Q. P. Code: 37497

Hours: 3 hrs Marks: 80

Note: 1. Question no**. 1** is compulsory.
2. Attempt any **three** questions out of remaining **five** questions.

Q.1.[a] Given two lines of regression lines $6y = 5x + 90,\ 15x = 8y + 130.$ [5]
Find (i) $\bar{x},\ \bar{y}$ (ii) correlation coefficient r.

[b] Show that $(41|(2^{20} - 1))$. [5]

[c] A random discrete variable x has the probability density function given [5]

x	-2	-1	0	1	2	3
P(x)	0.2	k	0.1	2k	0.1	2k

Find (i) k (ii) E(X) (iii) V(X).

[d] Show that $G = \{1, -1, i, -i\}$ is a group under usual multiplication of complex number. [5]

Q.2.[a] Find gcd (2378, 1769) using Euclidean Algorithm. Also find x and y such that $2378x + 1769y = \gcd(2379,1769)$. [6]

[b] Give an example of a graph which has [6]
(i) Eulerian circuit but not a Hamiltonian circuit
(ii) Hamiltonian circuit but not an Eulerian circuit
(iii) Both Hamiltonian circuit and Eulerian circuit

[c] Show that $(D_{10}, \leq)$ is a lattice. Draw its Hasse diagram. [8]

Q.3.[a] Derive mgf of Binomial distribution and hence find its mean and variance. [6]

[b] It was found that the burning life of electric bulbs of a particular brand was normally distributed with the mean 1200 hrs and the S.D. of 90 hours, Estimate the number of bulbs in a lot of 2500 bulbs having the burning life: (i) more than 1300 hours (ii) between 1050 and 1400 hours. [6]

[c] **(i)** Find inverse of $8^{-1} \pmod{77}$ using Euler's theorem. [8]
(ii) Find the Jacobi's symbol of $\left(\frac{32}{15}\right)$.

Q.4.[a] Calculate the coefficient of correlation between x and y from the following data [6]

x	23	27	28	29	30	31	33	35	36	39
y	18	22	23	24	25	26	28	29	30	32

[b] Let G be a group of all permutations of degree 3 on 3 symbols 1, 2 & 3. [6]
Let H ={I, (1 2)} be a subgroup of G. find all the distinct left cosets of H in G and hence index of H.

[c] **(i)** The average marks scored by 32 boys is 72 with standard deviation of 8 while that for 36 girls is 70 with standard deviation of 6. Test at 5% LOS whether the boys perform better than the girls. [8]

(ii) A random sample of 15 items gives the mean 6.2 and variance 10.24. Can it be regarded as drawn from a normal population with mean 5.4 at 5% LOS?

Q.5.[a] Solve $x \equiv 1(\text{mod } 3),\ x \equiv 2(\text{mod } 5),\ x = 3\ (\text{mod } 7)$. [6]

[b] Given L = {1, 2, 4, 5, 10, 20}with divisibility relation. Verify that $(L, \leq)$ is a distributive but not complimented Lattice. [6]

[c] **(i)** Draw a complete graph of 5 vertices. [8]

(ii) Give an example of tree. (sketch the tree).

Q.6.[a] Show that $111^{333} + 333^{111}$ is divisible by 7. [6]

[b] The following table gives the number of accidents in a city during a week Find whether the accidents are uniformly distributed over a week. [6]

Day	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
No. of accidents	13	15	9	11	12	10	14	84

[c] **(i)** Write the following permutation as the product of disjoint cycles [8]

$f = (1\ 3\ 2\ 5)\ (1\ 4\ 5)\ (2\ 5\ 1)$.

(ii) Simplify as sum of product $(A+B)\ (A+B')\ (A'+B)\ (A'+B')$.

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

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

1. Solve any four out of five sub questions. [04 x 05=20]
   a) Compare Computer Organization and Computer Architecture.
   b) Explain various pipeline hazards.
   c) Differentiate between Hardwired and Micro programmed control unit.
   d) Discuss various characteristics of memory.
   e) Explain following instructions of 8086 microprocessor –ADC, DAA, MOVSB, LEA, ROL

2. a) Discuss various addressing modes of 8086 microprocessor with example. 10
   b) Using Booth's algorithm demonstrates multiplication of (-7)*(-6). 10

3. a) Explain concept of DMA in detail. 10
   b) Describe various cache memory mapping techniques. 10

4. a) Describe Flynn's classification in detail. 10
   b) Divide 13 by 4 using restoring division algorithms. 10

5. a) Describe Minimum modes of 8086 microprocessor in detail. 10
   b) Express $(-10.100)_{10}$ in IEEE 754 single & double precision standard of floating point number representation. 10

