Roll No - 17103011

TOC Assignment-1

I.

① $L = \{ a^{2n} b^n \mid n \geq 1 \}$

$$P: \begin{cases} S \rightarrow aaAb \\ A \rightarrow aaAb \mid \wedge \end{cases}$$

$\therefore G \Rightarrow (\{A, S\}, \{a, b\}, P, S)$

② $L = \{ a^n b^n c^m d^m \mid n, m \geq 1 \}$

$$P: \begin{cases} S \rightarrow aAbcBd \\ A \rightarrow aAb \mid \wedge \\ B \rightarrow cBd \mid \wedge \end{cases}$$

$G \Rightarrow (\{A, B, S\}, \{a, b, c, d\}, P, S)$

③ $L = \{ a^n b^m c^m d^n \mid n, m \geq 1 \}$

$$P \Rightarrow \begin{cases} S \rightarrow aBd \\ B \rightarrow aBd \mid X \\ X \rightarrow bYC \\ Y \rightarrow bYc \mid \wedge \end{cases}$$

$G \Rightarrow (\{S, B, X, Y\}, \{a, b, c, d\}, P, S)$

④ $L = \{ a^n b^m c^K$, where $2n = m$ & $K \geq 2 \}$

$$P: \begin{cases} S \rightarrow AccX \\ A \rightarrow aAbb \mid \wedge \\ X \rightarrow cX \mid \wedge \end{cases}$$

$G \Rightarrow (\{S, A, X\}, \{a b c\}, P, S)$

(5) $L = \{ a^n b^m \mid n = 2 + (m \% 3) \}$

$P: \begin{cases} S \to aaA \\ A \to ab \mid aabb \mid Abbb \mid \wedge \end{cases}$

$G = \{ \{S, A\}, \{a, b\}, P, S \}$

(11.)

(1) $S \to pA \mid qB \mid rC$

$A \to Sp$

$B \to Sq$

$C \to \wedge$

Let (i) $S \to pA$

$\Rightarrow pSp \Rightarrow pqBp \Rightarrow pqSqp \Rightarrow \underline{pqrqp}$

(ii) $S \to rC \Rightarrow \underline{r}$

(iii) $S \to pA \Rightarrow pSp \Rightarrow \underline{prp}$

(iv) $S \to qB \Rightarrow qSq \Rightarrow \underline{qrq}$

So, $L(G) = \{ wrw^T : \text{where } w \in (p,q)^* \}$

(2) $S \to AB \mid \lambda$

$A \to aB$

$B \to Bb \mid b$

Let (i) $S \to \wedge \Rightarrow \underline{\wedge}$

(ii) $S \to AB \Rightarrow a\underline{B}B \Rightarrow a\underline{B}bB \Rightarrow abbB$

$\Rightarrow abbBb \Rightarrow \underline{abbbb}$

(iii) $S \to AB \Rightarrow aBB \Rightarrow \underline{abb}$

(iv) $S \to AB \Rightarrow qBB \Rightarrow aBbB \Rightarrow abbB \Rightarrow \underline{abbb}$

$\therefore L(G) = \{ \wedge \mid ab^n : \text{where } n \geq 2 \}$

③ $S \rightarrow aS/bS/SS/\wedge$

Let, i) $S \rightarrow aS \Rightarrow a$

ii) $S \rightarrow bS \Rightarrow b$

iii) $S \rightarrow \wedge \Rightarrow \wedge$

iv) $S \rightarrow aS \Rightarrow abS \Rightarrow ab$

v) $S \rightarrow bS \Rightarrow baS \Rightarrow ba$

$\therefore L = \{ (a,b)^* \}$

④ $S \rightarrow aS \mid bS \mid SSS \mid \wedge$

from previous question, with the help of $S \rightarrow aS \mid bS \mid \wedge$, we can generate $(a,b)^*$. Since $(a,b)^*$ already includes all the possible strings of a & b so $S \rightarrow SSS$ will give no additional contribution.

So $L = (a,b)^*$

⑤ $S \rightarrow aS \mid bS \mid Sb \mid Sa \mid SS$

from previous question ⇒

$L = (a,b)^*$