Duration: 3hrs   **[Max Marks: 80]**

N.B.:   (1) Question No 1 is Compulsory.

       (2) Attempt **any three** questions out of the remaining five.

       (3) All questions carry equal marks.

       (4) Assume suitable data, if required and state it clearly.

1		Attempt **any FOUR** (Draw neat diagrams if applicable)	**[20]**
	a	Differentiate between a Process and a Thread.	
	b	Explain the CPU Scheduling Criteria	
	c	What is External Fragmentation in Memory Management System? Explain with an example.	
	d	Explain Disk Organization within the OS.	
	e	Explain the Critical Section problem.	

2	a	Suppose the following disk request sequence for a disk with 200 tracks is given as: 100, 150, 20, 180, 30, 70, 190, 50, 120. Assume that initial head position of the R/W head is on track 80. Count the difference in the distance that will be traversed by the head when SSTF algorithm is used as compared to the SCAN algorithm, assuming that SCAN moves towards 200 when it starts the execution.	**[10]**
	b	Explain different File Organization Methods.	**[10]**

3	a	What is a process? Draw and Explain Process State Transition Diagram with six states.	**[10]**
	b	Calculate the Hit and Miss Ratio for the following string using LRU technique. Compare the results for frame size 3 and 4 in terms of "number of hits" Page String : 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 7, 2, 0, 7, 5, 0, 7, 5	**[10]**

4	a	Explain ULT and KLT. Explain the differences between the two.	**[10]**
	b	What is a Deadlock? Explain various Deadlock Prevention Techniques.	**[10]**

5	a	Explain the three types of schedulers with a proper diagram illustrating connection within them.	**[10]**
	b	What is Producer-consumer Problem? Provide the solution to the problem using Semaphores.	**[10]**

6   a   Explain the following terms in brief   **[10]**
             i.   Starvation
             ii.   Thrashing
             iii.   Aging
             iv.   Convoy Effect
             v.   Context Switch

    b   With the help of a diagram and an example, explain how a System Call works in   **[10]**
       an OS.

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(Time: 3 hours)   **Max. Marks: 80**

N.B.   **(1) Question No. 1 is compulsory.**
   (2) Answer any three questions from Q.2 to Q.6.
   (3) Use of Statistical Tables permitted.
   (4) Figures to the right indicate full marks

Q1. (a) If matrix A = $\begin{bmatrix} -1 & 2 & 3 \\ 0 & 3 & 5 \\ 0 & 0 & -2 \end{bmatrix}$ find Eigen values of $A^3 + 5A + 8I$.   [5]

 (b) Evaluate the integral $\int_0^{1+i}(x - y + i\,x^2)\,dz$ along the parabola $y^2 = x$.   [5]

 (c) Find the z-transform of f (k) = a^k, $k \geq 0$.   [5]

 (d) Maximise   z = $x_1 + 3\,x_2 + 3x_3$

Subject to $x_1 + 2\,x_2 + 3x_3 = 4$

     $2\,x_1 + 3x_2 + 5x_3 = 7$ find all basic solutions. Which

  of them are basic feasible, And optimal basic feasible solutions.   [5]

Q2 (a) Verify Cayley- Hamilton theorem for the matrix A where A = $\begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{bmatrix}$

And hence find $A^{-1}\,and\,A^{-2}$.   [6]

 (b) The means of two random samples of size 9 and 7 are 196.42 and 198.82 respectively

 The sum of the squares of the deviations from the means are 26.94 and 18.73 respectively. Can

The samples be considered to have been drawn from same population?   [6]

(c) Solve the L.P.P by using simplex method.

       Maximise   z = $3\,x_1 + 2\,x_2$
       Subject to $3\,x_1 + 2\,x_2 \leq 18$;
                $0 \leq x_1 \leq 4$;
                $0 \leq x_2 \leq 6$;
                $x_1, x_2 \geq 0$.   [8]

Q3 (a) Find the Laurent's series for

F (z) = $\frac{4z+3}{(z-3)\,z\,(z+2)}$ valid for $2 < |z| < 3$.   [6]

(b) Using the method of Lagrange's multiplier solve the N.L.P.

