

DATE _____

Assignment # 03

DAY

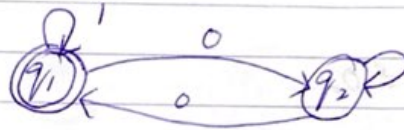
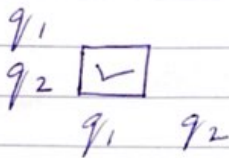
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Question # 01.

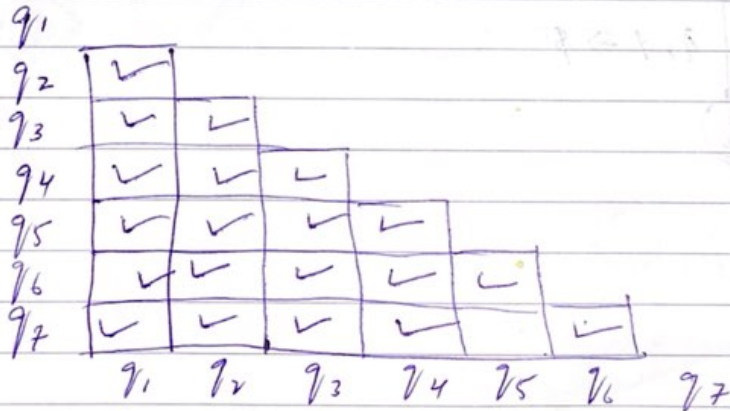
iv) Closure.

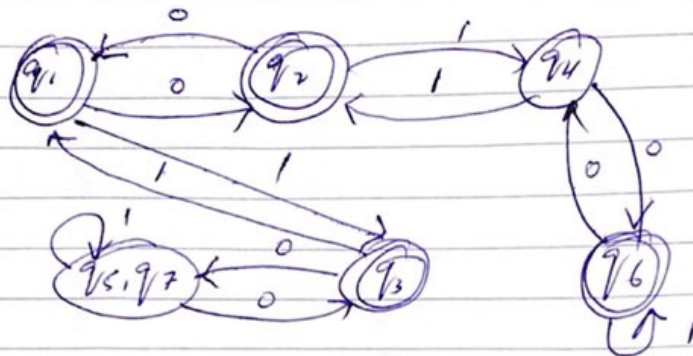


ii) Union



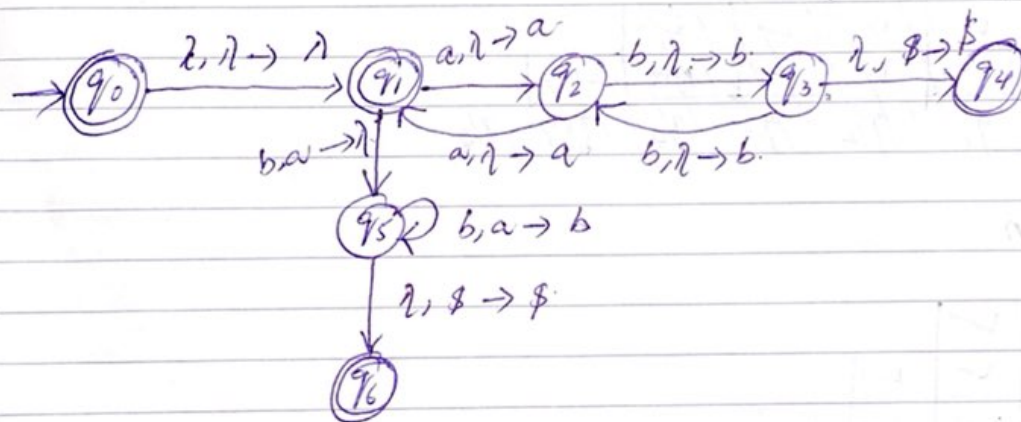
ii) Union

 q_5, q_7



Question #02.

