



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

δ	0	1
p	{p, q}	{p}
q	{r}	{r}
r	{s}	-
s	{s}	{s}

(OR)

- b) Give non-deterministic finite automata accepting the set of strings in $(0 + 1)^*$ such that two 0's are separated by a string whose length is $4i$, for some $i \geq 0$.
12. a) i) Prove that any language accepted by a DFA can be represented by a regular expression. (7)
- ii) Construct a finite automata for the regular expression $10 + (0 + 11)0^*1$. (6)
- (OR)
- b) Prove that the following languages are not regular :
- i) $\{w \in \{a, b\}^* \mid w = w^R\}$ (7)
- ii) Set of strings of 0's and 1's, beginning with a 1, whose value treated as a binary number is a prime. (6)
13. a) Suppose $L = L(G)$ for some CFG $G = (V, T, P, S)$, then prove that $L - \{\epsilon\}$ is $L(G')$ for a CFG G' with no useless symbols or ϵ -productions.

(OR)

- b) Prove that the languages accepted by PDA using empty stack and final states are equivalent.
14. a) State and prove Greibach normal form.
- (OR)
- b) Design a Turing machine to compute proper subtraction.



15. a) Prove that Post Correspondence Problem is undecidable.

(OR)

b) Prove that the universal language L_u is recursively enumerable but not recursive.

PART - C

(1×15=15 Marks)

16. a) i) Suppose $L = N(M)$ for some PDA M , then prove that L is a CFL. (7)

ii) Give a CFG for the language $N(M)$ where $M = (\{q_0, q_1\}, \{0, 1\}, \{Z_0, X\}, \delta, q_0, Z_0, \Phi)$ and δ is given by

$\delta(q_0, 1, Z_0) = \{(q_0, XZ_0)\}$	$\delta(q_0, \epsilon, Z_0) = \{(q_0, \epsilon)\}$	
$\delta(q_0, 1, X) = \{(q_0, XX)\}$	$\delta(q_1, 1, X) = \{(q_1, \epsilon)\}$	
$\delta(q_0, 0, X) = \{(q_1, X)\}$	$\delta(q_1, 0, Z_0) = \{(q_0, Z_0)\}$	(8)

(OR)

b) i) Design a Turing machine to compute multiplication of two positive integers. (8)

ii) Design a Turing machine to recognize the language $\{0^n 1^n 0^n \mid n \geq 1\}$. (7)

