**( 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.

**Q.1** **(a)** Find all the basic solutions to the following problem: **05**

$$\text{Maximise} \quad z = x_1 + 3x_2 + 3x_3$$
$$\text{subject to} \quad x_1 + 2x_2 + 3x_3 = 4$$
$$2x_1 + 3x_2 + 5x_3 = 7$$
$$x_1, x_2, x_3 \geq 0$$

**(b)** Evaluate $\int_0^{1+2i} z^2\, dz$, along the curve $2x^2 = y$. **05**

**(c)** A random sample of size 16 from a normal population showed a mean of 103.75 cm & sum of squares of deviations from the mean 843.75 $cm^2$. Can we say that the population has a mean of 108.75? **05**

**(d)** If $A = \begin{bmatrix} \pi/2 & \pi \\ 0 & 3\pi/2 \end{bmatrix}$, find $\sin A$ **05**

**Q.2** **(a)** Evaluate $\int_c \frac{dz}{z^3(z+4)}$, where c is the circle $|z| = 2$ **06**

**(b)** Memory capacity of 9 students was tested before & after a course of mediation for a month. State whether the course was effective or not from the data below **06**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Before | 10 | 15 | 9 | 3 | 7 | 12 | 16 | 17 | 4 |
| After | 12 | 17 | 8 | 5 | 6 | 11 | 18 | 20 | 3 |

**(c)** Solve the following LPP using Simplex Method **08**

$$\text{Maximise} \quad z = 6x_1 - 2x_2 + 3x_3$$
$$\text{subject to} \quad 2x_1 - x_2 + 2x_3 \leq 2$$
$$x_1 + 4x_3 \leq 4$$
$$x_1, x_2, x_3 \geq 0$$

**Q.3** **(a)** Find the Eigen values and Eigen vectors of the following matrix. **06**

$$A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}$$

**(b)** For a normal distribution 30% items are below 45% & 8% are above 64. Find the mean & variance of the normal distribution. **06**

**(c)** Obtain Laurent's series for $f(z) = \frac{1}{z(z+2)(z+1)}$ about $z = -2$ **08**

**[Turn over**

**Q.4** **(a)** An ambulance service claims that it takes on an average 8.9 min to reach the destination in emergency calls. To check this the Licensing Agency has then timed on 50 emergency calls, getting a mean of 9.3 min with a S.D. 1.6 min. Is the claim acceptable at 5% LOS? **06**

**(b)** Using the Residue theorem, Evaluate $\int_0^{2\pi} \frac{\cos 2\theta}{5 + 4\cos\theta} d\theta$ **06**

**(c)** (i) If 10% 0f the rivets produced by a machine are defective, find the probability that out of 5 randomly chosen rivets at the most two will be defective.
(ii) If x denotes the outcome when a fair die is tossed, find M.G.F. of x and hence, find the mean and variance of x. **04+04**

**Q.5** **(a)** Check whether the following matrix is Derogatory or Non-Derogatory:

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$ **06**

**(b)** Justify, if there is any relationship between sex and color for the following data.

| Color | Male | Female |
|---|---|---|
| Red | 10 | 40 |
| White | 70 | 30 |
| Green | 30 | 20 |

**06**

**(c)** Use the dual simplex method to solve the following L.P.P.

*Minimise* $z = 2x_1 + x_2$

*subject to* $3x_1 + x_2 \geq 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + 2x_2 \leq 3$

$x_1, x_2 \geq 0$ **08**

**Q.6** **(a)** Show that the matrix $A$ satisfies Cayley-Hamilton theorem and hence find $A^{-1}$ .

Where $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ **06**

**(b)** The Probability Distribution of a random variable X is given by

| X : | -2 | -1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| P(X = x): | 0.1 | k | 0.2 | 2k | 0.3 | k |

Find k, mean and variance. **06**

**(c)** Using Kuhn-Tucker conditions, solve the following NLPP

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

*subject to* $2x_1 + 5x_2 \leq 98$

$x_1, x_2 \geq 0$ **08**

**(3 Hours)** **[Total Marks:80]**

1. Question No. 1 is compulsory.
2. Attempt any three out of remaining five questions.
3. Make suitable assumptions wherever necessary and justify it.
4. Figures to right indicate full marks.

Q.1 Answer the following

a. Write the difference between greedy method and dynamic programming. 5M

b. Explain the general procedure of divide and conquer method. 5M

c. Determine the frequency counts for all statements in the following algorithm segment. 5M

```
I=1;
While(I<=n)
    {
      X=X+I;
      I=I+1;
    }
```

d. What is backtracking Approach? Explain how it is used in Graph Coloring 5M

Q.2.a. Explain with example how divide and conquer strategy is used in binary search? 10M

b. Solve sum of subsets problem for following 10M
N=6 W={3,5,7,8,9,15} & M =20 Also write the Algorithm for it.

