TOC Question Bank 5

1. Design CFG for
   i. $\{a^n b^n | n >= 1\}$
   ii. $\{a^n b^{2n} | n >= 0\}$
   iii. $\{a^m b^n c^{n+m} | n >= 0, m >= 0\}$
   iv. $\{a^n b^m | n \neq m\}$
   v. $a^n b^n c^m d^m : n \geq 1, m \geq 1\} \cup \{a^n b^m c^m d^n : n \geq 1, m \geq 1\}$.
   vi. Balanced parenthesis with {, }, (,), [,]
   vii. $w \in \{0, 1\}* |$ the length of w is odd and the middle symbol is 0 }
   viii. $\{ ab^n acab^n a | n \geq 0 \}$
   ix. $\{a^n b^m : m >= n$ and m-n is odd$\}$
   x. $\{a^m b^{n+m} c^n | n >= 0, m >= 0\}$
   xi. language of all non-palindromes over $\{0, 1\}*$
   xii. $\{x \in \{0, 1\}* |$ symbol at position i is same as symbol at position i+2 and $| x | \geq 2\}$
2. Find LMD, RMD and parse tree
   i. for 1110111 for CFG $P \rightarrow 0P0 | 1P1 | 0 | 1 | \varepsilon$
   ii. for $a * (a + b00)$ $E \rightarrow I$, $E \rightarrow E + E$, $E \rightarrow E * E$, $E \rightarrow (E)$, $I \rightarrow a|b|0\}1$
   iii. for aabbccdd $S \rightarrow AB | C$, $A \rightarrow aAb | ab$, $B \rightarrow cBd | cd$, $C \rightarrow aCd | aDd$, $D \rightarrow bDc | bc$
3. Check whether CFG is ambiguous or not. If ambiguous, remove it.
   i. $A \rightarrow AA | (A) | a$
   ii. $S \rightarrow AB | C$
   $A \rightarrow aAB | ab$
   $B \rightarrow cBd | cd$
   $C \rightarrow aCd | aDd$
   $D \rightarrow bDc | bc$
   iii. $S \rightarrow aSb | SS | \varepsilon$
   iv. $S \rightarrow SS | a | b$
   v. $S \rightarrow A | B$
   $A \rightarrow aAb | ab$
   $B \rightarrow abB | \varepsilon$
   vi. $S \rightarrow A$
   $A \rightarrow A + A | B++$
   $B \rightarrow y$
   vii. $S \rightarrow AS | \varepsilon$
   $A \rightarrow A1 | 0A1 | 01$
4. Convert to CNF
   i. $S \rightarrow aS | AB$, $A \rightarrow \varepsilon$, $B \rightarrow \varepsilon$, $D \rightarrow b$
   ii. $S \rightarrow XY | YX | XX | X | Y$ $X \rightarrow 0X | 0$ $Y \rightarrow 1Y | 1$
   iii. $S \rightarrow a | Xb | aYa$, $X \rightarrow Y | \varepsilon$, $Y \rightarrow b | X$
   iv. $S \rightarrow a | Xb | aYa$, $X \rightarrow Y | \varepsilon$, $Y \rightarrow b | X$
   v. $S \rightarrow Xa$, $X \rightarrow aX | bX | \varepsilon$
   vi. $S \rightarrow ASB | \varepsilon$ $A \rightarrow aAS | a$ $B \rightarrow SbS | A | bb$
   vii. $S \rightarrow aXbX$ $X \rightarrow aY | bY | \varepsilon$ $Y \rightarrow X | c$
   viii. $S \rightarrow 0A0 | 1B1 | BB$, $A \rightarrow C$, $B \rightarrow S|A$, $C \rightarrow S | \varepsilon$