SE - IT | Sem IV | C- Scheme | May - June 23.

(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 $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$, then find the Eigen values of $4A^{-1} + A^3 + I$ [5]

b) Evaluate $\int_c |z|\, dz$, where C is the left half of unit circle $|z| = 1$ from z = - i to z = i. [5]

c) *Maximise* $z = x_1 + 3x_2 + 3x_3$ [5]

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

$2x_1 + 3x_2 + 5x_3 = 7.$

Find all the basic solutions to the above problem. Which of them are basic feasible, non-degenerate, infeasible basic and optimal solution.

d) Tests made on breaking strength of 10 pieces of a metal wire gave the following results 578, 572, 570, 568, 572, 570, 570, 572, 596 and 584 in kgs. [5]

Test if the breaking strength of the metal wire can be assumed to be 577 kg ?

Q2 (a) Using Cauchy's residue theorem evaluate [6]

$\int_C \frac{(z+4)^2}{z^4+5z^3+6z^2} dz$, Where c is $|z|=1$.

(b) Find $Z\{f(k) * g(k)\}$ *if* $f(k) = 4^k\, U(k), g(k) = 5^k U(k)$. [6]

(c) Solve the following L.P.P by Simplex Method [8]

Maximise $z = 3x_1 + 2x_2 + 5x_3$

Subject to $x_1 + 2x_2 + x_3 \leq 430$

$3x_1 + 2x_3 \leq 460$

$x_1 + 4x_2 \leq 420$

$x_1, x_2, x_3 \geq 0$

Q3 a) Theory predicts that the proportion of beans in the four groups A, B, C, D should be 9: 3 :3 :1. In an experiment among 1600 beans the numbers in the four groups were 882, 313, 287 and 118. Does the experimental results support the theory? [6]

(Given that Critical value of chi-square 3 d. f and 5% L.O.S is 7.81)

b) Obtain Taylor's and Laurent's series expansion of $f(z) = \frac{z-1}{z^2-2z-3}$ [6]

c) Use the method of Lagrange's multipliers to solve the following N.L.P.P [8]

Optimize $z = 6x_1 + 8x_2 - {x_1}^2 - {x_2}^2$

Subject to $4x_1 + 3x_2 = 16$,

$3x_1 + 5x_2 = 15$

$x_1, x_2 \geq 0$

Q4a) fit a Poisson distribution to the following data [6]

No. of deaths	0	1	2	3	4
Frequencies	123	59	14	3	1

b) Find the inverse Z-transform of $\frac{1}{(z-2)(z-3)}$, *if ROC is* (*i*) $|z| < 2$ (*ii*) $2 < |z| < 3$ [6]

c) Show that the matrix $A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ is diagonalizable. Find the transforming matrix and the diagonal matrix. [8]

Q5a) Using the method of Lagrange's multipliers to solve the following N.L.P.P [6]

Optimize $z = 4x_1 + 8x_2 - {x_1}^2 - {x_2}^2$

Subject to $x_1 + x_2 = 4$,

$x_1, x_2 \geq 0$. [6]

b) Verify Cayley- Hamilton Theorem for the matrix $A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$ [6]

c) Solve by the dual Simplex Method [8]

Minimise $z = 6x_1 + x_2$

Subject to $2x_1 + x_2 \geq 3$,

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

Q6a) Find the Z-transform of $f\{k\} = \begin{cases} b^k, & k < 0 \\ a^k, & k \geq 0 \end{cases}$ [6]

b) The income of a group of 10,000 persons were found to be normally distributed with mean Rs.520 and standard deviation Rs.60. Find the lowest income of the richest 500. [6]

c) Using Kuhn Tucker conditions, solve the following NLPP [8]

Maximise $z = 10x_1 + 4x_2 - 2{x_1}^2 - {x_2}^2$

Subject to $2x_1 + x_2 - 5 \leq 0$

$x_1, x_2 \geq 0$

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(3 Hours)

Total Marks: 80

N.B.: (1) Question No.1 is compulsory.
(2) Attempt any three questions from the remaining five questions.
(3) Make suitable assumptions wherever necessary but justify your assumptions.

Q.1. Solve **any four**

a. Compare Twisted pair cable, Coaxial cable and Fiber optics cable. 05 M
b. Explain Ethernet Protocol. 05 M
c. Explain Repeater, Hub, Bridge, Switch, and Gateway. 05 M
d. Compare lossy with lossless data compression technique. 05 M
e. How many networks and hosts are possible using 'Class B' IP addressing? What is subnet mask? 05 M

Q.2.a. Draw and Explain OSI reference model with functions of each layer. 10 M

Q.2. b. Explain the difference between static and dynamic routing. Explain distance vector routing. 10 M

Q.3.a. Explain CSMA protocols. Explain how collisions are handled in CSMA /CA. 10 M

Q.3.b. A bit stream 1101011011 is transmitted using the standard CRC method.

The generator polynomial is x^4+x+1.

i) What is the actual bit string transmitted?
ii) Suppose the third bit from the left is inverted during transmission. How will the receiver detect this error? 10 M

Q.4.a. Draw and explain guided and unguided transmission media. 10 M

Q.4.b. Explain Go-Back-N protocol. 10 M

Q.5.a. Explain in detail TCP congestion control mechanism. 10 M

Q.5.b. What is IP addressing? Explain in detail Classful and Classless IP address 10 M

Q.6.Write a short note on (Any Four) 20 M

a. RPC
b. FTP
c. VPN
d. VLAN
e. HTTP

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

N.B.: 1) Question No.**1** is **compulsory**.
2) Attempt any **THREE** questions out of the remaining **FIVE** questions.
3) **Figures** to the **right** indicate **full** marks.
4) Assume suitable data if **necessary**.