Q.3 a. Obtain the solution to knapsack problem by Greedy method n=7,m=15 (p1, p2,…p7)=(10,5,15,7,6,18,3), (w1,w2,…w7)=(2,3,5,7,1,4,1) 10M

b. Sort the list of the elements 10,5,7,6,1,4,8,3,2,9 using merge sort algorithm and show its computing time is O(n log n). 10M

Q. 4.a. Explain different string matching algorithms. 10 M

b. What do you understand by NP Complete? Explain Is Subset sum problem NP complete? If so explain. 10M

Q. 5.a. Write a detailednote on Hamiltonian cycles. 10 M

b. Explain how backtracking is used for solving n- queens problem. Show the state space tree. 10M

Q.6 Write Short Note on (**any 2**) 20 M

a. Job sequencing with deadlines

b. 8 queens problem

c. Longest common subsequence

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**Q. P. Code: 39078**

**(3 Hours)** **Total Marks: 80**

**N.B.**

1. Question No.1 is compulsory
2. Solve any three questions from the remaining questions
3. Assume suitable data if required

| | | |
|---|---|---|
| 1a. | Compare Von Neumann architecture and Harvard Architecture | 10 |
| 1b. | Explain IEEE 754 floating point representation formats and represent $(34.25)_{10}$ to single precision format. | 10 |
| 1c | Explain memory hierarchy in the computer system. | |
| 1d | Explain the requirements of the I/O modules. | |
| 2a. | Draw the flowchart of Booth's algorithm. Perform following multiplication using Booth's algorithm M = $(-9)_{10}$ Q= $(6)_{10}$ | 10 |
| 2b. | Explain the restoring method of binary division with algorithm. Divide $(7)_{10}$ by $(4)_{10}$ using restoring method of binary division. | 10 |
| 3a. | What is the necessity of cache memory? Explain set associative cache mapping | 10 |
| 3b. | Explain the page address translation in case of virtual memory and explain TLB | 10 |
| 4a. | Explain interrupt driven I/O method of data transfer. | 10 |
| 4b. | Explain DMA method of I/O data transfer | 10 |
| 5a. | Explain the superscalar architecture. | 10 |
| 5b. | State the functions of control unit. Explain Micro-programmed control unit | 10 |
| 6 | Write short notes on (any two) :- | 20 |
| a. | Principle of locality of reference | |
| b. | Instruction Pipelining and its hazards | |
| c. | Flynn's Classification | |
| d. | Bus arbitration | |

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**Duration: 3hours** **Marks: 80**

**NB: (1) Question no. 1 is compulsory.**
**(2) Attempt any three out of remaining five questions.**
**(3) Assume data if required**

Q-1 Attempt **any FOUR**

a Explain the difference between monolithic kernel and micro kernel. 5
b What is mutual exclusion? Explain its significance. 5
c Discuss various scheduling criteria. 5
d Explain various file allocation techniques 5
e Explain the disk cache. 5

2-a What is operating system? Explain various functions and objectives. 10
b What is deadlock? Explain the necessary and sufficient condition for deadlock. What is the difference between deadlock avoidance and prevention? 10

3-a Explain the following in brief: 10
(a) Process synchronization (b)Inter-Process Communication
b Consider the following set of processes, assuming all are arriving at time 0. 10

| process | Burst time | Priority |
|---|---|---|
| P1 | 2 | 2 |
| P2 | 1 | 1 |
| P3 | 8 | 4 |
| P4 | 4 | 5 |
| P5 | 5 | 3 |

Calculate average waiting time and turn-around time for FCFS, SJF (Non-Pre-emptive), Priority and RR (Quantum=2).

4-a What is paging? Explain LRU, FIFO and Optimal page replacement policy for the following string. Page frame size is 4. 10
1,2,3,4,5,3,4,1,6,7,8,7,8,9,7,8,9,5,4,5,4,2
b Explain banker's algorithms in detail. 10

5-a What is system call? Explain any five system call in details. 10
b Explain paging hardware with TLB along with protection bits in page table. 10

Q-6 Write short notes on: **(any two):** 20
(a) Linux Virtual file system
(b) Process control block
(c) Readers and writer problem using Semaphore
(d) Explain disk scheduling algorithms.

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

**Please check whether you have got the right question paper.**

**N.B:** **(1) Question No.1 is compulsory**
**(2) Attempt any three of remaining five questions**
**(3) Assume any suitable data if necessary and justify the same**

| | | | |
|---|---|---|---|
| **Q 1** | **a)** | **Explain CSG method for solid modeling.** | **5** |
| | **b)** | **What is aliasing and Explain any one antialiasing method.** | **5** |
| | **c)** | **Compare Raster Scan and Random Scan displays.** | **5** |
| | **d)** | **Prove that two successive rotations are additive i.e. $R1(\theta_1) * R2(\theta_2) = R(\theta_1 + \theta_2)$** | **5** |
| **Q 2** | **a)** | **Explain Bresenham line drawing algorithm with proper mathematical analysis and identify the pixel positions along a line between A(10,10) and B(18,16) using it.** | **10** |
| | **b)** | **Explain the steps for 2D rotation about arbitrary point and provide a composite transformation for the same.** | **10** |
| **Q 3** | **a)** | **Explain Liang Barsky line clipping algorithm. Apply the algorithm to clip the line with coordinates (30,60) and (60,20) against window(xmin,ymin)=(10,10) and (xmax,ymax)=(50,50).** | **10** |
| | **b)** | **Explain Sutherland Hodgman polygon clipping algorithm with suitable example and comment on its shortcoming.** | **10** |
| **Q 4** | **a)** | **What is window and viewport? Derive the window to viewport transformation and also identify the geometric transformation involved.** | **10** |
| | **b)** | **Explain what is meant by Bezier curve? State the various properties of Bezier curve.** | **10** |
| **Q 5** | **a)** | **What is meant by parallel and perspective projection? Derive matrix for oblique projection.** | **10** |
| | **b)** | **Explain Z Buffer algorithm for hidden surface removal.** | **10** |
| **Q 6** | | **Write short notes on(any two)** | |
| | **a)** | **Koch curve** | |
| | **b)** | **Sweep representation and Octree representation** | **20** |
| | **c)** | **Gouraud and phong shading** | |
| | **d)** | **Halftoning and Dithering.** | |

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