

I)

$$S \rightarrow aS \rightarrow a\lambda \rightarrow a$$

$$S \rightarrow aS \rightarrow abS \rightarrow ab\lambda \rightarrow ab$$

$$S \rightarrow bS \rightarrow b\lambda \rightarrow b$$

$$S \rightarrow bS \rightarrow baS \rightarrow ba\lambda \rightarrow ba$$

$$S \rightarrow aS \rightarrow abS \rightarrow abas \rightarrow abas\lambda \rightarrow abaa$$

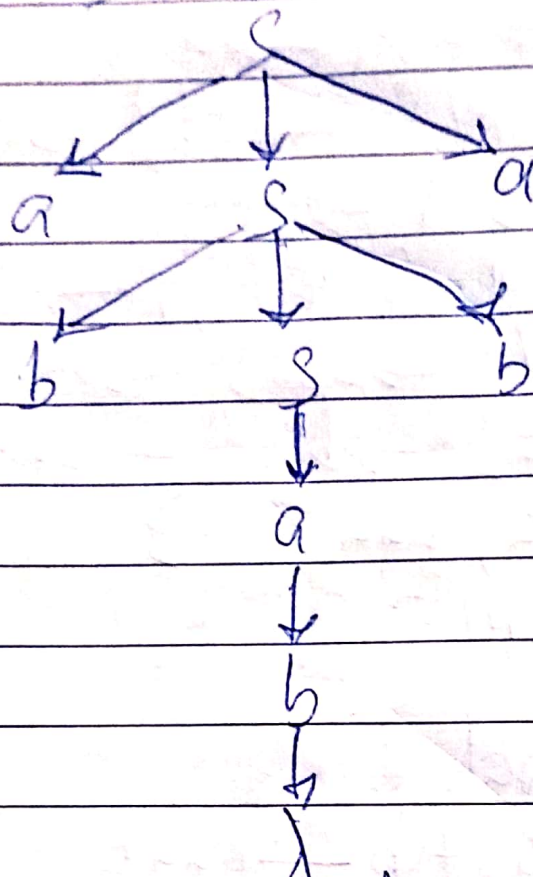
$$S \rightarrow bS \rightarrow baS \rightarrow baas \rightarrow baas\lambda \rightarrow baasa$$

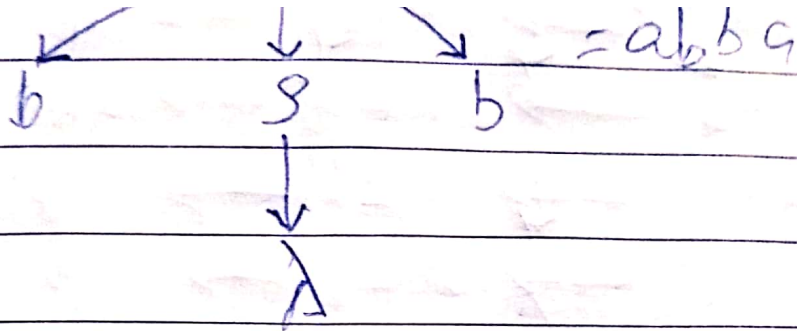
$\{ \lambda, a, ab, bba, aba, baa, \dots \}$

$$\{ a^n b^m \mid n \geq 0, m \geq 0 \}$$

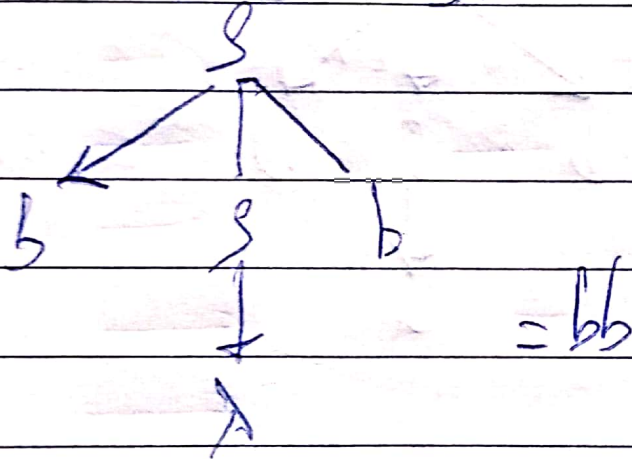
II.  $S \rightarrow aAb \rightarrow aab$

