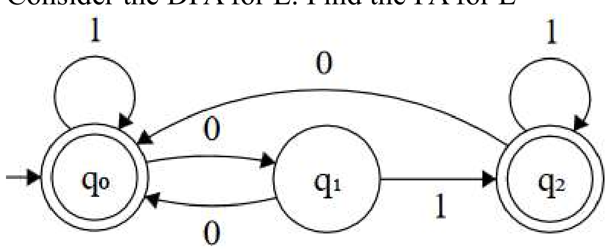
ToC Question Bank – 2

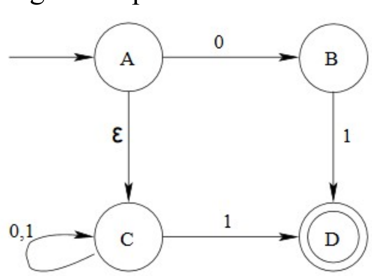
1. Prove that L is not regular.
   i. $L = \{a^i b^i \mid i \geq 0\}$
   ii. $L = \{a^i b^j \mid i > j\}$
   iii. $L = \{ww \mid w \text{ in } \{a,b\}^*\}$
   iv. $L = \{w_1w_2 : w_1,w_2 \in \{a,b\}^*, |w_1|=|w_2|\}$
   v. $L= \{ a^nb^nc^n \mid n \geq 0\}$
   vi. $\{ a^nba^mba^{n+m} \mid n, m > 1\}$
   vii. L= {w| w has an equal number of 0s and 1s}
   viii. $L = \{ 1^{n^2} \}$
   ix. $L = \{ a^iba^j \mid i > j >= 0 \}$
   x. $L = \{ a^iba^j \mid 0 <= i < j \}$
   xi. L = {a | k is a prime number}
   xii. $L = \{a^nb^{n+1}\}$
   xiii. $L = \{a^nb2^n\}$
   xiv. { all words in PALINDROME that have even length}
   xv. $L = \{ w \mid w\ 0\ \{a, b\}^*, w = w^R \}$
   xvi. $L = \{ 0^n \mid n \text{ is a power of } 2 \}$
2. Find the regular expressions over {0, 1).
   i. Even number of 0's followed by odd number of 1's
   ii. Two 0's do not come together
   iii. Even length strings and starting with 0
   iv. Strings containing at least two 0's.
   v. Strings that begin and end with either 0 or 1.
   vi. Strings containing the substring 00.
   vii. Strings containing at most two 0's.
   viii. Strings are of odd length and have a 1 at every odd position.
   ix. Strings have a 1 at every even position.
   x. Strings that do not contain single 0
3. Simplify the CFG
   i. aa((b*+a)a(ab*+aa)
   ii. (a*b*)*+a*
4. Find the complement RE for L={ ε, a} over {a, b}
5. $\sum= \{0, 1\}, \Delta = \{a, b\}$. h(0) = aa, h(1) = aba. L = {ab + ba}*. What is $h^{-1}(L)$?
6. Design CFG for
   i. $\{a^nb^n \mid n >=1\}$
   ii. $\{a^nb^{2n} \mid n >=0\}$
   iii. $\{a^mb^nc^{n+m} \mid n >=0, m>=0\}$
   iv. $\{a^nb^m \mid n \neq m\}$
7. Find parse tree for 1110111 for CFG $P \to 0P0 \mid 1P1 \mid 0 \mid 1 \mid \varepsilon$
8. Check whether CFG is ambiguous or not. If ambiguous, remove it.
   i. $A \to AA \mid (A) \mid a$
   ii. $S \to AB \mid C$
      $A \to aAB \mid ab$
      $B \to cBd \mid cd$

