

(3 Hours)

[Total Marks: 80]

N.B. : (1) Question No. one 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

1. (a) Find the Eigen values of $A^2 + 2I$, where $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & -2 & 0 \\ 3 & 5 & 3 \end{bmatrix}$ and I is the Identity

matrix of order 3.

5

(b) Evaluate the line integral $\int_0^{1+i} (x^2 + iy) dz$ along the path $y = x$

5

(c) If x is a continuous random variable with the probability density function given by

$$f(x) = \begin{cases} k(x - x^3) & 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find i) k ii) the mean of the distribution.

5

(d) Compute Spearman's rank correlation coefficient from the following data

X	18	20	34	52	42
Y	39	23	35	18	46

5

2. (a) Is the following matrix Derogatory? Justify.

$$\begin{bmatrix} 5 & -6 & -6 \\ -1 & 4 & 2 \\ 3 & -6 & -4 \end{bmatrix}$$

6

(b) Evaluate $\oint_c \frac{e^{2z}}{(z-1)^4} dz$ where c is the circle $|z| = 2$

6

(c) The marks of 1000 students in an Examination are found to be normally

distributed with mean 70 and standard deviation 5, estimate the number of students

whose marks will be i) between 60 and 75 ii) more than 75.

8

[Turn over]

3. (a) Solve the following non-linear programming problem using Kuhn-Tucker conditions

$$\text{Maximize } z = 10x_1 + 4x_2 - 2x_1^2 - x_2^2$$

$$\text{Subject to } 2x_1 + x_2 \leq 5; \text{ and } x_1, x_2 \geq 0$$

- (b) Fit a Binomial distribution to the following data

x	0	1	2	3	4	5	6
F	5	18	28	12	7	6	4

- (c) Is the following matrix diagonalizable? If yes, find the transforming matrix and the diagonal matrix.

$$\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$$

4. (a) Solve the following LPP using Simplex method

$$\text{Maximize } z = 4x_1 + x_2 + 3x_3 + 5x_4$$

$$\text{Subject to } -4x_1 + 6x_2 + 5x_3 + 4x_4 \leq 20$$

$$-3x_1 - 2x_2 + 4x_3 + x_4 \leq 10$$

$$-8x_1 - 3x_2 + 3x_3 + 2x_4 \leq 20$$

$$x_1, x_2, x_3, x_4 \geq 0$$

- (b) If a random variable X follows the Poisson distribution such that

$$P(X = 1) = 2P(X = 2), \text{ find the mean, the variance of the distribution and}$$

$$P(X = 3)$$

- (c) Expand $f(z) = \frac{1}{z(z-2)(z+1)}$ in the regions

$$i) |z| < 1, ii) 1 < |z| < 2, iii) |z| > 2$$

[Turn over

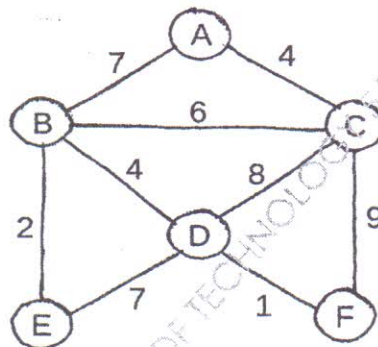
(3 Hours)

Total Marks: 80

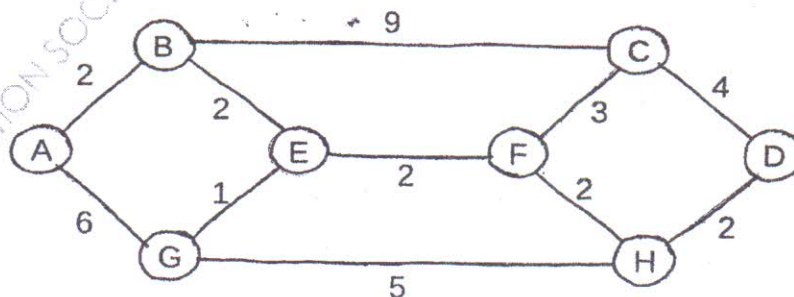
N.B.: (1) Question No. 1 is compulsory.

