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Course: CS4402

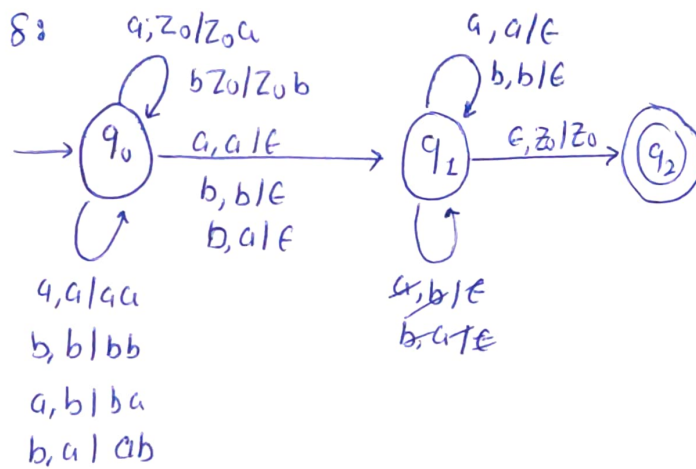
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Class-Test-2.

Solution-1: N-DPDA $L = \{xy \mid x, y \in (a+b)^*, |x|=|y| \text{ and } x \neq y\}$

$$L = \{ab, ba, aabb, bbba, \dots\}$$

$$M = \{Q, \Sigma, \delta, q_0, F, \Gamma, Z_0\}$$



$$Q = \{q_0, q_1, q_2\}$$

$$\Sigma = \{a, b\}$$

$$q_0 = q_0$$

$$F = \{q_2\}$$

$$\Gamma = \{a, b\}$$

$$Z_0 = Z_0$$

Solution 2: Given CFG for $L = \{a^n b^m c^k \mid k = [n-m], n \geq 0, m \geq 0 \text{ and } n \geq m\}$

Here production rule of S_3 doesn't follow language L , as it's generating at least one word which is not in L .

$$S_3 \Rightarrow aS_3b \Rightarrow aS_4b \Rightarrow abS_4cb \Rightarrow abcb.$$

So we can take no Context Free Grammar that requires the rule of S_3 .

also we have here

$$S \rightarrow S_1 / S_2$$

$$S_1 \rightarrow aS_1S_2c / \lambda$$

$$S_2 \rightarrow aS_2b / \lambda$$

$$S_3 \rightarrow aS_3b / S_4 / \lambda$$

$$S_4 \rightarrow bS_4c / \lambda.$$

So let's have look at them one by one :-

$$S_2 \Rightarrow aS_2b \Rightarrow a^n b^n \text{ also power of } c \text{ i.e. } k = n - m = 0$$

$$\text{And } S_1 \Rightarrow aS_1S_2c \Rightarrow a^k (S_2c)^k \Rightarrow a^k a^{kn} b^{kn} c^k$$

$$\Rightarrow a^{k+kn} b^{kn} c^k \text{ which is } c\text{'s power } k = (k+kn) - kn = k$$

So by above rule we can generate the words in L .

So Tuples are: $G = (V, T, P, S)$

$$V = \{A, B, S_i\}$$

$$T = \{a, b, c\}$$

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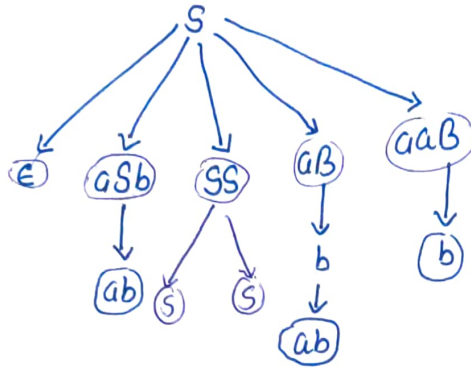
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$$P = \{ S \rightarrow ABS_1, A \rightarrow aA \mid a, B \rightarrow bB \mid \epsilon, S_1 \rightarrow CS_1 \mid c \}$$

$$S = \{ S \}$$

Solution 3: $G = (\{S, B\}, \{a, b\}, \{S \rightarrow aSb \mid SS \mid aB \mid \epsilon, B \rightarrow b\}, S)$

Let's draw a parse tree first



Now we will check in given parse tree from top to bottom if some word is achieved by many parse tree then that grammar is ambiguous. So,

Here ab can be achieved by two parse tree's one which we have,

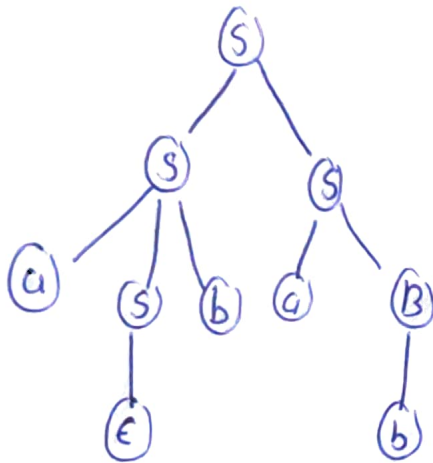
$$S \rightarrow aSb \rightarrow (ab)$$
$$S \rightarrow \epsilon$$

And other we have

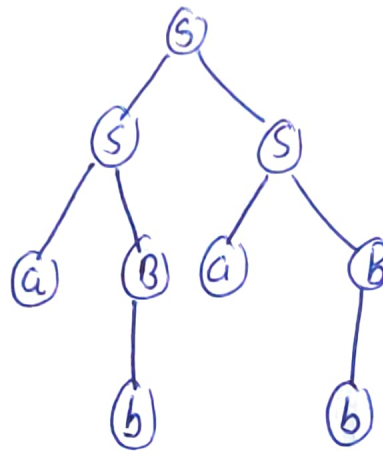
$$S \rightarrow aB \rightarrow (ab)$$
$$B \rightarrow b$$

Hence given grammar is Ambiguous.

Parse Tree



parse T1



parse T2