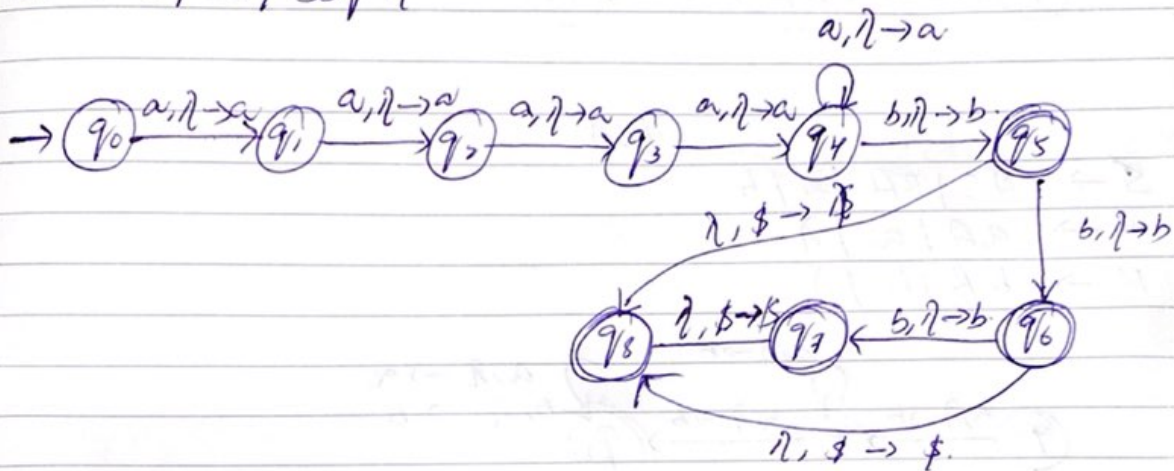
(a)
 $S \rightarrow aaS / bbA / aB / \epsilon$
 $A \rightarrow bbA / \epsilon$
 $B \rightarrow aaB / bC$
 $C \rightarrow bbC / \epsilon$



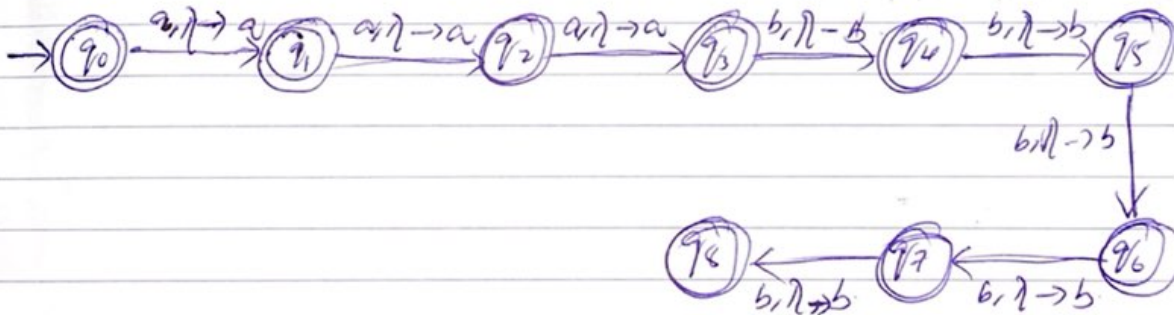
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(b)

 $S \rightarrow AB$ $A \rightarrow a a a a c \mid a a a a$ ~~$B \rightarrow b b b b b b b b \mid b b b b b b b b$~~ $C \rightarrow a c \mid \lambda$ $B \rightarrow b \mid b b \mid b b b \mid \lambda$ 

(c)

 $S \rightarrow AB$ $A \rightarrow a \mid a a \mid a a a \mid \lambda$ $B \rightarrow b \mid b b \mid b b b \mid b b b b \mid \lambda$ 

