SET-D ← key cycle test -3

PART-A. FLA

1. $A = \{HB, HHB, HH\}$

$B = \{HB, HH, BHH\}$

Sol) Consider $A_1 = HB$ $A_2 = HHB$ $A_3 = HH$

$B_1 = HB$ $B_2 = HH$ $B_3 = BHH$

Here $A_1 = B_1$ $A_2 A_3 = B_2 B_3$

$A_3 = B_2$ $A_1 A_3 = B_1 B_2$

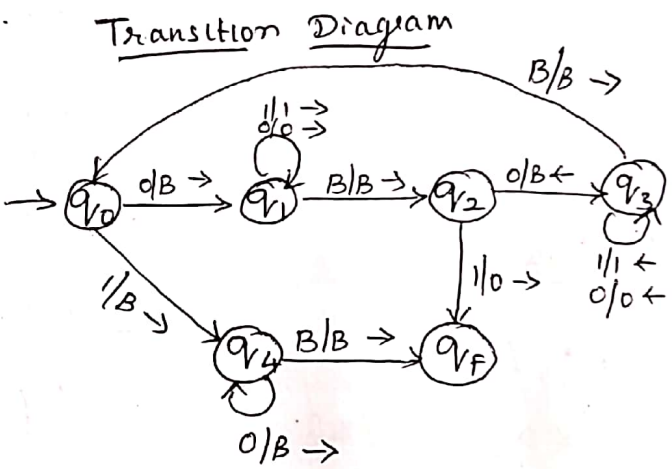
∴ pair (A,B) has PCP Solution.

PART-B

2) i) $\delta(m,n) = \begin{cases} m-n & \text{if } m>n \\ 0 & \text{if } m \leq n. \end{cases}$

	0	1	B
q_0	(q_1, B, R)	(q_4, B, R)	–
q_1	$(q_1, 0, R)$	$(q_1, 1, R)$	(q_2, B, L)
q_2	(q_3, B, L)	$(q_F, 0, R)$	–
q_3	$(q_3, 0, L)$	$(q_3, 1, L)$	(q_0, B, R)
q_4	(q_4, B, R)	–	(q_F, B, R)
q_F	–	–	–

Transition Diagram



(ii) Tuple Notation.

$M = (\{q_0, q_1, q_2, q_3, q_4, q_F\}, \{0,1\}, \{0,1,B\}, \delta, q_0, B, \{q_F\})$

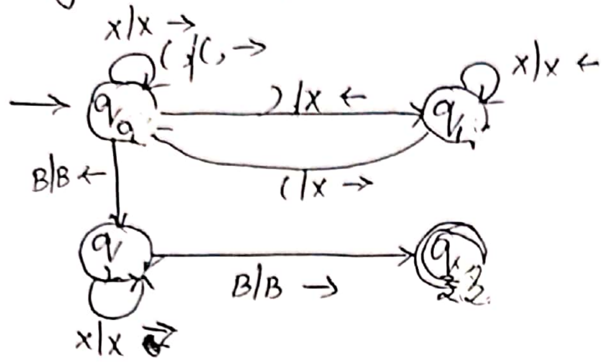
(iii) C

(iv) C

3 (i) D

(ii) A, B, C, D Any option is correct.

(iii) Turing Machine for Balanced Parenthesis.



(iv) Instantaneous Description String ((()))

q_0 ((())) $\vdash$ (q_0 (())) B

$\vdash$ ((q_0 ())) B

$\vdash$ (((q_0))) B

$\vdash$ ((q_1 (X)) B

$\vdash$ ((X q_0 X)) B

$\vdash$ ((X X q_0)) B

$\vdash$ ((X X q_1 X X) B

$\vdash$ ((X q_1 X X X) B

$\vdash$ (q_1 (X X X) B

$\vdash$ (X q_0 X X X) B

$\vdash$ (X X q_0 X X) B

$\vdash$ (X X X q_0 X) B

$\vdash$ (X X X X q_0) B

~~$\vdash$ (X X X X q_2 X , B~~

~~$\vdash$ (X X X q_1 X X B~~

~~$\vdash$ (X X q_1 X X X B~~

~~$\vdash$ (X q_1 X X X X B~~

Continue.

$\vdash$ (X X X q_1 X X B

$\vdash$ (X X q_1 X X X B

$\vdash$ (X q_1 X X X X B

$\vdash$ (q_1 X X X X X B

$\vdash$ q_1 (X X X X X B

$\vdash$ X q_0 X X X X X B

$\vdash$ X X q_0 X X X X B

$\vdash$ X X X q_0 X X X B

$\vdash$ X X X X q_0 X X B

$\vdash$ X X X X X q_0 X B

$\vdash$ X X X X X X q_0 B

$\vdash$ X X X X X q_2 X B

$\vdash$ X X X X X X q_2 B

$\vdash$ X X X X X X q_3

The String accepted.

Continue

~~$\vdash$ q_1 (X X X X) B~~

~~$\vdash$ X q_0 X X X X B~~

~~$\vdash$ q_0 X X X~~

4) (i) A

(ii) A

(iii) Turing machine for the given Scenario accepts the language $X+5$

	0	1	B
q_0	$(q_0, 0, R)$	$(q_1, 0, R)$	–
q_1	$(q_1, 0, R)$	–	(q_2, B, L)
q_{22}	(q_3, B, R)	–	–
q_3	–	–	–

(iv) Code for states

$q_0 \rightarrow 0$
$q_1 \rightarrow 00$
$q_{22} \rightarrow 000$
$q_3 - 0000$

Code for dir

$L \rightarrow 0$
$R \rightarrow 00$

Code for tape Sly.

$0 \rightarrow 0$
$1 \rightarrow 00$
$B \rightarrow 000$

$(q_0, 0) = (q_0, 0, R) - C_1 = 0^1 | 0^1 | 0^1 | 0^1 | 0^{R2}$

$(q_0, 1) = (q_1, 0, R) - C_2 = 0^1 | 0^2 | 0^2 | 0^1 | 0^2$

$(q_1, 0) - (q_1, 0, R) - C_3 = 0^2 | 0^1 | 0^2 | 0^1 | 0^2$

$(q_1, B) - (q_2, B, L) - C_4 - 0^2 | 0^3 | 0^3 | 0^3 | 0^1$

$(q_2, 0) - (q_3, B, R) - C_5 - 0^3 | 0^1 | 0^4 | 0^3 | 0^2$

TM is $< C_1 || C_2 || C_3 || C_4 || C_5 >$.