

Q1)

$$a) S \rightarrow aSa \mid bSb \mid \epsilon$$

~~b)  $S \rightarrow a_1b_1a_1b_1$   
 $S \rightarrow a_2b_2a_1b_1$~~

$$b) S \rightarrow A \mid \epsilon$$

$$A \rightarrow aB \mid bB$$

$$B \rightarrow aaS \mid abS \mid baS \mid bbS$$

$$c) S \rightarrow aSB \mid bSB \mid \epsilon$$

$$B \rightarrow aa \mid bb$$

Q2)

$$a) S \rightarrow aB$$

$$B \rightarrow abB \mid \epsilon$$

$$b) S \rightarrow Ba$$

$$B \rightarrow abB \mid \epsilon$$

c)  $S \rightarrow AcB$

$$A \rightarrow abA \mid \epsilon$$

$$B \rightarrow aB \mid bB \mid \epsilon$$

Q3)

$$S \rightarrow AA$$

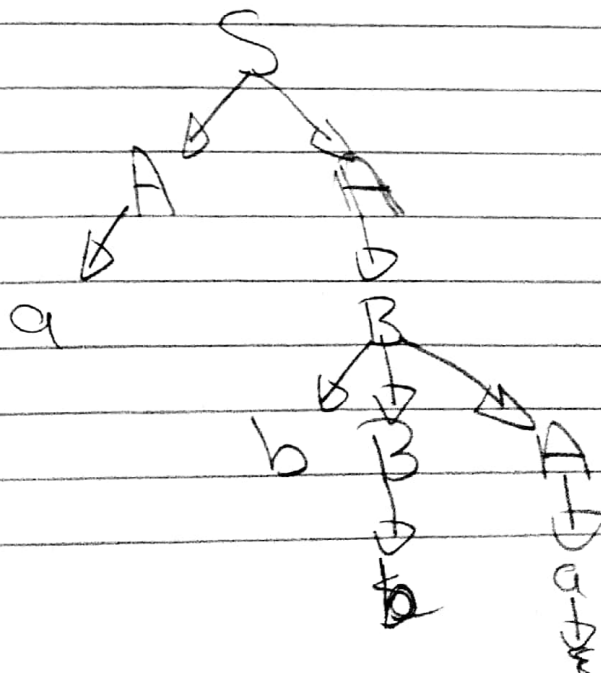
$$AA \rightarrow aBA \quad (A \rightarrow aB)$$

$$aBA \rightarrow abBA \quad (B \rightarrow bB)$$

$$abBA \rightarrow abbA \quad (B \rightarrow \epsilon)$$

$$abbA \rightarrow abbaBC \quad (A \rightarrow aB)$$

$$abbaB \rightarrow abba \quad (B \rightarrow \epsilon)$$



(Q4)

