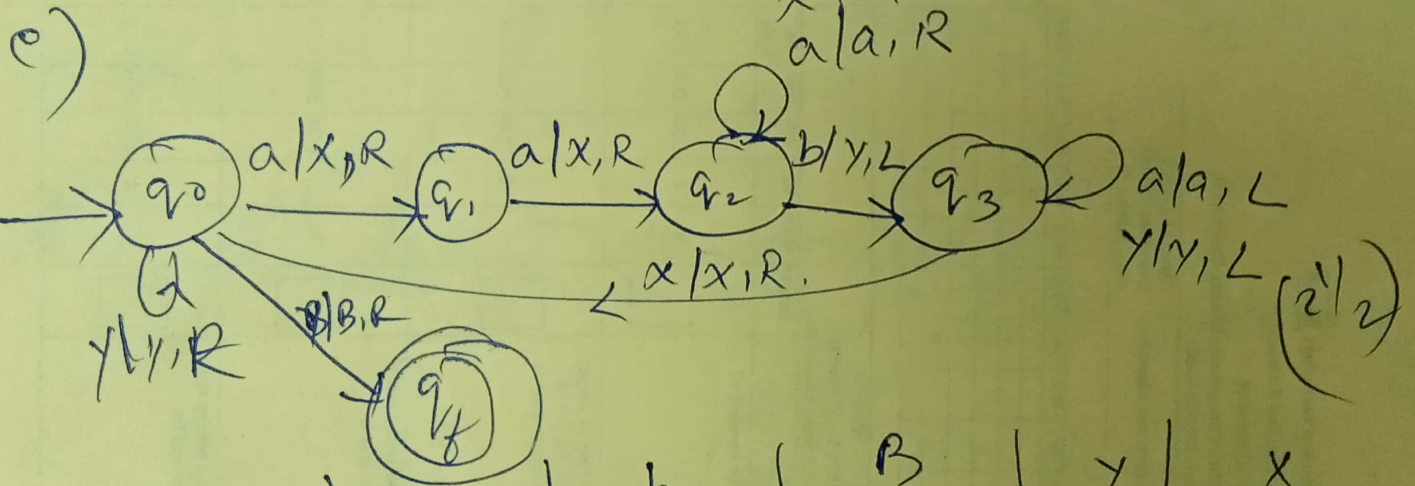


- i) a) iv) recursive  
b) i) TM that accepts L

d) ~~xxxxxyyy~~ c)  $a^{2n} b^n$  (2)  
aaabbbB (8)

$$\begin{aligned} \delta(q_0, a) &= (q_1, x, R) & \delta(q_3, y) &= (q_3, y, L) \\ \delta(q_1, a) &= (q_2, x, R) & \delta(q_3, x) &= (q_0, x, R) \\ \delta(q_2, a) &= (q_2, x, R) & \delta(q_0, y) &= (q_0, y, R) \\ \delta(q_2, b) &= (q_3, y, L) & \delta(q_0, B) &= (q_4, B, R) \\ \delta(q_3, a) &= (q_3, a, L) \\ \delta(q_2, x) &= (q_2, x, R) \end{aligned}$$



	a	b	B	y	x
q <sub>0</sub>	(q <sub>1</sub> , x, R)		(q <sub>4</sub> , B, R)	(q <sub>0</sub> , y, R)	(2/2)
q <sub>1</sub>	q <sub>2</sub> , x, R				
q <sub>2</sub>	q <sub>2</sub> , x, R	(q <sub>3</sub> , y, L)		(q <sub>2</sub> , x, R)	
q <sub>3</sub>	(q <sub>3</sub> , a, L)			(q <sub>3</sub> , y, L)	q <sub>0</sub> (q <sub>0</sub> , x, R)
q <sub>4</sub>					

1) Yes CFG. use pumping lemma (2)

2)  $n=3$   
 $w = aaaaabbbb$  (4)

