SET-A

1)

a) ii (Recursively Enumerable)

b) iv (Infinite tape)

c) $L = \{$ unary addition $\}$

d) Transition rules

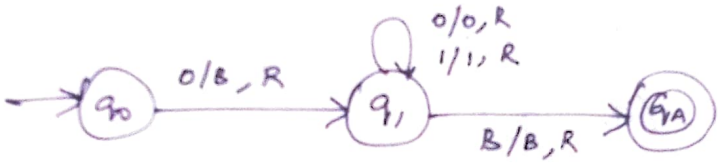
1) $\delta(q_0, 0) = (q_1, B, R)$

2) $\delta(q_1, 0) = (q_1, 0, R)$

3) $\delta(q_1, 1) = (q_1, 0, R)$

4) $\delta(q_1, B) = (q_A, B, R)$

e)



	0	1	B
→ q_0	(q_1, B, R)	-	-
q_1	$(q_1, 0, R)$	$(q_1, 0, R)$	(q_A, B, R)
* q_A	-	-	-

f) Computing device

g) $w = 000001000$

$q_0 000001000\,B \vdash B q_1 00001000\,B \vdash B0 q_1 0001000B$
$\vdash B00 q_1 001000\,B \vdash B000 q_1 01000\,B \vdash B0000 q_1 1000B$
$\vdash B0000B q_1 000\,B \vdash B000000 q_1 00\,B \vdash B0000000 q_1 0B$
$\vdash B00000000 q_1 B \vdash B00000000 B q_A B.$

∴ TM halts and output is computed.

Set A:

2) a) iv (Recursive)

b) iv) (L is recursive)

c) ~~bccc~~

Lets assume red as a

yellow as b

$L = \{ a^n b^n \mid n \geq 1 \}$.

