

order.

Example:  $uabwcdwefughkw \rightarrow uabwcdwdeubakw$

Example:  $U \neq V$

Ans:

$MR \xrightarrow{x \neq U} R \xrightarrow{x \neq U} R \xrightarrow{x \neq U} R \xrightarrow{x \neq U} R \xrightarrow{x \neq U} ML \xrightarrow{x \neq U} MR_u \xrightarrow{y \neq U} ML_u$

Curved arrows indicate self-loops with labels  $x=U$  and  $y=U$ . A straight arrow from  $ML$  to  $R_u$  is labeled  $x=U$ . A curved arrow from  $MR_u$  back to  $ML$  is labeled  $y=U$ .

$$aa^*c(bb)^*$$

$y \neq a \wedge R \xrightarrow{x=a} R \xrightarrow{x \neq a} \text{"don't accept"}$

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graph TD; Start(( )) --> XEqualsC{x=c}; XEqualsC --> R1((R)); R1 -- "x=b" --> R2((R)); R2 -- "x=b" --> R1; R1 -- "x ≠ b, c" --> NoAccept1[don't accept]; R2 -- "x ≠ b" --> NoAccept2[don't accept]; R1 --> Yes[yes];
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The flowchart illustrates the logic for the decision problem  $x \in \{b, c\}$ . It begins with a vertical line leading to a decision point  $x=c$ . If  $x=c$ , the flow proceeds to a state labeled  $R$ . From this  $R$  state, there are two paths: one labeled  $x=b$  that loops back to the same  $R$  state, and another that leads to a state labeled  $\sqcup$ . From  $\sqcup$ , the flow proceeds to the output "yes". If  $x \neq b, c$  (from the initial  $R$  state) or  $x \neq b$  (from the looped  $R$  state), the flow proceeds to the output "don't accept".

3) Let  $G$  be the grammar  $(W, \Sigma, R, S)$ , where

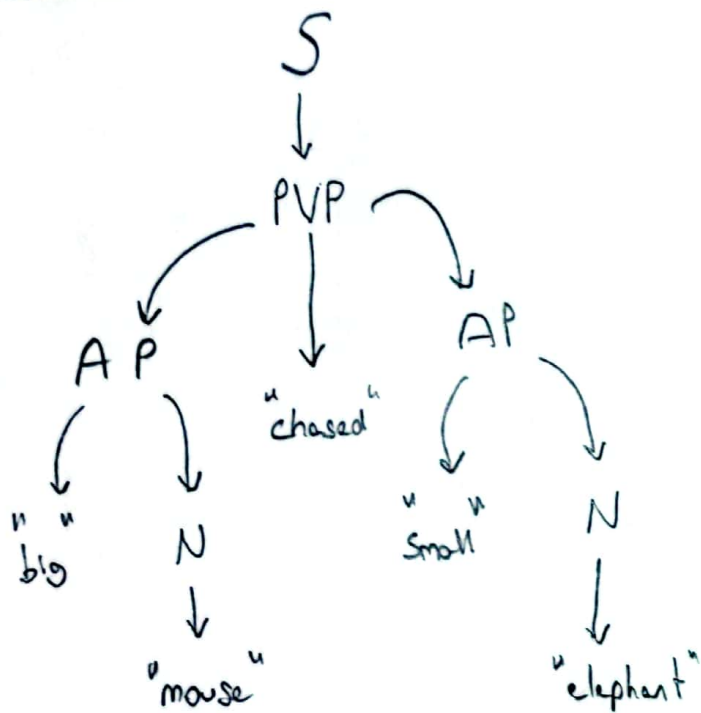
$$W = \{S, A, N, V, P\} \cup \Sigma,$$

$$\Sigma = \{\text{elephant}, \text{big}, \text{mouse}, \text{small}, \text{chased}\},$$

$$R = \{P \rightarrow N, \quad A \rightarrow \text{big}, \\ P \rightarrow AP, \quad N \rightarrow \text{elephant}, \\ S \rightarrow PVP, \quad N \rightarrow \text{mouse}, \\ A \rightarrow \text{small}, \quad V \rightarrow \text{chased}\}.$$

"big mouse chased small elephant" Parse tree, ambiguous.

ANS.



( NOT  
AMBIG.)

⇒ If there exists at least 1 string in the language that can be generated by the grammar in more than one way; it is ambiguous.

This tree cannot draw by different way to exp. the string.

So it is not ambiguous because there is only one valid parse.

4) Construct a pushdown automaton for the following language;

$$\{a^i b^j c^k \mid i, j, k \geq 0, i+k=j\}$$

ANS

$$(s, \epsilon, \epsilon) \rightarrow (q_1, x)$$

$$(q_1, a, x) \rightarrow (q_1, ax)$$

$$(q_1, a, a) \rightarrow (q_1, aa)$$

$$(q_1, \epsilon, \epsilon) \rightarrow (q_2, \epsilon)$$

$$(q_2, b, a) \rightarrow (q_2, \epsilon)$$

$$(q_2, b, x) \rightarrow (q_2, bx)$$

$$(q_2, b, b) \rightarrow (q_2, bb)$$

$$(q_2, \epsilon, \epsilon) \rightarrow (q_3, \epsilon)$$

$$(q_3, c, b) \rightarrow (q_3, \epsilon)$$

$$(q_3, \epsilon, \epsilon) \rightarrow (q_4, \epsilon)$$

$$(q_4, \epsilon, x) \rightarrow (q_4, \epsilon)$$

5) Construct a pushdown automaton for the following language;

$$\{a^i b^j c^k d^m \mid i, j, k, m \geq 0, i=k \text{ or } j=m\}$$

ANS

for  $i=k \Rightarrow a^i b^j c^i d^m$   
 $b^j d^m$  if  $i=0$   
 $d^m$  if  $i, j=0$

$$(s, \epsilon, \epsilon) \rightarrow (q_1, x)$$

$$(q_1, a, x) \rightarrow (q_1, ax)$$

$$(q_1, a, a) \rightarrow (q_1, aa)$$

$$(q_1, \epsilon, a) \rightarrow (q_2, a)$$

$$(q_2, b, a) \rightarrow (q_2, a)$$

$$(q_2, \epsilon, a) \rightarrow (q_3, a)$$

$$(q_3, c, a) \rightarrow (q_3, \epsilon)$$

$$(q_3, \epsilon, x) \rightarrow (f, x)$$

$$(f, d, x) \rightarrow (f, \epsilon)$$

for  $j=m \Rightarrow a^i b^j c^k d$   
 $a^i c^k$   
 $a^i$

if  $j=0$

if  $j, k=0$

$(s, e, e) \longrightarrow (a, x)$

$(a, a, x) \longrightarrow (a, x)$

$(a, e, x) \longrightarrow (q_2, x)$

$(q_2, b, x) \longrightarrow (q_2, bx)$

$(q_2, b, b) \longrightarrow (q_2, bb)$

$(q_2, e, b) \longrightarrow (q_3, b)$

$(q_3, c, b) \longrightarrow (q_3, b)$

$(q_3, e, b) \longrightarrow (f, b)$

$(f, d, b) \longrightarrow (f, e)$

$(f, e, x) \longrightarrow (f, e)$