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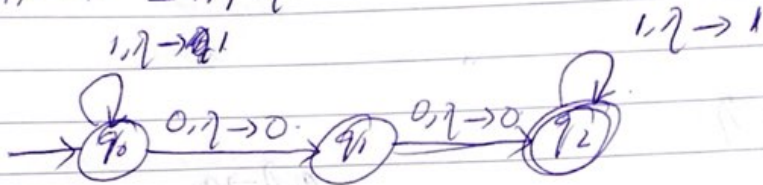
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(d)

$S \rightarrow A O O A$

$A \rightarrow 1 A | \lambda$

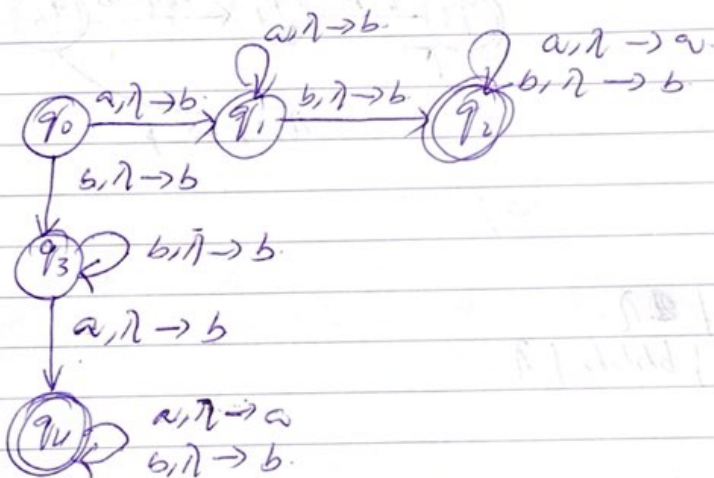


(e)

$S \rightarrow \cdot AB | BA | a | b$

$A \rightarrow aA | a | \lambda$

$B \rightarrow bB | b | \lambda$



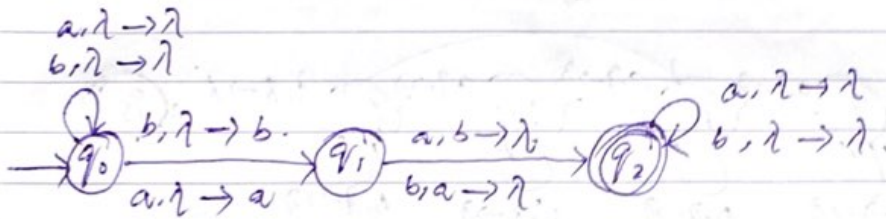
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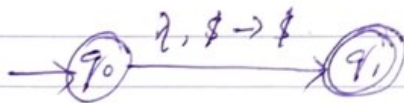
(e)

$S \rightarrow XabX / XbaX$
 $X \rightarrow aX / bX / \lambda$



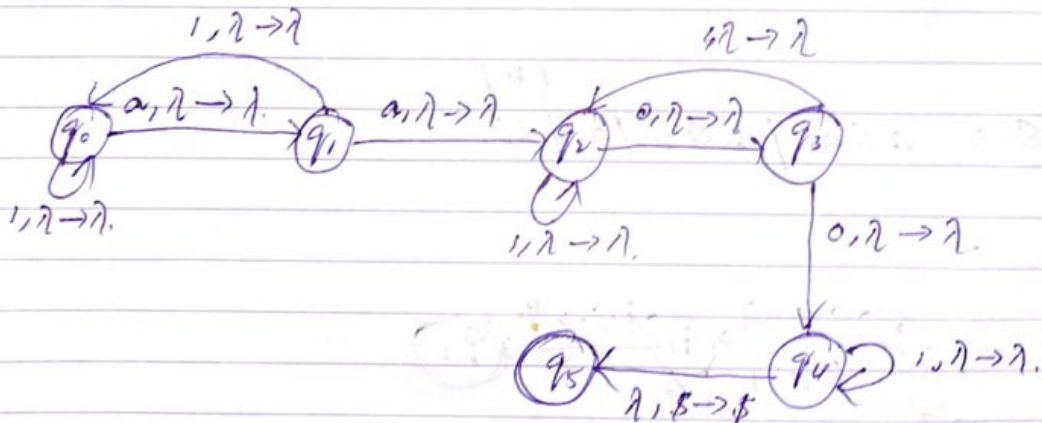
(f)