) Transition rules

1) $\delta(q_0, a) = (q_1, X, R)$

2) $\delta(q_1, a) = (q_1, a, R)$

3) $\delta(q_1, b) = (q_2, Y, L)$

4) $\delta(q_2, a) = (q_2, a, L)$

5) $\delta(q_2, X) = (q_0, X, R)$

6) $\delta(q_1, Y) = (q_1, Y, R)$

7) $\delta(q_2, Y) = (q_2, Y, L)$

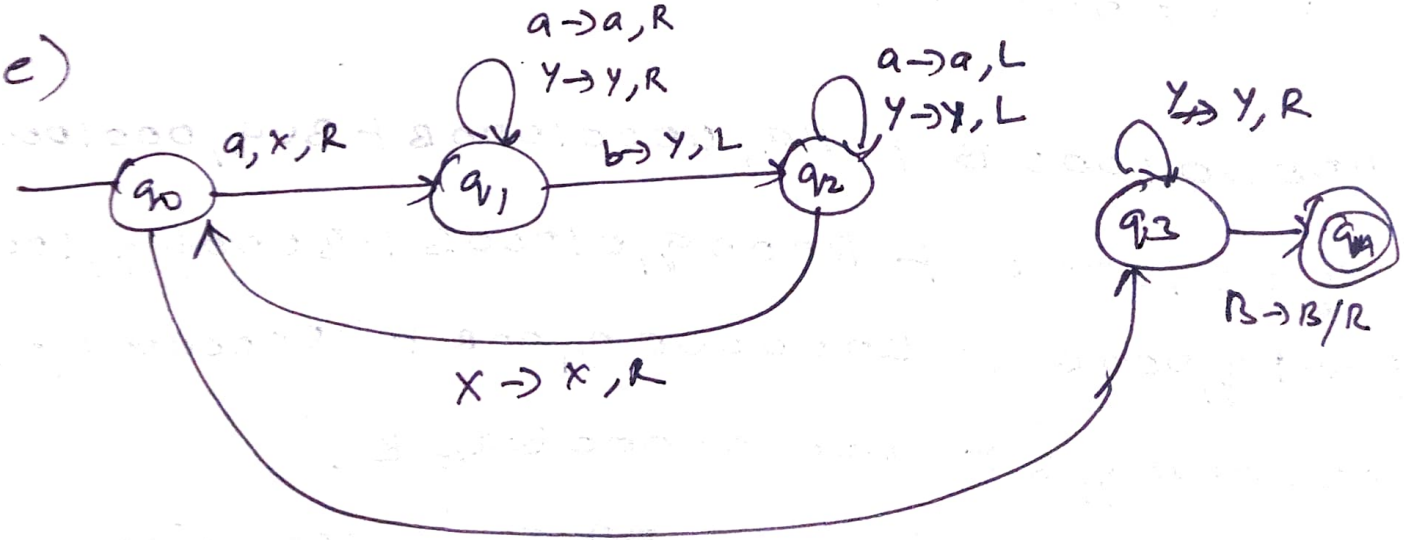
8) $\delta(q_0, Y) = (q_3, Y, R)$

9) $\delta(q_3, Y) = (q_3, Y, R)$

10) $\delta(q_3, B) = (q_4, B, R)$

d) transition diagram & table

e)



yellow as b

$L = \{a^n b^n \mid n \geq 1\}$.

d) transition diagram & table

e) encode the message.

Lets assume

q_0 - 0	a - 0	L - 0
q_1 - 00	b - 00	R - 00
q_2 - 000	X - 000	
q_3 - 0000	Y - 0000	
q_A - 00000		

For each transition encode: the and the coded M/

0 1 0 100 1 000 1 00 11 00 1 0 1 00 10 1 00 11

00 1 00 1 000 1 0000 1 0 11 000 1 0 1 0001 010

Similarly encode all transitions.

f)

List A	List B
RYY	YYYR
YYR	YRYR
RR	RRY
YY	YRY

have solution because all the permu

yellow as b

$L = \{a^n b^n \mid n \geq 1\}$.

d) transition diagram & table

e) encode the message.

Lets assume

q_0 - 0	a - 0	L - 0
q_1 - 00	b - 00	R - 00
q_2 - 000	X - 000	
q_3 - 0000	Y - 0000	
q_A - 00000		

For each transition encode: the and the coded m

➡ 0 1 0 | 00 | 1 | 000 | 1 | 00 || 00 | 1 | 0 | 1 | 00 | 1 | 0 | 00 | 1 | 1)

0 0 | 1 | 00 | 1 | 000 | 1 | 0000 | 1 | 0 || 000 | 1 | 0 | 1 | 0000 | 1 | 0

Similarly encode all transitions.

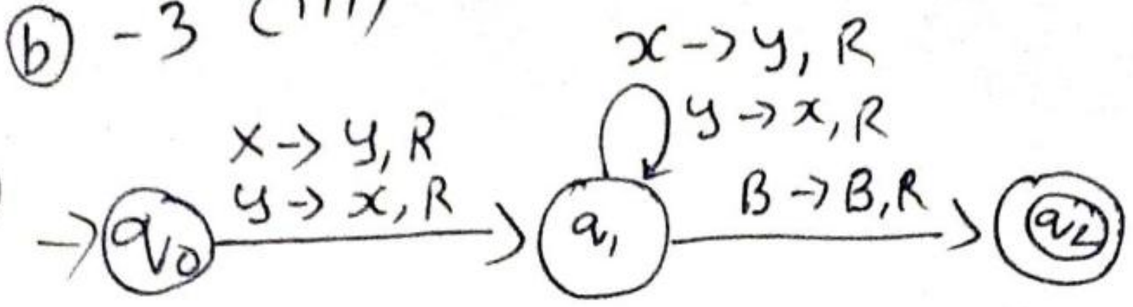
f)

List A	List B
RYY	YYYR
YYR	YRYR
RR	RRY
YY	YRY

Doesnt have solution. Because all the permu combination doesnt give solution.

