

2.9)

$S \rightarrow aLbR, L \rightarrow bRc, R \rightarrow cLb$

$L \rightarrow aLb, R \rightarrow aLb$

$R \rightarrow aLb, L \rightarrow aLb$

$L \rightarrow aLb, R \rightarrow aLb$

$R \rightarrow aLb, L \rightarrow aLb$

ambig. ex. if build $abc \rightarrow$

$S \rightarrow aLbR$

$\rightarrow aLbR$

$\rightarrow aLbR$

$\rightarrow abc$

$S \rightarrow LbR$

$\rightarrow aLbR$

$\rightarrow aLbR$

$\rightarrow abc$

2.20

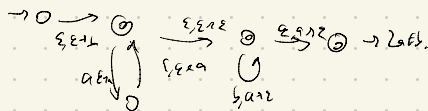
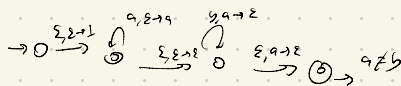
is A CF \rightarrow PDA for A $(Q, \Sigma, \Gamma, \delta, q, z, F)$

if b is regular it is context free and we generate another PDA (A but with all variables prime)

create third PDA L by passing w into PDA for A until we reach state q

if path from q to accept state in A exists, use transition to lead to accept state and run the PDA B in the new input symbols. if accept state in both A and B is reached, we accept w else reject

2.24)



M1)

$S \rightarrow L(R(LALSb)ASbRbL)E$

$L \rightarrow aLb$

$R \rightarrow aLbL$

M2)

$S \rightarrow S_1S_2S_3$

$E_1 \rightarrow \{a^i b^j : i < j\}$

$S_1 \rightarrow aSbLcSLe$

$E_2 \rightarrow \{a^i b^j : i < j < 2i\}$

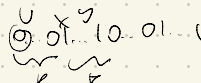
$S_2 \rightarrow aSbLaSbS$

$E_3 \rightarrow \{a^i b^j : 2i < j\}$

$B \rightarrow aSbSLe$

$S_3 \rightarrow aSbLbSbLbS$

2.20)



$UV^2xy^2 \notin L$ for all position of $UVxy$

Case 1: $UVxy$ is in occurrence of 0^i or 1^j . pump down \rightarrow

has 0^i or 1^j at cn in other half $\notin L$

Case 2: $UVxy$ can be in 0^i or 1^j . if $0^i < 1^j$, in occurrence

And cn in other section

not context free.

2.27)

$a...ab...bba...ab...b$

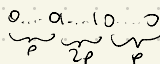
$UV^2xy^2 \notin L$

Using the exact same cases as

the previous problem we can see the

part of the same result

2.31)



$UV^2xy^2 \notin L$

Very in all 0's region, pump down $\notin L$

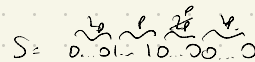
Very in all 1's region, pump down $\notin L$

Very in region of both 0 & 1.

$0^p 1^p 0^p \rightarrow$ pump down

$0^p 1^p 0^p \neq$ palindrome

2.45)



$UV^2xy^2 \notin L$

in all cases of UV^2xy^2

pump up how to turn some

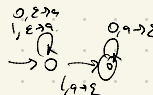
of 0's to 1's. take 0's

from w or length 1.

all cases $UV^2xy^2 \notin L$

Not CFL

2.47)



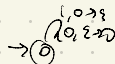
2.49)

$S \rightarrow LR$

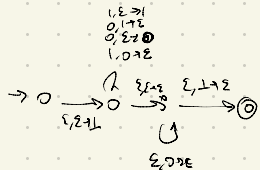
$R \rightarrow LR(LAL)1$

$L \rightarrow 011$

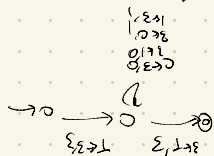
2.51)



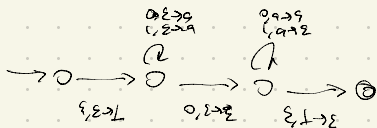
b.



c.



d.



e.

