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) What is job sequencing with deadlines? Let the number of jobs be n=4, with profits (P1, P2, P3, P4) = (100,10,15,27) and deadlines (d1, d2, d3, d4) = (2,1,2,1). Solve the problem to find the optimal solution using greedy method. **(05)**

b) Write algorithm for insertion sort and sort the following elements using the same: 22, 15, 11, 16, 19. Show all the passes. **(05)**

c) Give the algorithm to solve the N-Queen Problem using backtracking. Give any 2 solutions for the 4-Queen Problem. **(05)**

d) Show the steps and find number of shifts to find the Pattern "aabc" in the Text String "abaaabccb" using Naïve String Matching Method. **(05)**

Q. 2

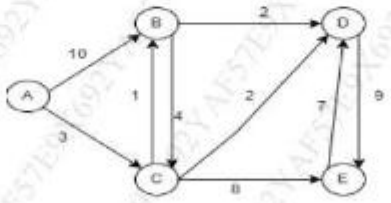
a) Explain O, Ω and Θ notations with appropriate equations and graphs. **(10)**

b) Solve the sum of subsets problem using backtracking for the following: n=4, m = 17, w = {2,7,8,15}. Show the entire state space tree and find all the solutions. **(10)**

Q. 3

a) Write an algorithm for Merge Sort. Derive its time complexity using the substitution method. Sort the following elements with using Merge Sort: 25, 11, 8, 39, 13, 12 **(10)**

b) Find the single source shortest path for the following graph using Greedy Method. Take vertex A as the source vertex **(10)**



Q. 4

a) Write algorithm for 0/1 knapsack using dynamic programming and obtain the solution to following 0/1 knapsack problem where: n = 4, Knapsack Capacity M = 5, Weights (W1, W2, W3, W4) = (2, 3, 4, 5) and profits (P1, P2, P3, P4) = (3, 4, 5, 6). **(10)**

b) Explain with an example how the Travelling Salesman Problem can be solved using Branch and Bound method. **(10)**

Q. 5

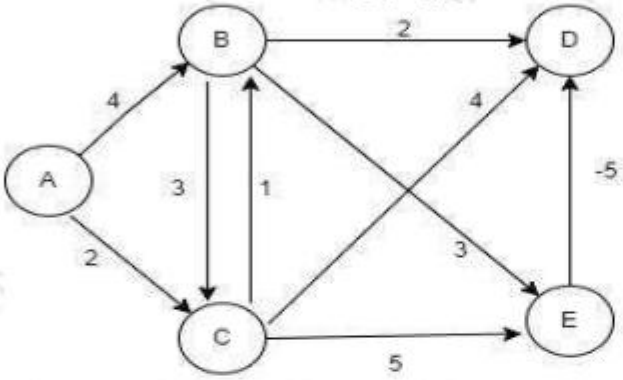
a) Give a suitable algorithm to find minimum and maximum element in a list using divide and conquer approach. Explain the approach with an example (Consider a list having atleast 7 elements). Discuss the time complexity for all cases. **(10)**

b) Give an algorithm to find Longest Common Subsequence between two sequences using Dynamic Programming. Also, find the LCS for the following strings: X = "SAVANT" **(10)**

Y = "ADVENT"

Q. 6

a) Give an algorithm to solve the All-pairs shortest path problem using dynamic programming. What is its time complexity? Find the All-pairs shortest path for all the vertices for the following graph. **(10)**



b) Give the Rabin-Karp Algorithm for string matching. Explain its working with a suitable example. List a few areas where String Matching Algorithms can be applied. **(10)**

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

NB. 1. Question number one is compulsory
2. Attempt any three out of remaining five questions
3. Assume suitable data
4. Figures to the right indicate the maximum marks