6. Write short notes on: **(any four)** [04 x 05=20]
   a) Segmentation concept of 8086 microprocessor.
   b) Cache coherency
   c) Von Neumann architecture
   d) Programmed I/O
   e) Six stage instruction pipeline

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

Note:

1) **Q.1 is compulsory**
2) **Answer any 3 from Q2-Q6**

Q.1. Answer the following (5M each)

a) Consider five source symbols of a discrete memory less source their probabilities as shown. Follow the Huffman's algorithm to find the codewords for each message:

m1	m2	m3	m4	m5
0.4	0.2	0.2	0.1	0.1

b) Compare Bus and Star topology

c) Compare Message Switching and Circuit Switching

d) Compare LAN,MAN,WAN

Q.2. a) Draw and explain the OSI Reference Model. (**10**)

Q.2. b) Generate the CRC code for a dataword 110010101.The divisor 10101. Check whether there are errors in the received codeword. (**10**)

Q.3. a) Explain ALOHA and Slotted ALOHA. (**10**)

Q.3. b) Compare wired and wireless media. (**10**)

Q.4. a) Explain the IPV4 header format. (**10**)

Q.4. b) Compare TCP and UDP. (**10**)

Q.5. a) What is routing? Explain DVR with an example. (**10**)

Q.5. b) Explain sliding window protocol. (**10**)

Q.6. Write short notes on any four: (5M each)

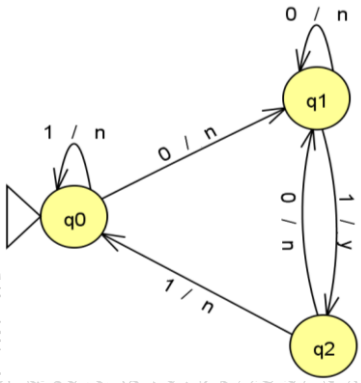
a) Speech Compression
b) DNS
c) Congestion Control
d) TCP Timers
e) WWW

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

1. Question No. **1** is **compulsory**.
2. Out of remaining questions, attempt any **three** questions.
3. Assume **suitable** data wherever required but **justify** the same.
4. **All** questions carry **equal** marks.
5. Answer to each new question to be started on a fresh page.
6. **Figure** to the **right** in brackets indicate **full** marks.

1. Solve any four from the followings.

(a) Construct Moore machine equivalent to following Mealy machine. **[05]**



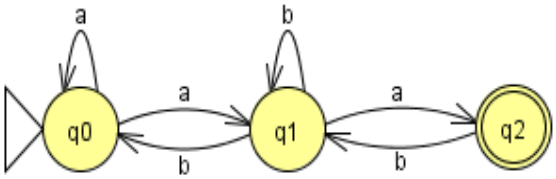
(b) Construct a PDA for the following Context Free Grammar (CFG). **[05]**

$S \rightarrow CBAA \qquad A \rightarrow 0A0 \mid 0 \qquad B \rightarrow 0B \mid 0 \qquad C \rightarrow 0C1 \mid 1C0 \mid \varepsilon$

(c) Construct right linear grammar and left linear grammar for the regular expression 1(01)*0(0 + 1)*. **[05]**

(d) Explain the concepts, acceptance by final state and acceptance by empty stack of a Pushdown automata with suitable example. **[05]**

(e) Construct regular expression for the following FA using state elimination method. **[05]**

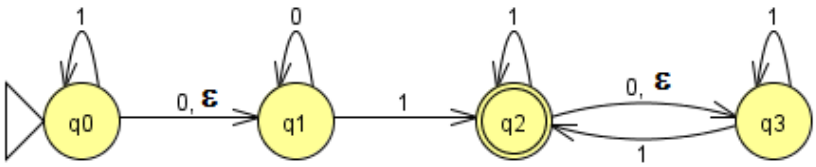


2. (a) Write down the regular expressions for the following language. **[04]**

i. L is the language of all strings over {0, 1} having odd number of 0's and any number of 1's.

ii. L is the language of all strings over {0, 1} having number of 1's multiple of three.