$S \rightarrow \lambda$

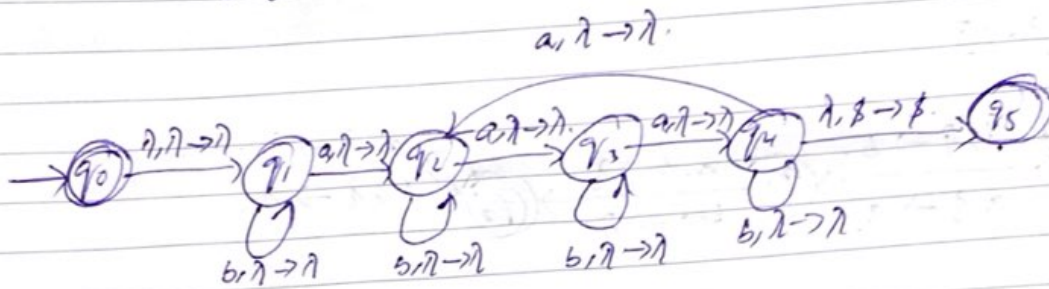


(g)

$S \rightarrow AOOA OOA$
 $A \rightarrow OA / \lambda$



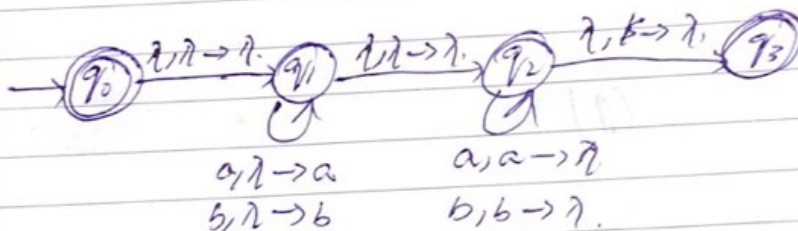
(b)
 $S \rightarrow BaBaBaBS / B$
 $B \rightarrow bB / \lambda$



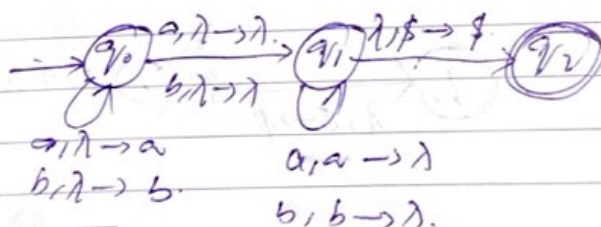
Question #03

(1) CFG and PDA
 (a)

$S \rightarrow aSa / bSb / \lambda$



(b)
 $S \rightarrow aSa / bSb / a / b$



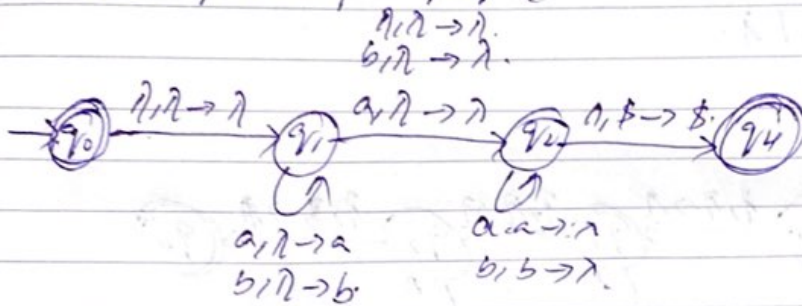
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(c)
 $S \rightarrow asa / bsb / a / b / \lambda$