Q1 **Attempt any FOUR of the following** **20**

a What is the content of page table? Explain.

b Compare process scheduling and process switching.

c What is Semaphore? What is its significance?

d Explain UNIX OS kernel.

e Explain Direct Memory Access (DMA) in detail.

Q.2

a Consider the following snapshot of the processes: **10**

Process	Burst time	Arrival time	Priority
P1	8	0	1
P2	20	1	3
P3	3	2	2
P4	6	3	5
P5	12	4	4

i. Draw the Gantt chart for the execution of the processes, showing their start time and end time using FCFS, SJF (without considering the priority), priority scheduling (pre-emptive), RR (with time quantum=5),
ii. Calculate turnaround time, and average waiting time and average turnaround time for the system.

b Explain with suitable example, how virtual address is converted to physical address? **10**

Q.3

a Consider the following state of a system with four processes, P1, P2, P3, and P4, and five types of resources, RS1, RS2, RS3, RS4, and RS5: **10**

C =

0	1	1	1	2
0	1	0	1	0
0	0	0	0	1
2	1	0	0	0

R =

1	1	0	2	1
0	1	0	2	1
0	2	0	3	1
0	2	1	1	0

E = (24144)

A = (01021)

Using the deadlock detection algorithm check deadlock is there or not? If deadlock is there, then identify the processes that are deadlocked.

b	What is virtual memory technique? Discuss segmentation with example.	10

Q.4

a	Consider the following reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. Find the number of page faults with FIFO, Optimal Page Replacement and LRU with frame size=4,	10
b	State features of Cloud OS. Enlist its advantages and disadvantages.	10

Q.5

a	What is demand paging? Discuss the hardware support required to support demand paging.	10
b	What is Threading and Multithreading? Explain importance of Multithreading.	10

Q.6	**Write short notes on any FOUR**	**20**
a	Necessary conditions for deadlock	
b	RAID levels	
c	Disk Scheduling	
d	Real Time Operating System	
e	Deadlock avoidance	
f	Process Control Block	

-----X-----

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(3 Hours) Marks: 80

Note: Question No. 1 is Compulsory
Attempt any three out of the remaining five questions
Assumptions made should be clearly stated
Draw suitable diagram where ever necessary

		Marks
Q.1.	**Attempt any four sub-questions.**	
a.	Describe Moore machine with all tuples in detail.	5M
b.	Arrange a mealy machine to accept all strings ending with 00 or 11.	5M
c.	Design DFA to accept strings over the alphabet $\sum = \{a,b\}$ containing even number of a's.	5M
d.	Evaluate given context-free grammar and Identify whether it is ambiguous or not. $S \longrightarrow a \mid Sa \mid bSS \mid SSb \mid SbS$	5M
e.	Draw diagram for Chomsky hierarchy and Show all the types with proper explanation.	5M
Q.2.		
a.	Design NFA for accepting input strings that contain either the keyword 000 or the keyword 010 and convert it into an equivalent DFA	10M
b.	Design a DFA corresponding to regular expression $(a+b)^*aba\ (a+b)^*$	10M
Q.3.		
a.	Design a Mealy machine that accepts strings ending in "00" and "11". Convert the same to Moore Machine	10M
b.	Define CFG, obtain CFG for the following grammar $(110+11)^*(10)^*$	10M
Q4.		
a.	Construct a Turing machine accepting palindromes over $\sum=\{a,b\}$	10 M
b.	Design a PDA for $L = \{ a^n b^n \mid n>= 1\}$	10 M
Q5.		
a.	Design a Moore machine which counts the occurrence of substring bba in input string.	10 M
b.	Design a TM accepting the set of strings with equal number of 0's and 1's over {0,1}*	10 M
Q6.		
a.	Write Short note on: Halting Problem in TM.	10 M
b.	Explain applications of FM, PDA and Turing Machine with example.	10 M

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TIME: 3 HRS **MAX MARKS: 80**

N.B. 1. Question No 1 is compulsory.
2. Solve any **three** questions out of the remaining five questions.
3. Assume suitable data if necessary.
4. Figures to the right indicate marks.

Q. 1. Solve any **four** out of five. **(4*5=20)**

a. Discuss any five arithmetic instructions of 8086 with examples.

b. Describe Key Characteristics of Computer memory.

c. Discuss six stage instruction pipeline with diagram.

d. Explain half adder with diagram.

e. Represent $(-309.1875)_{10}$ in the IEEE 754 double precision format.

Q. 2. a) Explain Flynn's classification in detail with diagram. **(10)**

b) Discuss various cache memory mapping techniques with advantages and disadvantages of it. **(10)**

Q. 3. a) Draw Flowchart of Non-Restoring division technique and divide 12 by 4 using Non-Restoring division technique. **(10)**

b) Explain JK flip with diagram and Compare SR and JK flip flop. **(10)**

Q. 4. a) Write 8086 Assembly Language Program to count the number of 0's and 1's in given 8-bit numbers. **(10)**

b) Discuss concept of DMA and its various data transfer techniques **(10)**

Q. 5. a) Draw flowchart of Booth's algorithm. Perform multiplication of (-15) and (3) using same. **(10)**

b) List and discuss addressing modes of the 8086 microprocessors with example. **(10)**

Q. 6. a) Write short note on decoder and encoder. **(10)**

b) Draw structure of four variable K map and minimize the following Boolean function.

$F(A, B, C, D) = \Sigma m(0, 2, 7, 10, 15) + \Sigma d(3, 14)$ **(10)**

SE-IT | Sem IV | e-scheme | 19|05|2023

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