$S \rightarrow SSS$

$SSS \rightarrow aXb SS$

$aXbSS \rightarrow abbSS$

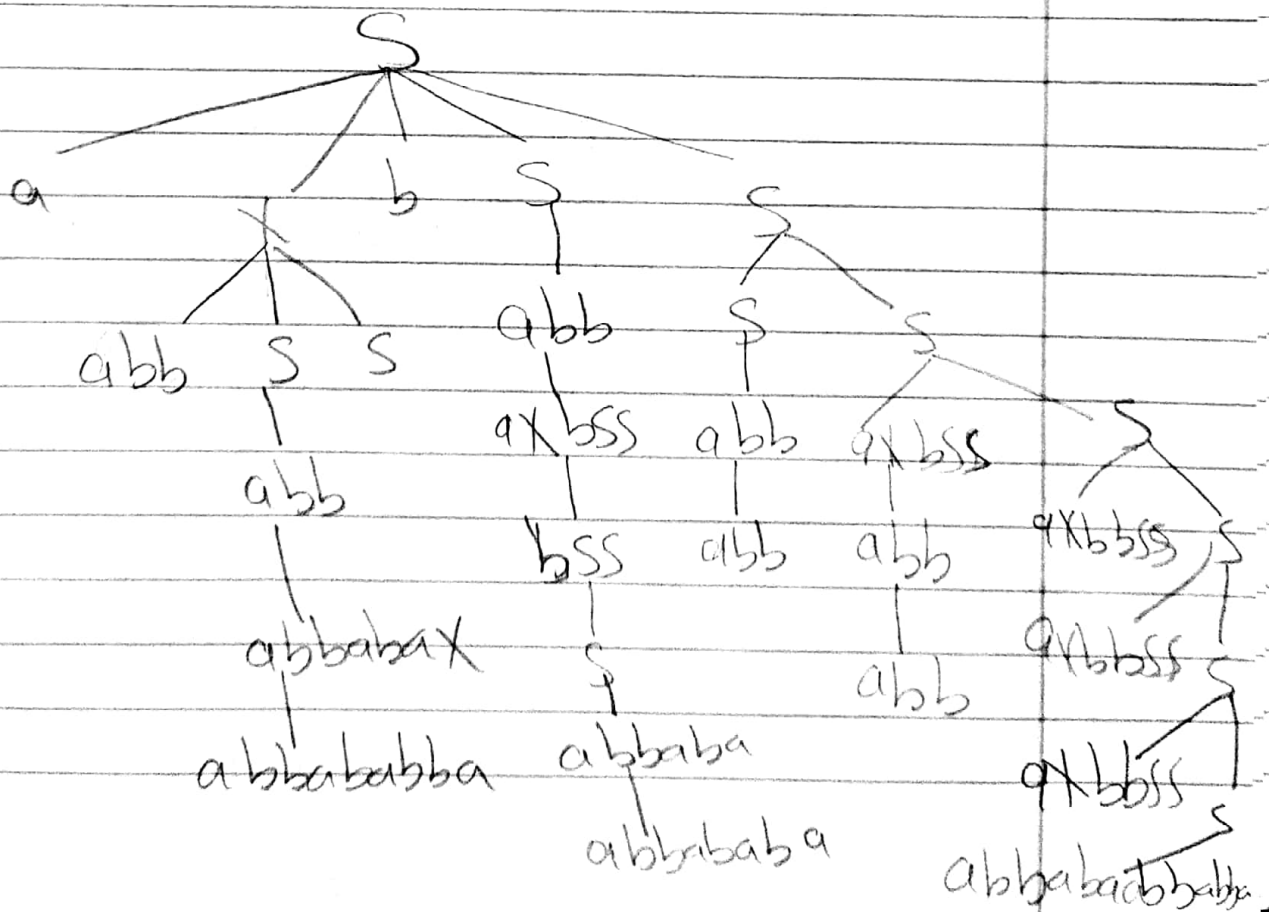
$abbSS \rightarrow abbabaXbSS$

$abbabaXbSS \rightarrow abbababbaSS$

$abbababbaSS \rightarrow abbababbaaXbS$

$abbababbaaXbS \rightarrow abbababbaabbaaXb$

$abbababbaabbaaXb \rightarrow abbababbaababb$





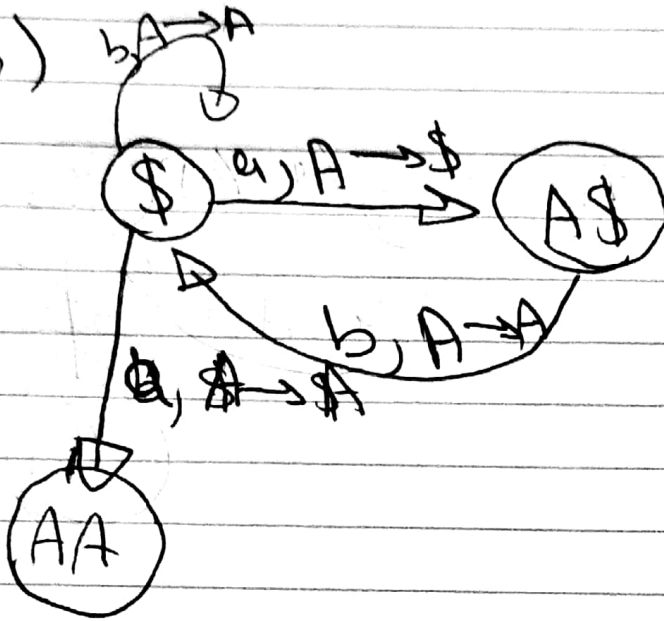
Q5)

