

Q #1. Design a Turing machine for recognizing the language (please give a formal description including tape alphabet, full state transition diagram identifying the acceptance and rejection states if any)

$$L = \{a^n b^n c^n \mid n \geq 0\}$$

$$L = \{w \mid w \text{ contains twice as many 0's as 1's, } w \text{ is made from } \{0,1\}^* \}$$

Q #2. Design a Turing machine to perform multiplication of two natural numbers represented as the number of zeroes. For example, number five is represented as 00000
Hint: Use repeated addition

Q #3 Design LR(0) items, their DFA and SLR(1) parse table for the following grammar showing the parse for the following input : ((a), a, (a, a)) Also show the parse tree obtained. Is this a LR(0) grammar? If not show the conflicts and show how you can resolve them through SLR(1) construction

Grammar :

$$E \rightarrow (L) \mid a$$

$$L \rightarrow L, E \mid E$$

Q #4 Design Context free grammars for the following languages (alphabet is {0,1})

a. $\{w \mid w \text{ starts and ends with the same symbol (either 0 or 1, which is the alphabet)}\}$

b. $\{w \mid w = w^r \text{ ie, } w \text{ is a palindrome}\}$

c. $\{a^i b^j c^k \mid i = j \text{ or } j = k, i, j, k \geq 0\}$

Q #5 Design pushdown automata (PDA) for the following language:

$\{w \mid w \text{ has odd length and the middle character is } 0\}$

Q #6 Show first, follow and predict sets for the following grammar after removing left recursion and left factoring:

$$E \rightarrow E + T$$

$$E \rightarrow T$$

$$T \rightarrow T * P$$

$$T \rightarrow P$$

$$P \rightarrow (E)$$

$$P \rightarrow ID$$

Q # 7 Using the pumping lemma show that the following languages are not regular:

$\{0^m 1^n \mid m \text{ not equal to } n\}$

$\{0^{2^n} \mid n \geq 0\}$

Q #8 Design NFA, DFA and minimize the DFA for the regular expression:

$0^* 1^* 0^*$