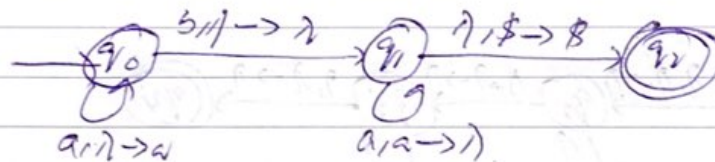


(d)

~~for~~ -

$S \rightarrow A / b$

$A \rightarrow aAa / b$



(e)

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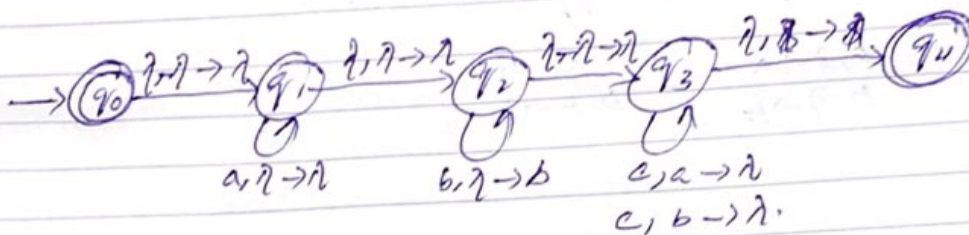
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(f)

$S \rightarrow asc \mid b \mid \lambda$

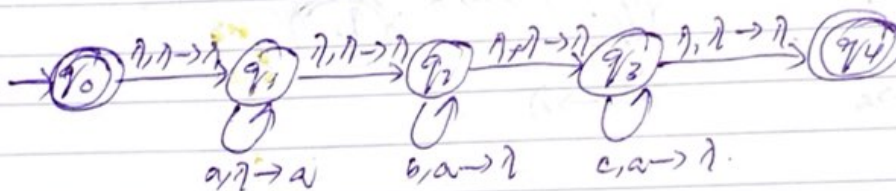
$B \rightarrow bBc \mid \lambda$



(g)

$S \rightarrow asc \mid \lambda$

$A \rightarrow aAb \mid \lambda$

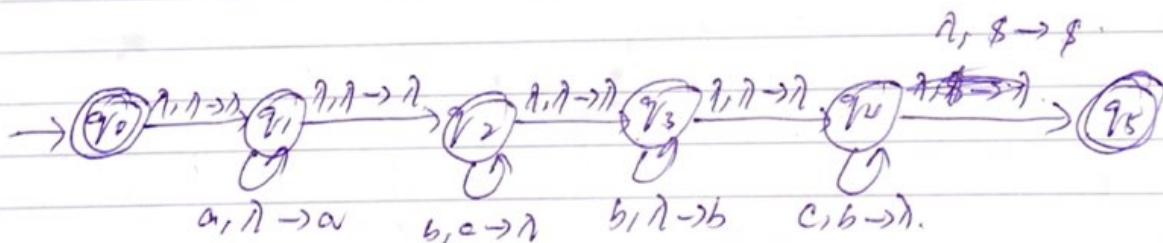


(h)