1)  $a^*(b|a(a|b)^*a)$

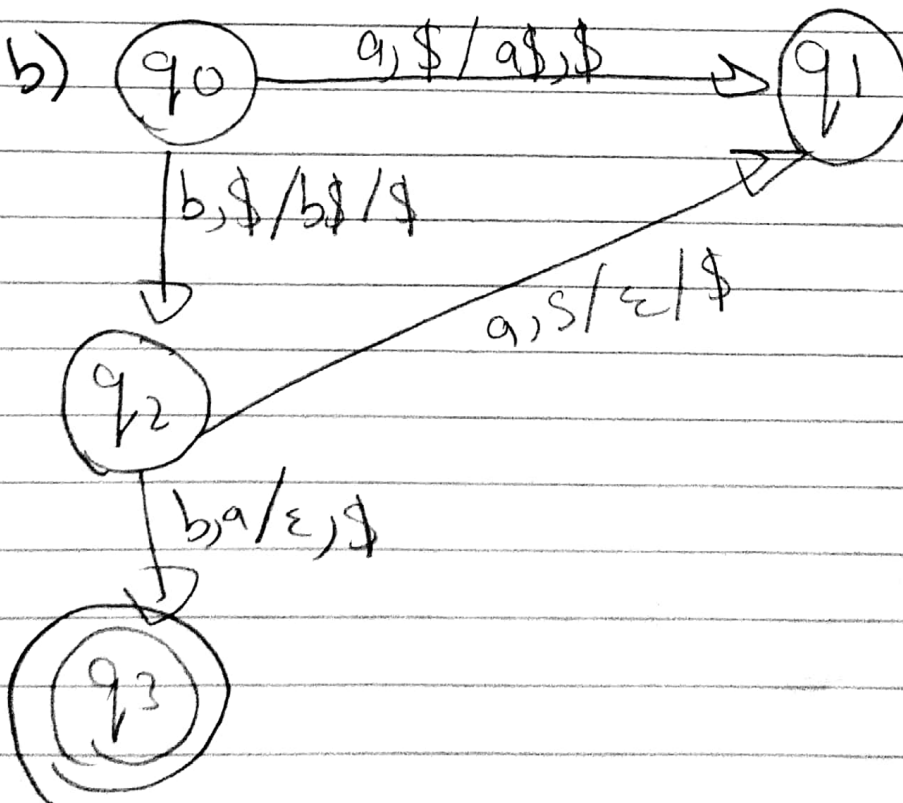
2)  $ab(a|b)^*$

Q6)

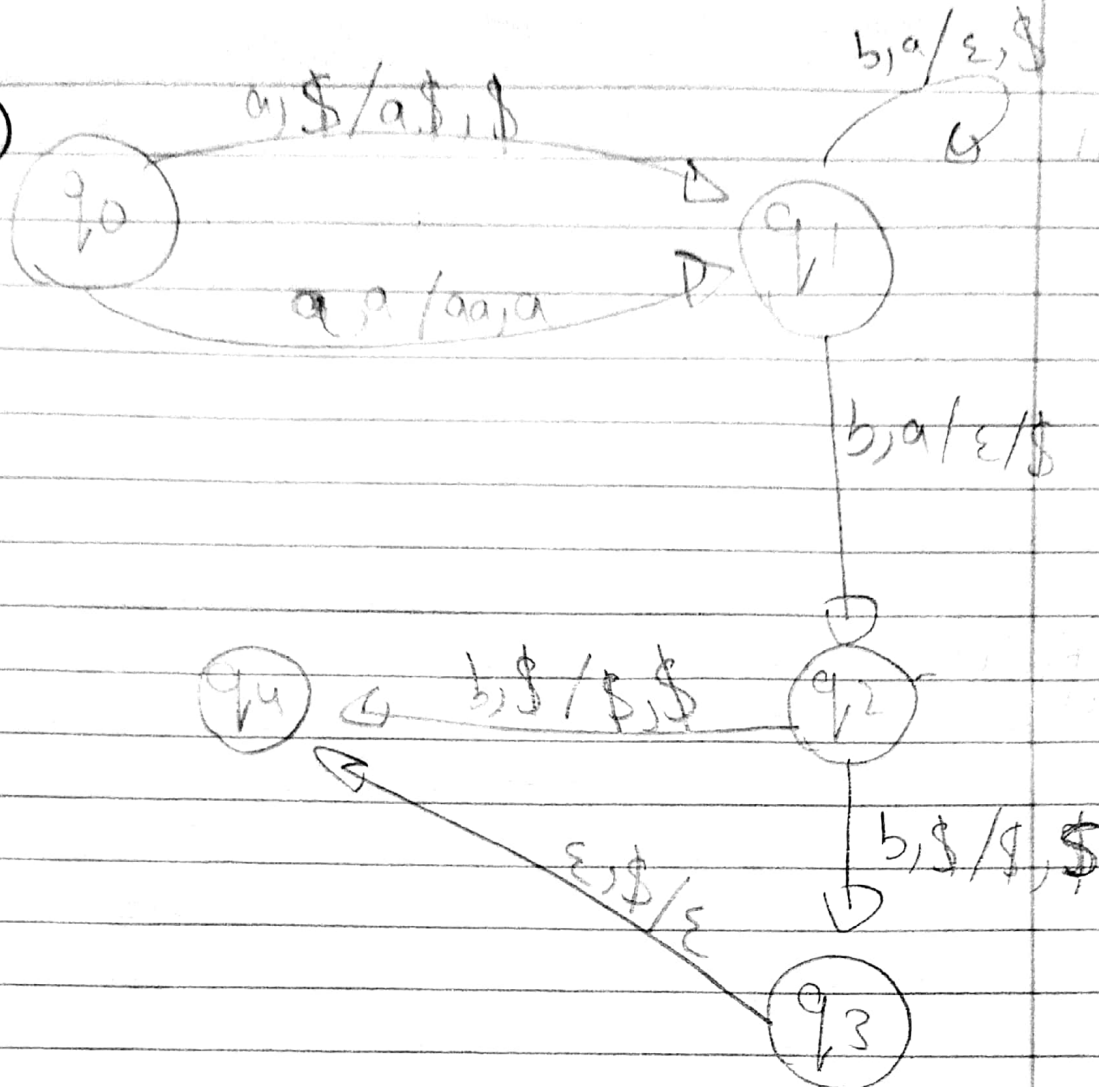
a)



