{06}$	$I_1I_2I_3I_5$
$T_{07}$	$I_1I_2I_3$
$T_{08}$	$I_2I_4$
$T_{09}$	$I_1I_3$

- (b) How can you define a cluster ? Write down k-mean algorithm to build clusters. 6

OR

10. (a) Discuss, how data warehouse differs from a database. Describe the process architecture of datawarehouse briefly. 8
- (b) Differentiate between classification and clustering with example. What is a decision tree ? How does it help in classification ? Give example. 6



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*Answer **all** questions.*

1. What is a single chip microprocessor ? With a suitable diagram, explain different components, in detail, of the single chip microprocessor ? 14

**OR**

- (a) What are the different types of memory used in microprocessor ? 7
- (b) Define and differentiate programmed I/O from interrupt I/O. 7
2. Write down 3-address instruction, 2-address instruction, 1-address instruction and 0-address instruction to evaluate the below expression. 14
- $$Z = (A + (B * C) + (D * E) - F/G - H * I)$$

**OR**

- (a) Define addressing mode ? Explain different types of addressing modes with suitable example. 10
- (b) What is an assembly language instruction ? Write down different parts of an assembly instruction ? 4
3. (a) Explain the register structure of 8085 microprocessor with a suitable diagram. 7
- (b) Explain the different types of addressing modes of 8085  $\mu$ p with suitable example ? 7

**OR**

- (a) Draw the timing diagram of memory fetch operation and explain. 7
- (b) Explain the interrupt system of 8085  $\mu$ p. 7
4. With a suitable architectural diagram of 8086  $\mu$ p, explain the BIU in detail ? Also explain the mode of operation of 8086  $\mu$ p ? 14

**OR**

- (a) Explain the register structure of 8086  $\mu$ p with a diagram. 10
- (b) Explain different addressing modes of 8086  $\mu$ p. 4
5. (a) Explain the different types of serial transmission in detail. 10
- (b) Define and differentiate serial transmission from parallel transmission. 4

**OR**

- (a) What is UART ? How it differs from USART ?  
With a neat and labelled diagram, explain UART. 10
- (b) How hexadecimal displays are interfaced to microprocessor ? 4



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*Answer all questions.*

1. (a) Explain with a neat diagram the layered structure of the UNIX OS. 7
- (b) What is super block ? What information are stored in super block ? 7

**OR**

- (c) Explain, in detail, the link and unlink system calls. 7
  - (d) What are inodes ? How many types of inodes are there in the UNIX OS ? 7
2. (a) Explain, in detail, the use of setjmp and longjmp system functions. 7

- (b) Explain the various ways in which a process can terminate in UNIX. 7

OR

- (c) Explain the use of functions getrlimit and setrlimit. 7
- (d) Write a short note on process accounting and time in UNIX OS. 7
3. (a) Explain the functions tegetpgrp and tsetpgrp. 7
- (b) What is meant by unreliable signals ? Explain with an example. 7

OR

- (c) Explain the concept of process groups with examples. 7
- (d) What is meant by a daemon process ? What are the rules for designing a daemon process ? 7
4. (a) What is meant by record locking in UNIX ? 7

- (b) Explain how terminal I/O attributes can be retrieved and set. 7

**OR**

- (c) Write short notes on termcap, terminfo and curses function. 7
- (d) Explain how temporary files are managed in UNIX OS. 7
5. (a) What are pipes ? Describe the use of popen and pclose functions. 7
- (b) Using a neat diagram, explain the concept of semaphore in Inter Process Communication (IPC). 7

**OR**

- (c) Explain, in detail, the use and working of message queues in inter process communication. 7
- (d) How is the open server used in advanced inter process communication in UNIX OS ? 7