(b) Construct DFA for the following NFA with **ε**-moves. **[10]**



(c) Construct NFA with ε-moves for the regular expression ab*(a + b)* + ba* **[06]**

3. (a) Covert the following context free grammar into Chomsky normal form. **[10]**

$S \rightarrow A \mid C \qquad A \rightarrow aA \mid a \mid B \qquad B \rightarrow bB \mid b \mid \varepsilon \qquad C \rightarrow cC \mid c \mid B$

(b) Construct a Context Free Grammar (CFG) for the following PDA. **[10]**

$M = (\{q_0, q_1\}, \{(,), [,]\}, \{(, [, Z_0\}, \delta, q_0, Z_0, \Phi)$ and δ is given by:

$\delta(q_0, (, Z_0) = (q_0, (Z_0)$

$\delta(q_0, [, Z_0) = (q_0, [Z_0)$

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$\delta(q_0,), ( ) = (q_0, \varepsilon)$

$\delta(q_0,], [ ) = (q_0, \varepsilon)$

$\delta(q_0, \varepsilon, Z_0) = (q_1, \varepsilon)$

4. (a) Construct a PDA for $L = \{a^n b c^m \mid n, m \geq 1 \text{ and } n < m\}$. **[10]**

(b) Design a DFA over {0, 1} which accepts all strings that contain substring '11' and do not contain the substring '00'. **[06]**

(c) Give context free grammar for the following languages. **[04]**

i. $L = \{0^n 1^m 0^k \mid m > n + k \text{ and } n, m, k \geq 0\}$

ii. $L = \{a^{2n} b^{3m} c^m d^n \mid n, m \geq 1\}$

5. (a) Construct Turing Machine to accept language $L = \{a^n b^{2n+1} \mid n \geq 1\}$. **[10]**

(b) Find the equivalent NFA with ϵ-moves accepting the regular language defined by the following grammar. **[05]**

$S \rightarrow 01S \mid 0A \qquad A \rightarrow 10 \mid 1B \mid 00A \qquad B \rightarrow 1S \mid 1B \mid \epsilon$

(c) Let G be the grammar having following set of production. **[05]**

$S \rightarrow ABA \qquad A \rightarrow aA \mid bA \mid \epsilon \qquad B \rightarrow bbb$

For the string "ababbbba", find a leftmost derivation and rightmost derivation.

6. (a) Minimize the following DFA $M = (\{q_0, q_1, q_2, q_3, q_4, q_5\}, \{0, 1\}, \delta, q_0, \{q_3, q_5\})$, where δ is given in the following table. **[06]**

	$\rightarrow q_0$	q_1	q_2	$*q_3$	q_4	$*q_5$
0	q_1	q_3	q_5	q_3	q_5	q_3
1	q_2	q_4	q_1	q_4	q_1	q_4

(b) Construct Turing Machine wherein given an input 1^n leaves 1^{3n+1} on the tape. Covert the TM design into equivalent function. **[10]**

(c) What do you understand by closure property? State the various set theoretic operations under which regular languages are closed. Give suitable example. **[04]**

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

N.B. 1) Question **no.1 is compulsory**

2) Solve any **Three** questions from remaining five.

3) Assume suitable data wherever required.

Q 1) a) Explain race condition with example. (5)

b) What is thrashing? How is it handled? (5)

c) What is demand paging? What are the advantages? (5)

d) Explain the concept of Virtual memory. (5)

Q 2) a) What is an operating system? What is the need for an operating system? Discuss the Major functions of an operating system with examples. (10)

b) Consider a system consisting of *m* resources of the same type, being shared by n processes. Resources can be requested and released by processes only one at a time. Show that the system is deadlock-free if the following two conditions hold:
a) The maximum need of each process is between 1 and *m* resources
b) The sum of all maximum needs is less than *m + n.* (10)

Q 3) a) A variable partition memory system has at some point in time the following hole sizes in the given order:- 20k,15k,40k,60k,10k,25k. A new process is to be loaded. Which hole size would be filled using best-fit, first-fit and worst fit respectively? (10)

b) What problems could occur of system allowed a file system to be mounted simultaneously at more than one location? (05)

c) Define critical section. What are the requirements to solve critical-section problem? (05)

Q 4) a) In a variable partition scheme, the OS must keep track of allocation and free space. Suggest a mean to of achieve this. Describe an effect of new allocation and process termination in your suggested scheme. (10)

b) What is the need of Page replacement? Consider the following reference string

7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1

Find the number of Page Faults with FIFO, Optimal Page replacement and LRU with four free frames which are empty initially. Which algorithm gives the minimum number of page faults? (10)

Q 5) a) What is paging? How it is different from segmentation? Explain hardware support for paging. (10)

b) What is the critical section problem? What requirement should a solution to critical section problem satisfy? State Peterson's solution and indicate how it satisfies the above requirements. (10)

Q 6) a) Compare the following main memory organization schemes: contiguous memory allocation, pure segmentation, and pure paging with respect to the following issues:

i) External fragmentation ii) Internal fragmentation iii) Ability to share code across processes. (10)

b) Explain the Distributed Processing in Operating Systems. What are the necessary conditions for deadlock? (10)