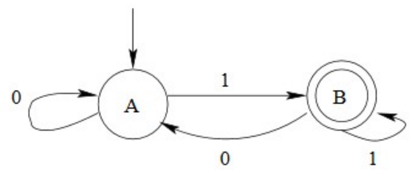
C →aCd|aDd
D → bDc|bc
iii. S → aSb|SS| ε
iv. S → SS| a|b
v. S → A | B
A → aAb|ab
B → abB|ε
vi. S→ A
A → A + A | B++
B → y
vii. S → AS | ε
A → A1| 0A1|01

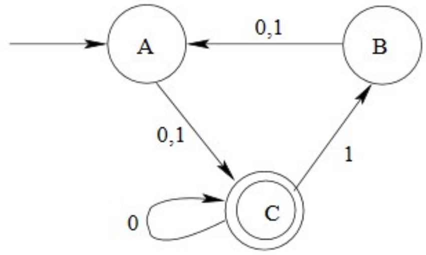
9. Find the NFA for the regular expression
   i. ab*((c+d) +c*)
   ii. (0+1)*(00 + 11)
   iii. L = (01 + 2*)1
   iv. bc(ab+c)*a
   v. 00(01+10)*11
10. Consider the DFA for L. Find the FA for L^R

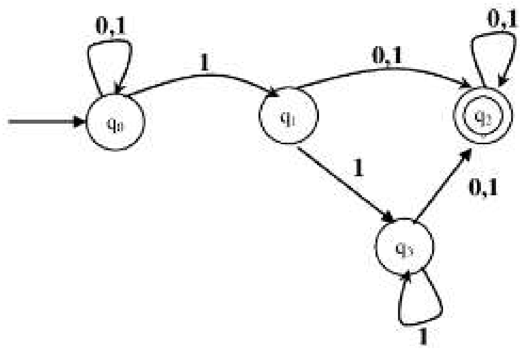


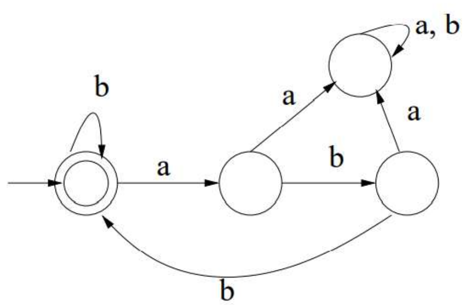
11. Convert to CNF
   i. S →aS | AB, A →ε, B→ε, D →b
   ii. S → XY | YX | XX | X | Y   X → 0X | 0   Y → 1Y | 1
   iii. S→a |Xb | aYa, X →Y| ε, Y →b | X
   iv. S→a |Xb | aYa, X →Y| ε, Y →b | X
   v. S →Xa, X →aX | bX | ε
   vi. S → ASB | ε   A →aAS | a   B →SbS | A| bb
   vii. S → aXbX   X → aY | bY | ε   Y → X | c
   viii. S →0A0 |1B1 | BB, A →C, B →S|A, C →S| ε
12. Find the Regular Expression for











13. Construct a PDA for language
    i. $L = \{0^n 1^m 2^m 3^n \mid n>=1, m>=1\}$
    ii. $L = \{a^n b^{2n} \mid n>=1\}$
    iii. $L = \{0^n 1^m \mid n >= 1, m >= 1, m > n+2\}$
    iv. $L = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i = j \text{ or } i = k\}$
    v. Accepting the language of balanced parentheses. (Consider any type of parentheses)
    vi. $L = \{a^i b^{i+j} c^j \mid i \geq 0, j \geq 1\}$
14. Show that the following languages are not CFL.
    i. $L=\{0^i 1^j 2^i 3^j \mid i \geq 1, j \geq 1\}$
    ii. $L = \{0^p \mid p \text{ is a prime}\}$
    iii. $L = \{a^n b^n c^i \mid i \leq n\}$
    iv. $L = \{a^i b^j \mid i \leq j^2\}$
    v. $L = \{a^i b^j c^k \mid k = ij\}$
    vi. L = (w belong to {a, b, c} $n_a(w) < n_b(w) < n_c(w)$