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

- Q1. a) Explain the asymptotic notations. [10]
b) Write an algorithm to find minimum and maximum value using divide and conquer and also derive its complexity. [10]
- Q2. a) Explain the concept of multiplying long integers using divide and conquer. [10]
b) Sort the following numbers using Quick Sort. Also derive the time complexity of Quick Sort. [10]
50, 31, 71, 38, 77, 81, 12, 33
- Q3. a) Solve the following Job sequencing with deadlines problem [10]
 $n=7$, Profits(p_1, p_2, \dots, p_7) = {3, 5, 20, 18, 1, 6, 30}
Deadlines(d_1, d_2, \dots, d_7) = {1, 3, 4, 3, 2, 1, 2}
b) Explain different string matching algorithms. [10]
- Q4. a) Find the Minimum Spanning Tree of the following graph using kruskal's algorithm [10]



- b) Explain flow shop scheduling with example. [10]
- Q5. a) Write an algorithm for sum of subsets. Solve the following problem. [10]
 $M=30$ $W=\{5, 10, 12, 13, 15, 18\}$
b) Find the shortest path from source vertex A using Dijkstra's algorithm [10]



- Q6. Write note on (any two): [20]
a) Strassen's matrix multiplication.
b) 8-Queen problem.
c) Graph coloring
d) 15-puzzle problem.

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SE Sem IV CBSGS CMPTN - Computer Organisation & Architecture

Q.P. Code : 541501

(3 Hours)

[Total Marks : 80

N.B. : (1) Q. 1 is compulsory.

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

(3) Assume suitable **data** if necessary.

1. Attempt any 4 sub questions.

- (a) Explain various pipeline hazards. 5
- (b) Express $(35.25)_{10}$ in the IEEE single precision standard of floating point representation. 5
- (c) Explain in brief the function of 8089 I/O processor. 5
- (d) Compare RISC and CISC processors. 5
- (e) Differentiate between Computer Architecture and Computer organization. 5

- 2. (a) Explain Flynn's classification in detail. 10
- (b) Explain the Interleaved memory. 10

- 3. (a) Calculate number of page faults and page hits for the page replacement policies FIFO, Optimal & LRU for given reference string 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1 (assuming three frame size). 10
- (b) What is the need of DMA? Explain its various techniques of data transfer. 10

- 4. (a) What is Bus arbitration? Explain its techniques. 10
- (b) Describe the register organization within the CPU. 10

- 5. (a) What are the features of cache memory design? 10
- (b) Multiply (-10) and (-4) using Booth's algorithm. 10

6. Write notes on

- (a) Joysticks 6
- (b) The characteristics of memory 8
- (c) Microinstructions to execute an instruction MOV [R1], R2. 6

Q.P. Code : 541600

(3 Hours)

Total Marks: 80

- N.B.:** (1) Question No.1 is **compulsory**.
 (2) Solve any **three** questions out of the remaining questions.
 (3) Make **suitable** assumptions if **needed**.

1. (a) Explain BCNF with example. 5
 (b) Write short note on Deadlocks. 5
 (c) Explain Total and Partial Participation. 5
 (d) Discuss the role of Database Administrator. 5
2. (a) Discuss steps in query processing. Also describe cost based query optimization. 10
 (b) Draw an ER Diagram and convert it into relational model for a Company, 10
 which has several Employees working on different types of Projects. Several Employees are working for one Department, every Department has a Manager. Several Employees are supervised by one Employee.
3. (a) Explain types of integrity constraints with example. 10
 (b) Discuss Data Definition and Manipulation Commands in SQL. 10
4. (a) Describe the overall architecture of DBMS with suitable diagram. 10
 (b) Explain Security and Authorization in DBMS. 10
5. (a) Explain the following Relational Algebra Operations with example: 10
 i. Natural Join iii. Generalized Projection
 ii. Set Intersection iv. Division Operator
 (b) Explain Assertions and Triggers in detail. 10
6. Write Short notes on: 20
 (a) ACID properties
 (b) Shadow Paging
 (c) Specialization and Generalization
 (d) Aggregate Functions in SQL

(3 Hours)

[Total Marks :80

- N.B. :** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **three** questions out of remaining **five** questions.
 (3) Assumptions made should be clearly stated.
 (4) **Figure** to the **right** indicate **full** marks.
 (5) **Assume** suitable **data** whenever required but justify that.