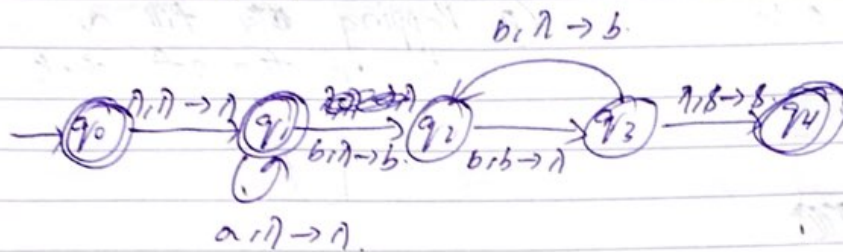
$S \rightarrow AB$

$A \rightarrow aAb \mid \lambda$

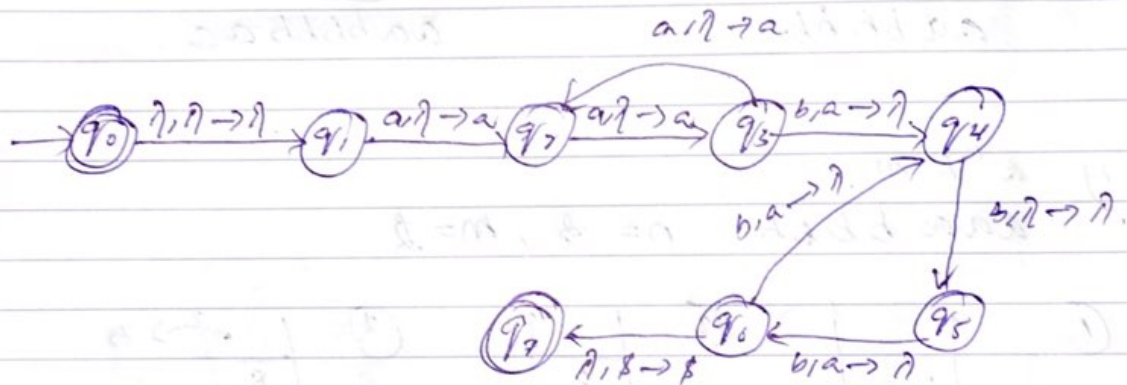
$B \rightarrow bBb \mid \lambda$



(c)

 $S \rightarrow AB$ $A \rightarrow Aa \mid \lambda$ $B \rightarrow bB \mid \lambda$ 

(d)

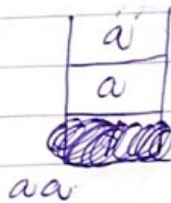
 $S \rightarrow aaSbbb \mid \lambda$ 

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(2)
Stack Operation.n) $a^n b^{n+m} c^m$ $n=2, m=2$

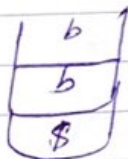
aa bbb b cc

① Pushing all a's.

② Popping ~~all~~ till a is on top of stack

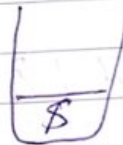
aa bb.

③



ad bbb b.

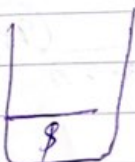
④



aa bbb b cc.

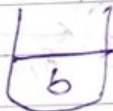
1) $a^n b^m$ aaa bbb b $n=3, m=2$

①



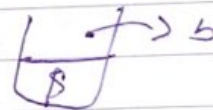
aaa

②



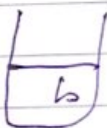
aaab

③



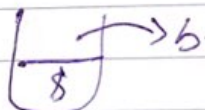
aaabb.

④

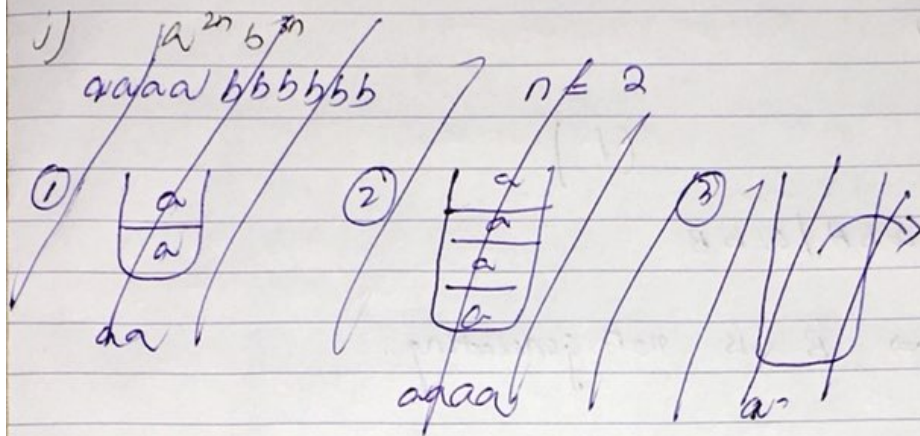


aaabbb

⑤



aaabbbb



(3)
Pumping lemma

f) $a^n b^n c^{n+m}$

aaaa bbb cccccc

x y z

$n=1$

aaabbbcbcccc $\notin L$
Not regular.

g) $a^{n+m} b^n c^m$

aaabbbcc

x y z

$n=1$

aaabbbcc $\notin L$
Not regular

h) $a^n b^n a^n$

aaaa bbbbbb

x y z

$n=1$

aaabbbbbb $\notin L$
Not regular.