Q.1		**Attempt any FOUR:**	**(20)**
	a)	Differentiate between Database Management System and File System.	**05**
	b)	Explain aggregate functions with syntax and suitable example.	**05**
	c)	Explain type of functional dependency with suitable example.	**05**
	d)	Describe types of Entities with example.	**05**
	e)	Explain Log based recovery.	**05**
Q.2	a)	Explain overall architecture of DBMS in detail with appropriate diagram.	**(10)**
	b)	Explain Relational Algebra-operators given below: 1. Select 2. Project 3. Union 4. Rename	**(10)**
Q.3	a)	Draw EER Diagram for Hospital Management system and Map it to Relational Model	**(10)**
	b)	Discuss types of Joins in sql with syntax and example..	**(10)**
Q.4	a)	Write SQl queries for given database. employee (eno, ename, bdate, title, salary, dno) project (pno, pname, budget, dno) department (dno, dname, mgreno) works (eno, pno, resp, hours) 1) Find the project number and name for projects with a budget greater than 100,000. 2) Find the employees (name only) in department 'D1' ordered by descending salary. 3) Find all works records where hours worked is less than 10 and the responsibility is 'Manager'. 4) Find name of employees that are ending with letter ' s'. 5) Find total number of employee. 6) Write the query to in increase salary of the employees by 10%. 7) Find Employee name with maximum salary.	**(10)**
	b)	Explain all types of integrity constraints with an example?	**(10)**
Q.5	a)	Define Normalization. Explain 1NF ,2NF ,3NF and BCNF with examples.	**(10)**
	b)	Write note on i) Log based protocol ii) Timestamp-based protocols	**(10)**
Q.6	a)	What is deadlock? Give deadlock prevention and detection with suitable example	**(10)**
	b)	Explain concept of Serializability along with Conflict Serializability and View Serializability	**(10)**

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

Note :

1) **Q. No. 01 is compulsory.**
2) **Solve any three from Q. No. 02 to 06.**
3) **Numbers to the right indicate full marks.**
4) **Use of statistical tables is allowed.**

Q. 1. Solve.

a) If $A = \begin{bmatrix} -1 & 2 & 38 \\ 0 & 2 & 37 \\ 0 & 0 & -2 \end{bmatrix}$ find the Eigen values of $A^3 + 5A + 8I$. **05**

b) Integrate the function $f(z) = x^2 + i\,xy$ from A(1, 1) to B(2, 4) along $y = x^2$ **05**

c) Find the Z-Transform of $f(k) = a^{-k}$, $k \geq 0$. **05**

d) If a random variable X follows Poisson distribution such that P (x = 1) = 2 P (x = 2). Find mean and variance of the distribution. **05**

Q. 2.

a) Find the Eigenvalues and Eigenvectors of the matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$. **06**

b) Find the Z-Transform of $\cos\left(\frac{\pi}{4} + k\alpha\right)$ $k \geq 0$. **06**

c) Use the dual simplex method to solve the LPP **08**

Min. $Z = 2\,X_1 - X_2 + 3\,X_3$,

$3X_1 - X_2 + 3X_3 \leq 7,\ 2X_1 - 4X_2 \geq 12, X_1, X_2, X_3, \geq 0$

Q. 3.

a) Evaluate $\int_C \frac{z+8}{z^2+5z+6} dz$ Where C is a circle $|z|=5$. **06**

b) Verify Caley-Hamilton theorem and hence find A^{-1} and A^4 where $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$. **06**

c) Solve the LPP by Big -M method **08**

Max. $Z = X_1 + 2X_2 + 3X_3 - X_4$

$X_1 + 2X_2 + 3X_3 = 15$, $2X_1 + X_2 + 5X_3 = 20$, $X_1 + 2X_2 + X_3 + X_4 = 10$ $X_1, X_2, X_3, X_4 \geq 0$

Q. 4.

a) Find inverse Z transform of $F(z) = \frac{1}{(z-2)(z-3)}$ for i) $|z| < 2$, ii) $|z| > 3$. **06**

b) A certain drug administered to 12 patients resulted in the following change in their blood pressure. 5, 2, 8, - 1, 3, 0, 6, - 2, 1, 0, 4,5 Can we conclude that the drug increases the blood pressure? **06**

c) Find all possible Laurent's series expansions of the function $f(z) = \frac{1}{(z+1)(z-2)}$ about z = 0 indicating the region of convergence in each case. **08**