Optimise $\quad z = 12\,x_1 + 8\,x_2 + 6x_3 - x_1^2 - x_2^2 - x_3^2 - 23.$

Subject to $\quad x_1 + x_2 + x_3 = 10. \quad x_1, x_2, x_3 \geq 0.$ [6]

(c) Marks obtained by students in an examination follow normal distribution. If 30 %

Of the students got below 35 marks and 10 % got above 60 marks. Find the mean and standard deviation. [8]

Q4 (a) Find the Eigen values and Eigen vectors of matrix A $= \begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$ [6]

(b) Find inverse z- transform of $\quad F\,(z) = \dfrac{3z^2 - 18\,z + 26}{(z-2)\,(z-3)\,(z-4)} \quad 3 < |z| < 4.$ [6]

(c) Using the Kuhn –Tucker conditions solve the N.L.P.P [8]

Maximise $\quad z = 12\,x_1 x_2 + 2\,x_1^2 - 7\,x_2^2$

Subject to $\quad 2\,x_1 + 5x_2 \leq 98\,;$

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

Q5 (a) Show that the matrix A $= \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ is diagonalisable. Find the diagonal

form D and the Diagonal zing matrix M. [6]

(b) Find the relative maximum or minimum of the function

$$z = x_1^2 + x_2^2 + x_3^2 - 4x_1 - 8x_2 - 12x_3 + 100.$$ [6]

(c) Evaluate $\oint \dfrac{2z-1}{(2\,z+1)\,z\,(z+2)}$ dz using Cauchy's residue theorem, where C is the

circle $\quad |z| = 1.$ [8]

Q6 (a) The number of car accidents in a metropolitan city was found to be

  20, 17, 12, 6, 7, 15, 8, 5, 16 and 14 per month respectively. Use χ^2- test

  To check whether these frequencies are in agreement with that occurrence was

  The same during 10 months period. Test at 5 % level of significance. [6]

(b) Find z – transform of $[\, 2^k \cos (3k + 2) \,]$, $k \geq 0$. [6]

(c) Use the dual simplex method to solve the L.P.P. [8]

   Minimise $z = 2 x_1 + x_2$

  Subject to $3 x_1 + x_2 \geq 3$;

         $4 x_1 + 3 x_2 \geq 6$;

         $x_1 + 2 x_2 \leq 3$;
         $x_1 , x_2 \geq 0$.

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[Time: 3 Hours]   **[Marks: 80]**

N.B. : (1) Question No 1 is Compulsory.
      (2) Attempt any three questions out of the remaining five.
      (3) All questions carry equal marks.
      (4) Assume suitable data, if required and state it clearly.

1   **Attempt any FOUR**   **[20]**

a Compare File Processing System with Database Management system   **05**

b   **05**

T1	T2
read(A) A := A − 50	
	read(A) temp := A ∗ 0.1 A := A − temp write(A) read(B)
write(A) read(B) B := B + 50 write(B) commit	
	B := B + temp write(B) commit

  Draw the precedence graph for above schedule?

c Define with an example different type of Entities in ER diagram   **05**

d Define Triggers. Write syntax and example of trigger.   **05**

e Explain five aggregate functions of SQL with example?   **05**

2 a Design an EER diagram for Hospital Management System. And map it into   **[10]**
      relational model. Assume Suitable data.

  b Brief overall database architecture with suitable diagram.   **[10]**

3 a Consider the following employee database.   **[10]**

        Employee (empname, street, city, date_of_joining)

      Works (empname, company_name,salary)

      Company (company_name, city)

      Manages (empname, manager_name)

Write the SQL queries for each of the statements given below

     a) Modify the database so that 'John' now lives in 'Mumbai'.

     b) Find all employees who joined in the month of October.

     c) Give all employees of 'ABC Corporation' a 10% raise.

     d) Find all employees in the database who live in the same cities as the companies for which they work

     e) Find all employees who earn more than average salary of all employees of their company

b Explain following relational algebra operators with example   **[10]**
    a) Selection operator   b) Union operator
    c) Rename operator   d) Cartesian product

4 a Explain concurrency control and explain time Stamp based protocol of concurrency control.   **[10]**

    b Why there is need of normalization? Explain 1NF,2NF,3NF and BCNF with examples.   **[10]**