Question #04.

(1)

$$S \rightarrow abS / abA / abB.$$

$$A \rightarrow cd$$

$$B \rightarrow aB \Rightarrow B \text{ is not generating.}$$

$$C \rightarrow dC$$

$$S \rightarrow abS / abA$$

$$A \rightarrow cd$$

$$C \rightarrow dC \Rightarrow \text{increasable.}$$

$$S \rightarrow abS / abA$$

$$A \rightarrow cd$$

Now CFG to CNF.

$$S' \rightarrow S.$$

$$S \rightarrow abS / abA$$

$$A \rightarrow cd.$$

$$S' \rightarrow abS / abA$$

$$S \rightarrow abS / abA.$$

$$A \rightarrow cd.$$

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(2)

$S \rightarrow aABC/a$

$A \rightarrow b$

$B \rightarrow c$

$C \rightarrow d$

$E \rightarrow e \Rightarrow$ unreachable

$F \rightarrow f \Rightarrow$ unreachable

$G \rightarrow g \Rightarrow$ unreachable.

$S \rightarrow ABC/a$

$A \rightarrow b$

$B \rightarrow c$

$C \rightarrow d$

CFG to CNF

$S \rightarrow AX/a$

$X \rightarrow BC$

$A \rightarrow b$

$B \rightarrow c$

$C \rightarrow d$

(3)

$S \rightarrow aB/bX$

$A \rightarrow Bacl/bSX/a$

$B \rightarrow aSB/bBX \Rightarrow$ non generating

$X \rightarrow SBD/aBX/ad$

$S \rightarrow bX$

$A \rightarrow bSX/a \Rightarrow$ unreachable

$X \rightarrow ad$



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$S \rightarrow bX$

$X \rightarrow ad$

CFG to CNF

$S \rightarrow FX$

$F \rightarrow b$

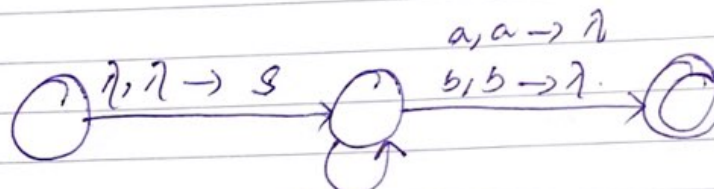
$X \rightarrow ad$

Question #05.

(a)

$S \rightarrow XS \mid \epsilon$

$A \rightarrow aXb \mid Ab \mid ab$



$\lambda, S \rightarrow XS$
 $\lambda, A \rightarrow aXb$
 $\lambda, A \rightarrow Ab$
 $\lambda, A \rightarrow ab$

(b)

$S \rightarrow S+X \mid X$

$X \rightarrow X*Y \mid Y$

$Y \rightarrow S$



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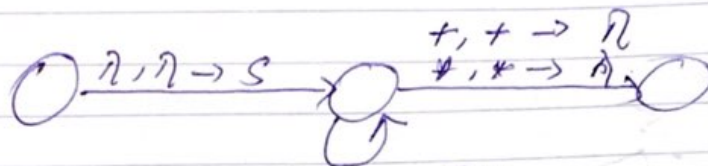
$$S \rightarrow S + X$$

$$S \rightarrow X$$

$$X \rightarrow X * Y$$

$$X \rightarrow Y$$

$$Y \rightarrow S$$



$$\lambda, S \rightarrow S + X$$

$$\lambda, S \rightarrow X$$

$$\lambda, X \rightarrow X * Y$$

$$\lambda, X \rightarrow Y$$

$$\lambda, Y \rightarrow S$$

(c)