b)

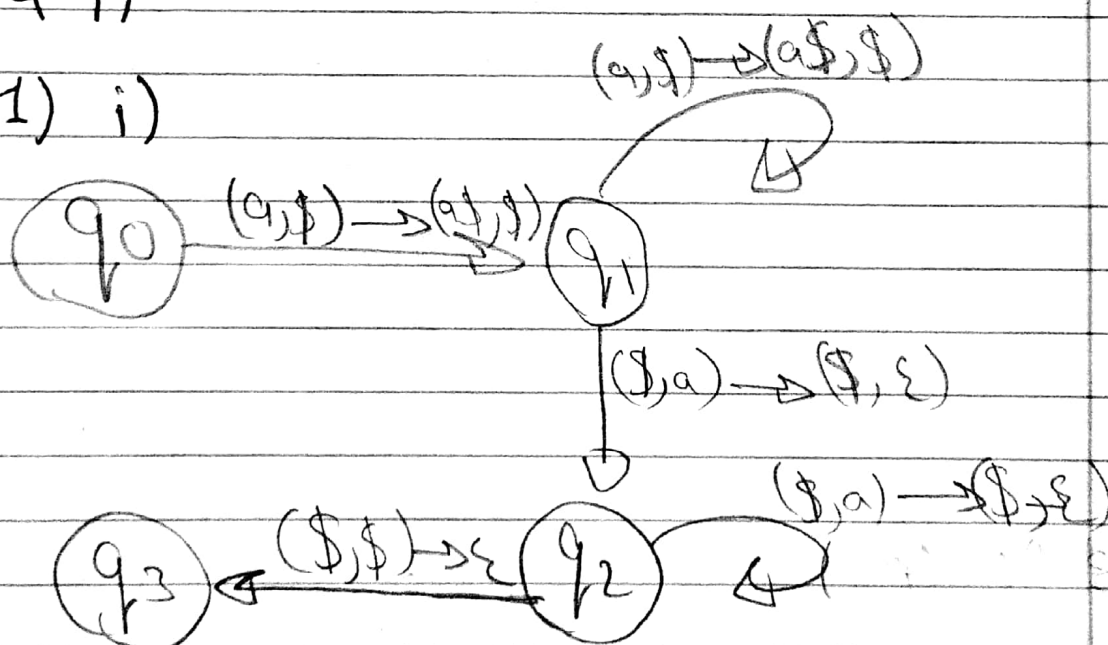


c)