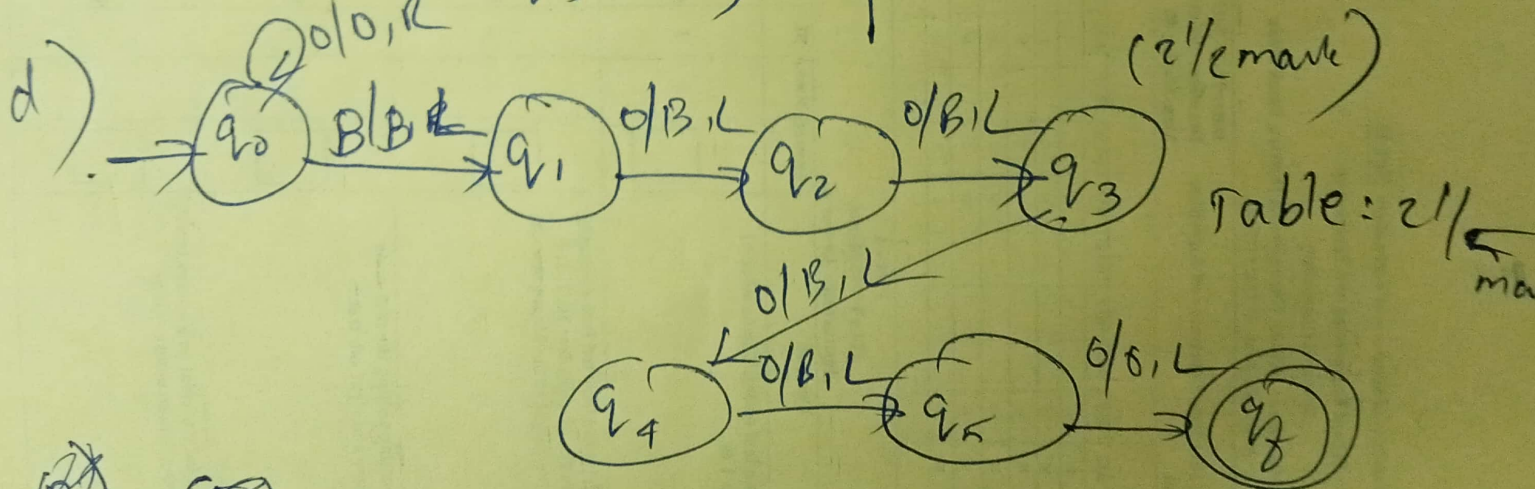
2) a) ii) long  
b) ii)

c)  $f(x) = a-4$   
 $w = aaaaa$  encode  $a-4$  0

(7)

1)  $\delta(q_0, 0) = (q_0, 0, R)$   
 $\delta(q_0, B) = (q_1, B, L)$   
 $\delta(q_1, 0) = (q_2, B, L)$   
 $\delta(q_2, 0) = (q_3, B, L)$

$\delta(q_3, 0) = (q_4, B, L)$   
 $\delta(q_4, 0) = (q_5, B, L)$   
 $\delta(q_5, 0) = (q_6, 0, L)$



(2) (2)

(7) encode.



e)  $w = 00000000BB.$

$q_{0000} \leftarrow$

(3)

f) Let  $q_0 = 0, q_1 = 00, q_2 = 000, q_4 = 0000, q_8 = 00000$

$q_{16} = 0000000, 0 \text{ as } 00000000 \quad R \text{ as } 0000000000$   
 $1 \text{ as } 000000000$

$(q_0, 0) = (q_0, 0, R)$

01001010000000/0000000000

like wise code for all rules.

(4)

3) a) ii)

b) ~~see~~ iv)

c) 
$$\frac{10111}{10} = \frac{1111}{11} = \frac{11}{11} = \frac{1}{1} = \frac{10}{10}$$

$$\frac{10}{6} = \frac{10 \cdot 1}{11} = \frac{10}{11}$$
  
2, 1, 1, 1, 3 (8)

d) ~~mpcp~~

e) ~~yes~~

f) ~~no~~

d)

	A	B
0	<del>1</del> * 1 *	* 1 * 1 *
1	1 *	* 1 * 1 *
2	1 * 0 * 1 * 1 * 1 *	* 1 * 0
3	1 * 0 *	* 0
4	\$	* \$

(6)

e) yes. ~~can~~ generate the sequence (6)

f) ~~yes~~. MPCP is undecidable — (1)  
Justification — (3)