Q. 5.

a) Determine all basic solutions to the following problem **06**

Max $= x_1 - 2x_2 + 4x_3$,

$x_1 + 2x_2 + 3x_3 = 7,\ 3x_1 + 4x_2 + 6x_3 = 15\ , x_1\ , x_2, x_3 \geq 0$.

b) If X is a Normal variate with mean 10 & s.d. 4, find i) P(5≤X≤18), ii) P(X≤12). **06**

c) Solve the NLPP **08**

Optimize $Z = 12x_1 + 8x_2 + 6x_3 - {x_1}^2 - {x_2}^2 - {x_3}^2 - 23$

Subject to $x_1 + x_2 + x_3 = 10\ , x_1\ , x_2\ ,\ x_3 \geq 0$.

Q. 6.

a) Show that the given matrix is diagonalizable and hence find diagonal form and transforming matrix where $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$. **06**

b) Based on the following data if there is a relation between literacy and smoking. **06**

	Smoking	Non-smoking
Literacy	83	57
Illiteracy	45	68

c) Max. $Z = 12x_1x_2 + 2{x_1}^2 - 7{x_2}^2$, Subject to $2x_1 + 5x_2 \leq 98,\ x_1\ , x_2 \geq 0$ by K-T condition. **08**

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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	[20]
	a	Explain the minimum mode of 8086	
	b	Explain in brief cache organization of Pentium processor	
	c	Write an assembly language program for 8086 to exchange contents of two memory blocks	
	d	Explain the following instructions: XOR, NOP related to 8086.	
	e	Discuss in brief the Segment Register of 80386DX	
2	a	Explain the implementation of Paging in Protected mode of 80386.	[10]
	b	Explain the modes of 8255 with proper diagram of each modes	[10]
3	a	Design 8086 microprocessor-based on following Specifications: 1. MP 8086 working at 10MHz minimum mode. 2. 16 KB DRAM using 4 KB Devices 3. 32 KB SRAM using 8KB chips	[10]
	b	Explain what is ISR? How does 8086 decide the priority of interrupts?	[10]
4	a	Interface Interrupt controller 8259 with 8086 Microprocessor and modes of 8259.	[10]
	b	Write an ALP for 8086 to reverse a string of 10 characters.	[10]
5	a	Differentiate between Memory Mapped I/O and I/O mapped I/O. Explain in brief address decoding Techniques	[10]
	b	Explain MESI protocol	[10]
6	a	Draw the timing diagrams for Read and Write operations in minimum and maximum mode	[10]
	b	Explain hyper threading technology and its use in Pentium 4	[10]

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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	Explain the term 'Busy Waiting'. Give solution to this problem using Semaphore.	
	b	Explain the Process Control Block	
	c	Explain how the Resource Allocation Graph (RAG) and Wait For Graph (WFG) are used to determine presence of a deadlock.	
	d	Differentiate between User Level Thread and Kernel level Thread.	
	e	Explain Five state Process transition diagram.	
2	**a**	Suppose that a disk drive has 1000 Cylinders, numbered 0 to 999. Queue = 123,874,692,475,105,376. The drive is currently serving a Request at cylinder 345 and the head is moving towards track 0. Find total number of head movements needed to satisfy the requests for the FCFS, SSTF and SCAN disk scheduling algorithm?	**[10]**
	b	Discuss various process scheduling criteria.	**[10]**
3	**a**	Explain the term 'Deadlock' with an example. Explain the deadlock prevention techniques.	**[10]**
	b	What is "Critical Region"? Explain the Peterson's Algorithm as a solution to the same.	**[10]**
4	**a**	Given five memory partition of 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in order), how would the first-fit, best-fit and worst-fit algorithms place processes of P1-212 KB, P2-417 KB, P3-112 KB and P4-426 KB (in order)? Which algorithm makes the most efficient use of memory?	**[10]**
	b	Explain Dining Philosophers Problem with solution using Semaphore.	**[10]**
5	**a**	With a diagram, explain the three schedulers used in process management.	**[10]**
	b	Explain file allocation methods in details.	**[10]**
6		Write Short notes on (Any Two)	**[20]**
	a	LRU as a page replacement policy	
	b	Functions of OS	
	c	Paging and Segmentation	

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