$$S \rightarrow 0S1 \mid 1S0 \mid \epsilon$$

$$S \rightarrow 0SX \mid 1SY \mid \epsilon$$

$$X \rightarrow 1$$

$$Y \rightarrow 0$$

$$S \rightarrow 0S1$$

$$S \rightarrow 1S0$$

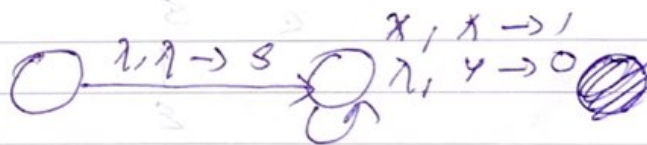
$$S \rightarrow \epsilon$$

$$S \rightarrow 0SX$$

$$S \rightarrow 1SY$$

$$X \rightarrow 1$$

$$Y \rightarrow 0$$



$$\lambda, S \rightarrow 0S1$$

$$\lambda, S \rightarrow 1S0$$

$$\lambda, S \rightarrow \epsilon$$

$$\lambda, S \rightarrow 0SX$$

$$\lambda, S \rightarrow 1SY$$

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Question # 6

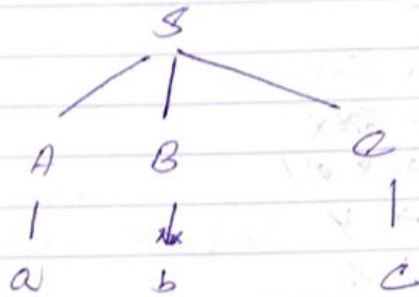
(1)

$S \rightarrow ABC$

$A \rightarrow a$

$B \rightarrow b$

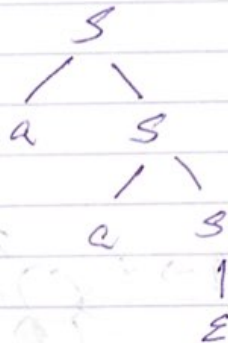
$C \rightarrow c$



Not ambiguous (1)

(2)

$S \rightarrow aS \mid \epsilon$



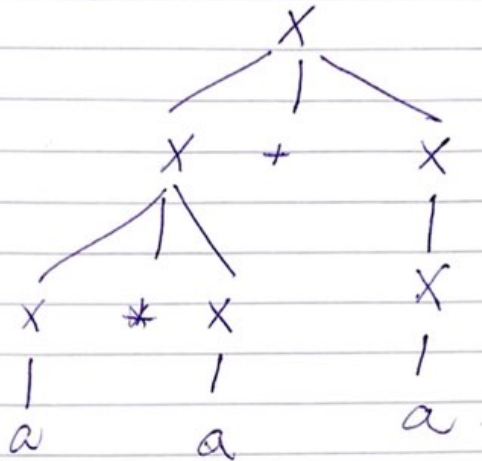
Not ambiguous

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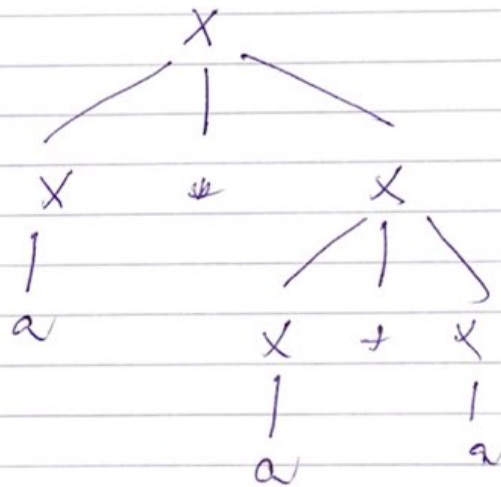
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$X \rightarrow X + X \mid X * X \mid X \mid a$ ⁽³⁾



$a * a + a$



$a * a + a$

Not ambiguous