Q.P. Code: 25530

Duration: 3 hours **Total marks: 80**

Note: (1) Question No. 1 is compulsory

(2) Attempt any three questions from remaining questions

(3) Draw suitable diagrams wherever necessary

(4) Assume suitable data, if necessary

Q 1. (a) Construct a DFA that accepts all the strings on {0, 1} except those containing the substring 010. **(05)**

(b) Find the CFG for the regular expression (11)*(010+01)*. **(05)**

(c) Write short note on Chomsky Hierarchy. **(05)**

(d) Give formal definition on NFA with epsilon. **(05)**

Q 2. (a) Write NFA for accepting regular Expression (b+ab)*(ba*+b). **(10)**

(b) Design a Moore and Mealy machine for a binary input sequence such that if it has a substring 010 the machine outputs A if input has substring 101 it outputs B otherwise it outputs C. **(10)**

Q 3 (a) Use pumping lemma to show that the set of palindromes is not a regular Language. (palindrome is a string that equals its own reverse, such as 0110). **(10)**

(b) Minimize the following DFA where q_0 is a start state and q_1, q_2 and q_4 are final states. **(10)**

∂	0	1
q_0	q_3	q_1
q_1	q_2	q_5
q_2	q_2	q_5
q_3	q_0	q_4
q_4	q_2	q_5
q_5	q_5	q_5

Q 4 (a) Explain rules for simplification of CFG. **(10)**

(b) Convert given CFG to CNF **(10)**

S→ASB | ε

B →SbS | A | bb

A→aAS | a

Q 5 (a) Design a PDA to accept the language $\{L = a^m b^m c^n \mid m, n>=1\}$ **(10)**

(b) Construct TM for checking well formness of the parenthesis. **(10)**

Q 6 Write short notes on (Any two) **(20)**

(a) Pumping Lemma for Regular Languages

(b) Universal Turing Machine.

(c) Unsolvable Problems

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SE - ~~III~~ IV - CBSGS - INFT / AM-IV / NOV-2017.

No student

Q.P. Code :23022

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

Please check whether you have got the right question paper.

N.B:
1. Question.No.1 is compulsory.
2. Attempt any three questions from Q.2 to Q.6
3. Use of statistical table permitted.
4. Figures to the right indicate full marks.

a) Evaluate $\int_c \log z \, dz$ where C is the unit circle in the z - plane. 05

b) Find the eigen values of the adjoint of $A = \begin{bmatrix} 2 & 0 & -1 \\ 0 & 2 & 0 \\ -1 & 0 & 2 \end{bmatrix}$ 05

c) If the arithmetic mean of regression coefficient is p and their difference is 2q, find the correlation coefficient. 05

d) Write the dual of the following L.P.P. 05

Maximise $Z = 2x_1 - x_2 + 4x_3$

Subject to $x_1 + 2x_2 - x_3 \leq 5$

$2x_1 - x_2 + x_3 \leq 6$

$x_1 + x_2 + 3x_3 \leq 10$

$4x_1 + x_3 \leq 12$

$x_1, x_2, x_3 \geq 0$

a) Evaluate $\int_C \frac{\cot z}{z} \, dz$ where C is the ellipse $9x^2 + 4y^2 = 1$ 06

b) Show that $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{bmatrix}$ is non- derogatory. 06

c) If X is a normal variate with mean 10 and standard deviation 4, find 08

i) $P(|X - 14| < 1)$, ii) $P(5 \leq X \leq 18)$, iii) $P(X \leq 12)$

a) Find the expectation of number of failures preceeding the first success in an infinite series of independent trials with constant probabilities p & q of success and failure respectively. 06

b) Using Simplex Method solve the following L.P.P 06
Maximise $Z = 10x_1 + x_2 + x_3$
Subject to $x_1 + x_2 - 3x_3 \leq 10$
$4x_1 + x_2 + x_3 \leq 20$
$x_1, x_2, x_3 \geq 0$

c) Expand $f(z) = \frac{1}{z(z+1)(z-2)}$ 08
(i) Within the unit circle about the origin.
(ii) with in the annulus region between the concentric circles about the origin having radii 1 and 2 respectively.
(iii) In the exterior of the circle with centre at the origin and radius 2.

a) If X is Binomial distributed with mean=2 and variance = 4/3, find the probability distribution of X. 06

b) Calculate the value of rank correlation coefficient from the following data regarding score of 6 students in physics & chemistry test. 06
Marks in Physics : 40, 42, 45, 35, 36, 39
Marks in Chemistry : 46, 43, 44, 39, 40, 43

c) Is the matrix $A=\begin{bmatrix}2 & 1 & 1\\ 1 & 2 & 1\\ 0 & 0 & 1\end{bmatrix}$ diagonalisable? If so find the diagonal form and the transforming matrix. 08

a) A random sample of 50 items gives the mean 6.2 and standard deviation 10.24 . Can it be regarded as drawn from a normal population with mean 5.4 at 5% level of significance? 06

b) Evaluate $\int_0^\infty \frac{dx}{(x^2+a^2)^3}$, a>0 Using Cauchy's residue theorem. 06

c) Using Kuhn-Tucker condition to solve the following N.L.P.P 08
Maximise $Z = 8x_1 + 10x_2 - x_1^2 - x_2^2$
Subject to $3x_1 + 2x_2 \leq 6$
$x_1, x_2 \geq 0$

a) The following table gives the number of accidents in a city during a week. Find whether the accidents are uniformly distributed over a week. 06

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

b) If two independent random samples of sizes 15 & 8 have respectively the following means and population standard deviations, 06

$\overline{X_1} = 980$ $\overline{X_2} = 1012$

$\sigma_1 = 75$ $\sigma_2 = 80$

Test the hypothesis that $\mu_1 = \mu_2$ at 5% level of significance,

(Assume the population to be normal)

c) Using Penally (Big M) method solve the following L.P.P. 08

Minimise $Z = 2x_1 + x_2$

Subject to $3x_1+x_2 = 3$

$4x_1+3x_2 \geq 6$

$x_1+2x_2 \leq 3$

$x_1, x_2 \geq 0$

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