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- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Due credit will be given to neatness and adequate dimensions.
 9. Assume suitable data whenever necessary.
 10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Construct DFA equivalent to NFA $(\{p, q, r, s\}, \{0, 1\}, p, \{s\}, \delta)$ where δ is given by. 7

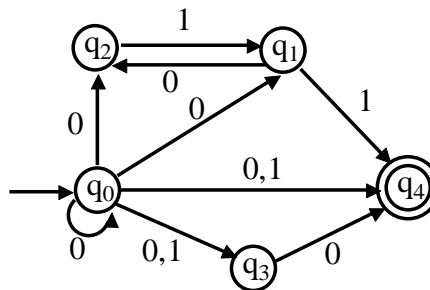
δ	0	1
p	p, q	p
q	r	r
r	s	-
s	s	s

- b) Differentiate between: - 6
- i) NFA and DFA
 - ii) Grammar and Language
 - iii) Mealy and Moore machine

OR

2. a) Construct Moore machine and transition table for count number of a's % 3 ($a \bmod 3$) over $\Sigma = \{a, b\}$. Also construct its equivalent Mealy machine. 8

- b) Construct DFA which is equivalent to following NFA over $\Sigma = \{0, 1\}$. 5

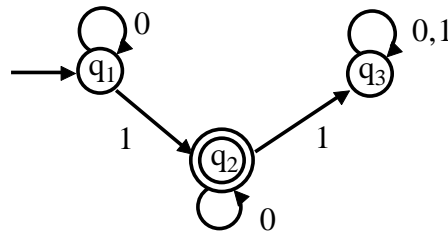


3. a) Construct equivalent LLG for the RLG given below. 6
- $S \rightarrow 0A \mid 1B$
- $A \rightarrow 0C \mid 1A \mid 0$
- $B \rightarrow 1B \mid 1A \mid 1$
- $C \rightarrow 0 \mid 0A$

- b) Prove that $L = \{a^n b^{n+m} c^m \mid n, m \geq 1\}$ is not regular. 5
- c) Prove that regular language is closed under union operation. 3

OR

4. a) Convert the grammar with the following productions to CNF. 4
 $S \rightarrow ABa$
 $A \rightarrow aab$
 $B \rightarrow Ac$
- b) Convert the grammar with the following productions to GNF. 4
 $E \rightarrow E + T \mid T$
 $T \rightarrow T * F \mid F$
 $F \rightarrow (E) \mid id$
- c) Construct a regular expression corresponding to the automata given below. 6



5. a) Convert following regular expression and language to its equivalent grammar. 8
 i) $((a + b)(a + b))^*$
 ii) $L = \{a^n b^m c^m d^n \mid n, m \geq 1\}$.
- b) Differentiate between Non-Deterministic pushdown Automata & deterministic pushdown Automata. 5

OR

6. a) Explain closure properties of CFL. 6
- b) Construct DPDA that accepts the language of strings with the same number of zeros & ones over $\Sigma = \{0, 1\}$. 7
7. a) Explain how TM work as a comparator. Consider & strings to show all the cases of comparison. 7
- b) Explain in detail different types of TM. 6

OR

8. a) Design a TM to find 2's complement of n digit binary number. 7
- b) Write short note on **any two**. 6
- i) Counter machine
- ii) Multitape TM
- iii) Offline TM
- iv) Multidimensional TM
9. a) Consider PCP system that described by the following test. 7
- $A = \{10, 01, 0, 100, 1\}$
- $B = \{101, 100, 10, 0, 010\}$
- Does this PCP have solution?
- b) Define Ackermann's function Compute 6
- $A(1, 1), A(2, 1), A(2, 2)$.

OR

10. a) State which of the following PCP's have a solution. 7
- i) $\{(01, 011), (1, 10), (1, 11)\}$
- ii) $\{(b^3, ab^2), (b^3, bab^3)\}$.
- b) What do you mean by recursion? Explain the properties of Recursive and Recursively enumerable languages. 6
11. a) What is primitive recursive function? Explain the category of basic function. 6
- b) Explain Mod and Div functions with example. 8

OR

12. a) Show that the function $g(x, y) = x^y$ is primitive recursive. 6
- b) Write short note on **any two**. 8
- i) μ - recursive function.
- ii) Bounded minimization.
- iii) Unbounded minimization



~ Mark Twain