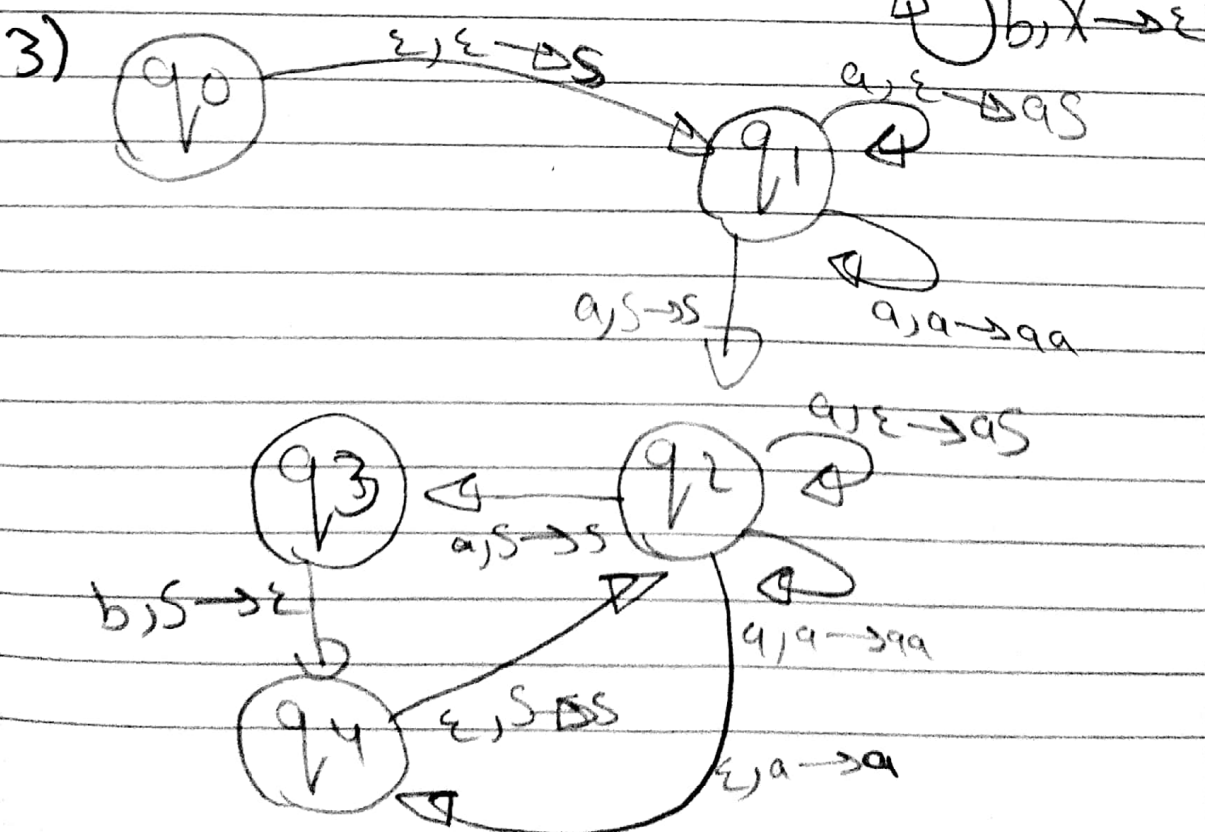
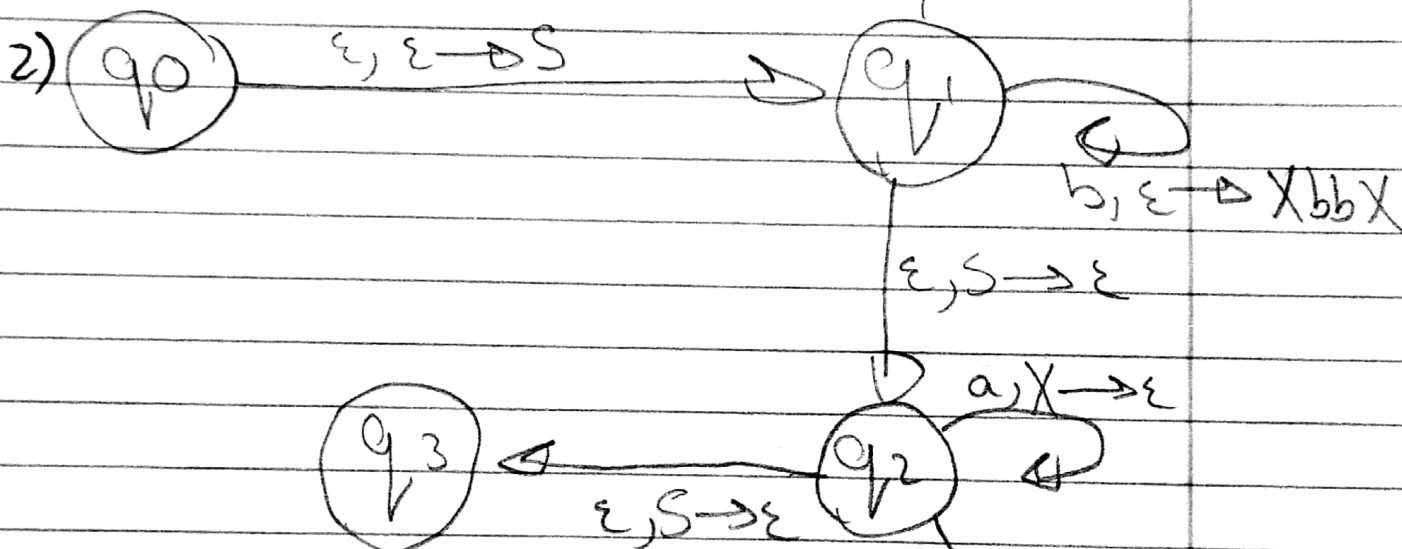