③ (a) - 3 (iii)
(b) - 3 (iii)

(c)



(d) $\delta(q_0, x) = (q_1, Y, R)$

$\delta(q_0, y) = (q_1, x, R)$

$\delta(q_1, x) = (q_1, y, R)$

$\delta(q_1, y) = (q_1, x, R)$

$\delta(q_1, B) = (q_2, B, R)$

step 1 =

$$\frac{\#}{\#\, q_0\, w\, \#}$$

step 2 : Right moves

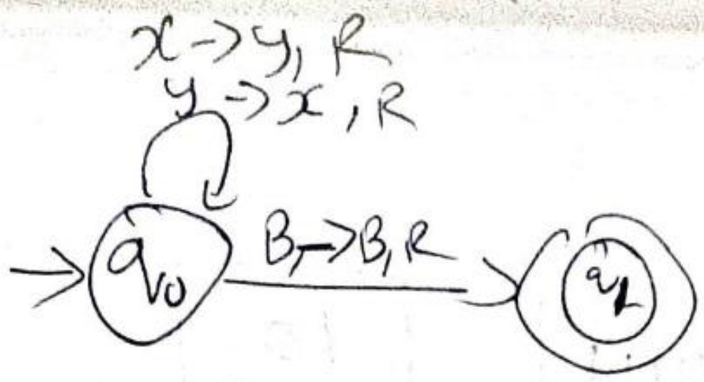
$\frac{q_0 x}{y\, q_1}$ $\frac{q_0 y}{x\, q_1}$ $\frac{q_1 x}{y\, q_1}$ $\frac{q_1 y}{x\, q_1}$

③ $\frac{x}{x}$ $\frac{y}{y}$ $\frac{B}{B}$

④ $\frac{x\, q_2}{q_2}$ $\frac{q_2\, x}{q_2}$ $\frac{y\, q_2}{q_2}$ $\frac{q_2\, y}{q_2}$

⑤ $\frac{\#}{\#}$ $\frac{\#}{B\, \#}$ ⑥ $\frac{q_2\, \#\, \#}{\#}$

(d)



$\delta(q_0, x) = (q_0, y, R)$

$\delta(q_0, y) = (q_0, x, R)$

$\delta(q_0, B) = (q_1, B, R)$

step1 : $\frac{\#}{\# q_0 w \#}$

step2 :

$\frac{q_0 x}{y q_0}$ $\frac{q_0 y}{x q_0}$

(3) $\frac{x}{x}$ $\frac{y}{y}$ $\frac{B}{B}$

(4) $\frac{x q_1}{q_1}$ $\frac{q_2 x}{q_1}$ $\frac{y q_1}{q_1}$ $\frac{q_1 y}{q_1}$

(5) $\frac{\#}{\#}$ $\frac{\#}{B \#}$

(6) $\frac{q_1 \# \#}{\#}$

(e)

x	y	x	B

q_0

y	y	x	B

q_1

y	x	x	B

q_1

y	x	y	B

q_2

(or)

x	y	x	B

q_0

y	y	x	B

q_0

y	x	x	B

q_0

y	x	y	B

q_1

(8) $w = xyx$

$$\frac{\#}{\#\, q_0\, w\, \#} \qquad \boxed{\frac{\#}{\#\, q_0\, xyx\, \#}}$$

$$\frac{\#}{\#\, q_0\, xyx\, \#} \qquad \boxed{\frac{q_0\, x}{y\, q_1}} \quad \boxed{\frac{y}{y}} \quad \boxed{\frac{x}{x}} \quad \boxed{\frac{\#}{\#}} \quad \boxed{\frac{\#}{\#\, q_0\, xyx}} \quad \boxed{\frac{\#}{\#\, q_0\, xyx\, \#}}$$

$$\boxed{\frac{q_0\, x}{y\, q_1}} \quad \cdots \quad \text{It loops}$$