2)  $S \rightarrow aSa | bSb | a | b | \lambda$



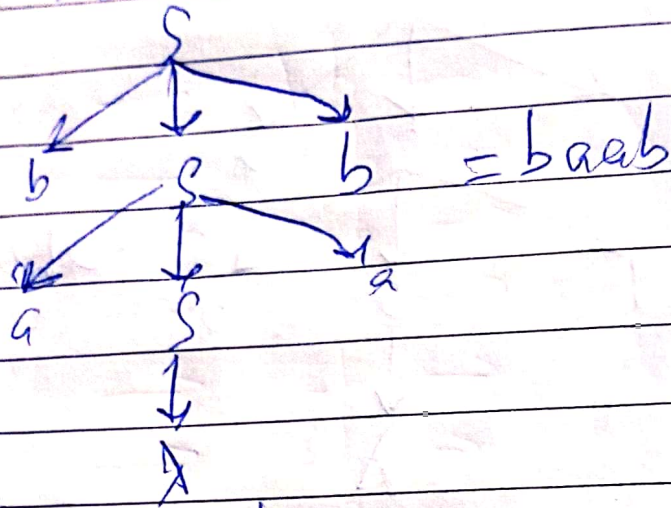


$$d) S \rightarrow bSb \rightarrow bAb \rightarrow bb$$

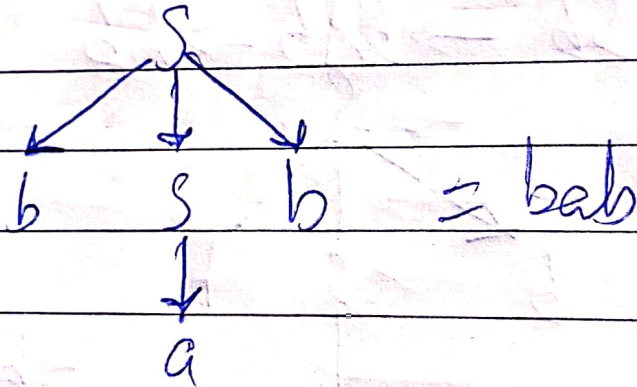


$$e) S \rightarrow aSa \rightarrow abSba \rightarrow abbba$$

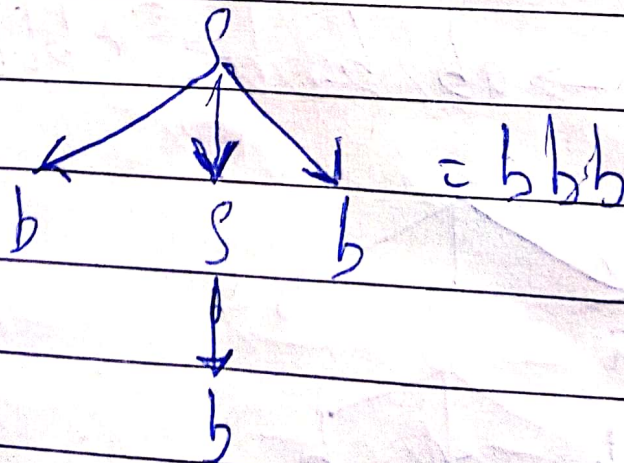
f)  $S \rightarrow bSb \rightarrow baSab \rightarrow baab$



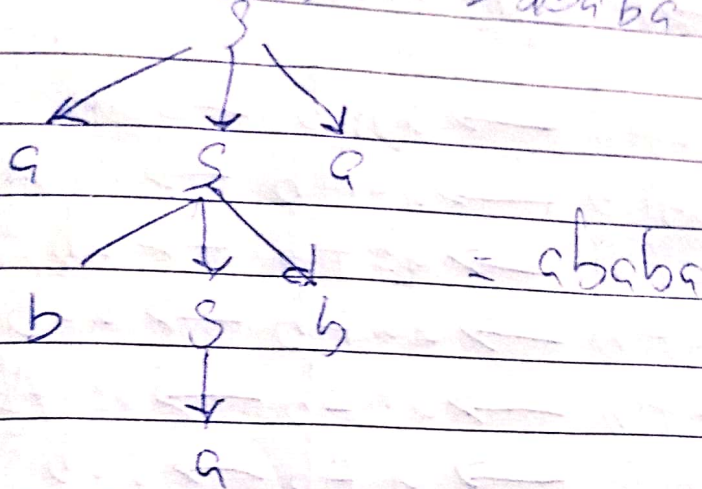
g)  $S \rightarrow bSb \rightarrow bab$



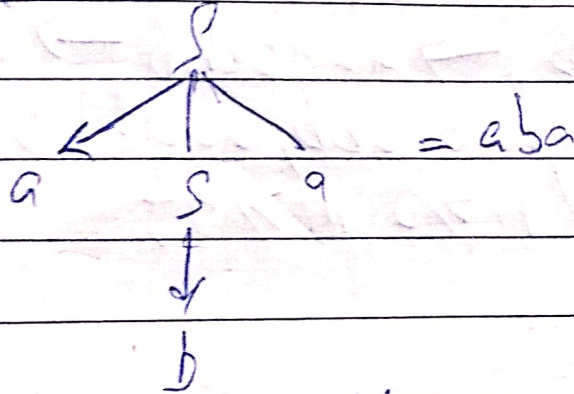
h)  $S \rightarrow bSb \rightarrow bbb$



i)  $S \rightarrow aSa \rightarrow abSba \rightarrow ababS \rightarrow ababab$



j)  $S \rightarrow aSa \rightarrow aba$



$= \{ \Lambda, aa, aaaS, abba, bb, bab, bbb, ababa, abbba, baab, ab \dots \}$

3)  $\Sigma = \{0, 1\}$

$G = (V = \{S\}, \Sigma = \{0, 1\}, S, R)$ , where  $R$

$S \rightarrow 0111S110S01S01S1$

The parse 0111001001

45  $S \rightarrow Ab, A \rightarrow aAb | aA$

Solution

$S \rightarrow aAb \rightarrow aAb \rightarrow ab$

$S \rightarrow aAb \rightarrow aaAb \rightarrow aaAb \rightarrow aab$

$S \rightarrow aAb \rightarrow abAb \rightarrow abAb \rightarrow abbb$

$S \rightarrow aAb \rightarrow aaAb \rightarrow aabAb \rightarrow aabbb$

$S \rightarrow aAb \rightarrow abAb \rightarrow abaAb \rightarrow ababb$

$S \rightarrow AB \rightarrow aAb \rightarrow aab$

$S \rightarrow AB \rightarrow aAB \rightarrow aaAB \rightarrow aaabB$

$\rightarrow aacbbB \rightarrow aaabbbB \rightarrow aaabbbb$

$\{ ab, aab, abbb, abb, aaabbbb, \dots \}$

$\{ a^n b^{m+1} \mid n \geq 0, m \geq 0 \}$