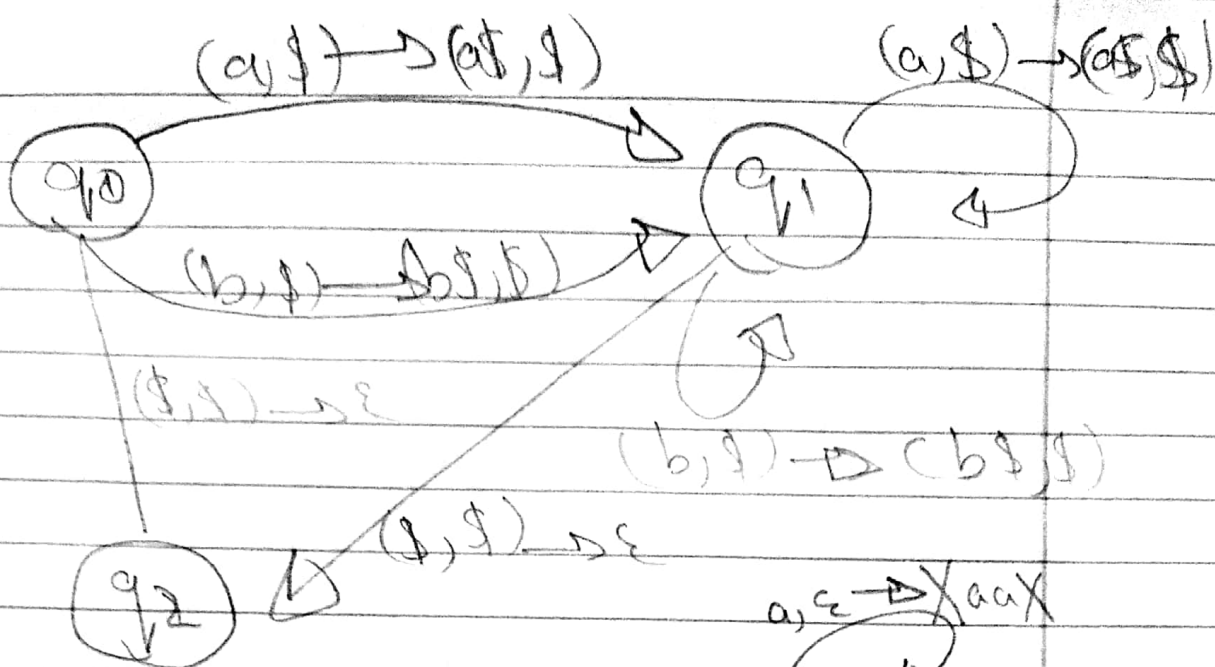


Q7)

1) i)



ii)





4)