5 a Describe ACID properties with examples and explain state transition diagram of transaction.   **[10]**

    b What is Deadlock. Explain wait-die and wound-wait methods with suitable example.   **[10]**

6 **Attempt any two**

    a Explain in detail with example of conflict and view serializability .   **[10]**

    b Explain following Integrity constraints: **[10]**
      a) Key Constraints.
      b) Domain Constraints (Null & Default Constraints).
      c) Referential Constraints.
      d) Check Constraints.

    c Write short note on Log based recovery mechanism   **[10]**

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Time: 3 hours   **Max. Marks: 80**

N.B. (1) Question one is Compulsory.
(2) Attempt any 3 questions out of the remaining.
(3) Assume suitable data if required.

Q. 1

a) Explain asymptotic notations.   **(05)**
b) Explain job sequencing with deadline with an example.   **(05)**
c) Write the algorithm and derive the complexity of binary search algorithm.   **(05)**
d) Definition of P, NP, NP-Hard, NP-Complete.   **(05)**

Q. 2

a) Explain 15-puzzle problem using branch and bound strategy.   **(10)**
b) Give the pseudo code for the KMP String Matching Algorithm. Use KMP algorithm to   **(10)**
find pattern="ababada" in text="badbababababadaab". Show the prefix table and the valid shifts.
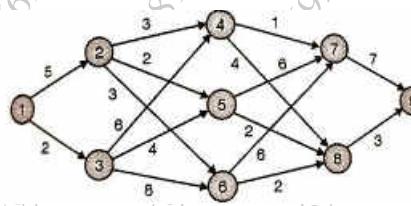
Q. 3

a) Write algorithm for quick sort. Derive its time complexity.   **(10)**
b) Write Kruskal's algorithm for finding a minimum spanning tree. Explain its working with
an example. Also compute the time complexity for the same.   **(10)**

Q. 4

a) Write algorithm for greedy knapsack and obtain the solution to following fractional   **(10)**
greedy knapsack problem where n=5, m=100, (p1, p2....p5) = (10,20,30,40,50) and
(w1,w2,.....,w5) = (20,30,66,40,60)
b) Find Longest Common Subsequence for the following string   **(10)**
X=xyzytxy and Y=ytzxyx

Q. 5

a) Find minimum cost path from 1 to 9 for following multistage graph using dynamic
programming.   **(10)**

b) Explain 8-Queen problem using backtracking.   **(10)**

Q. 6

a) Write the algorithm for insertion sort. Also sort the following numbers using   **(10)**
same algorithm 11,7,17,3,9,29,85,9 and show output after every pass.
b) Write the algorithm for 0/1 knapsack using dynamic programming. Also solve the   **(10)**
following instance where M=21, n=4, (p1, p2, p3, p4) =(2,5,8,1), (w1,w2,w3,w4)=(10,15,6,9)

Duration: 3hrs   **Max Marks:80**

Q.1 (a) Design 8086 microprocessor-based on following Specifications: 10
      1. MP 8086 working at 10MHz minimum mode.
      2. 32 KB ROM using 8 KB Devices
      3. 16 KB RAM using 4KB chips

   (b) Draw and explain Write operation and Read operation Timing diagram of   10
      8086 Processor in Maximum mode.

Q.2 (a) Explain the Initialization command words (ICWs) and Operational command   10
      words(OCWs) of the 8259 PIC.

   (b) Explain the interrupt structure of the 8086 processor(IVT) and differentiate
      between Hardware and Software interrupts

Q.3 (a) Comparison 80386 ,Pentium 1 ,Pentium 2 and Pentium 3 Processor   10

   (b) Write an assembly language program for searching a Character in a Given   10
      String.(Consider your own String) and Explain the following instructions:
      XLAT, DAA,LAHF,AAA related to 8086.

Q.4 (a) Draw and explain Pentium 4: Net burst microarchitecture.

   (b) Explain MESI Protocol   10

Q.5 (a) Draw and explain architecture of 8086.   10

   (b) Differentiate between real Mode , Virtual Mode and Protected Mode of   10
      80386 Processor .Explain the Floating point Pipeline of Pentium Processor

Q.6 (a) Explain Modes of 8255 with a neat block diagram. Show the CWR   [10]
      initialization.

   (b) Write an ALP for 8086 to transfer the block of data.

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