

Q.1 Identify the language generated by the following grammar, where S denotes start variable:

$$S \rightarrow XY$$

$$X \rightarrow aX|a$$

$$Y \rightarrow aYb|\epsilon$$

Q.2 Below is the grammar for $L = \{a^n b^n c^n \mid n \geq 1\}$

$$S \rightarrow abc \mid aSAc$$

$$cA \rightarrow Ac$$

$$bA \rightarrow bb$$

Try deriving string $w = aaabbbccc$

Q.3 Give context-free grammars that generate the following languages.

(a) $w \in \{0, 1\}^* \mid w = wR \text{ and } |w| \text{ is even } \}$

(b) $w \in \{0, 1\}^* \mid \text{the length of } w \text{ is odd and the middle symbol is } 0 \}$

(c) Design a CFG G with set of terminals $T = \{0, 1, (,), \cup, *, \emptyset, e\}$ that generates exactly the regular expressions with alphabet $\{0, 1\}$.

Q.4 Using your CFG G , give a derivation and the corresponding parse tree for the string $(0 \cup (10)^*1)^*$.

Q.5 The language of non null string of a 's can be defined by context free grammar for as follows: $S \rightarrow aS|Sa|a$

How many trees can be a^3 ? Justify your answer with respective trees.

Q.6 Check whether the following languages are context free or not, justify your answer.

1. $L1 = \{0^i 1^j \mid i \neq j\}$

2. $L2 = \{0^i 1^j \mid i = j\}$

3. $L3 = \{0^i 1^j \mid i = 2j+1\}$

4. $L4 = \{0^i 1^j \mid i \neq 2j\}$

Q.7 Given the language $L = \{ab, aa, baa\}$, find out whether following strings are in L^* or not? Provide proper explanation for the same.

a) $abaabaaabaa$

b) $baaaaabaaaab$

c) $baaaaabaa$

d) $aaaabaaaa$

e) $baaabaaaaa$