1. (a) Explain post correspondence problem. 5
 (b) Differentiate between NFA and DFA. 5
 (c) Show that language $L = \{0^i \mid i \text{ is prime number}\}$ is not regular. 5
 (d) Compare recursive and recursively enumerable languages. 5

 2. (a) Design the DFA to accept all the binary strings over $\Sigma = \{0,1\}$ that are beginning with 1 and having its decimal value multiple of 5. 10
 (b) Design DPDA to accept language $L = \{x \in \{a, b\}^* \mid N_a(x) \geq N_b(x)\}$. 10
 $N_a(x) > N_b(x)$ means number of a's are greater than number of b's in string x.

 3. (a) Explain variations and equivalence of Turing machine. 10
 (b) State and prove pumping lemma for context free languages. 10

 4. (a) Design mealy machine to find out 2's complement of a binary number. 10
 (b) Convert the following NFA to an equivalent DFA 10
- | State | a | b | ϵ |
|-------------------|----------------|----------------|------------|
| $\rightarrow q_0$ | $\{q_0, q_1\}$ | $\{q_1\}$ | $\{\}$ |
| q_1 | $\{q_2\}$ | $\{q_1, q_2\}$ | $\{\}$ |
| $*q_2$ | $\{q_0\}$ | $\{q_2\}$ | $\{q_1\}$ |
5. (a) Consider the following grammar $G = (V, T, P, S)$, $V = \{S, X\}$, $T = \{a, b\}$ and productions P are
 $S \rightarrow aSb \mid aX$
 $X \rightarrow Xa \mid Sa \mid a$
 Convert this grammar in Greibach Normal Form (GNF). 10
 (b) State and prove Rice's theorem. 10

 6. (a) Design a Turing machine as an acceptor for the language $\{a^n b^m \mid n, m \geq 0 \text{ and } m \geq n\}$ 10
 (b) Design PDA to check even parentheses over $\Sigma = \{0,1\}$ 10

Q. P. Code : 541801

(3 hours)

[80 Marks]

N.B.:

1. Question No.1 is compulsory.
2. Attempt any Three questions out of remaining Five questions.
3. Figures to the right indicate full marks.
4. Assume any suitable data wherever required but justify the same.

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|-----|----|--|----|
| Q.1 | a) | Prove that two successive rotations are additive. | 5 |
| | b) | Explain the various applications of computer graphics | 5 |
| | c) | Explain dithering technique in detail. | 5 |
| | d) | Specify the disadvantage of DDA algorithm | 5 |
| Q.2 | a) | Explain the steps used in rotation of 2 D object about an arbitrary axis and hence derive the matrix for the same. | 10 |
| | b) | Compare flood fill and boundary fill algorithm illustrating the same with a diagram | 10 |
| Q.3 | a) | Explain any one polygon clipping algorithm in detail. | 10 |
| | b) | Explain midpoint circle algorithm. Explain the same to plot a circle whose radius is 10 units | 10 |
| Q.4 | a) | Explain Cohen Sutherland line clipping algorithm in detail | 10 |
| | b) | Explain what is meant by Bezier curve. Also explain the properties of Bezier curve | 10 |
| Q.5 | a) | What is meant by parallel and perspective projections? Derive matrix for perspective projections | 10 |
| | b) | Define window, viewport and hence explain how window to viewport transformation is performed | 10 |
| Q.6 | | Write short notes on (any two): | 20 |
| | a) | Gouraud and Phong shading technique | |
| | b) | Shearing and viewing transformation | |
| | c) | Sweep representation | |