Cycle test - 3 Set B

① 10m

Assume H = Head
T = Tail

List R: (T, H, HTH, TT)

List S: (TH, TH, HT, T)

Now, we have to find out a sequence that strings formed by R and S are identical. such a sequence is 1, 2, 1, 3, 3, 4 Hence.

1 2 1 3 3 4 1 2 1 3 3 4

T H T HTH HTH TT THTHTH HT HT T

Here Instance of PCP = 12133 4

2. i) This is one of the solns

Turing machine as acceptor 4m

$Tm, m = (Q, \Sigma, \Gamma, q_0, B, \delta, F)$

Q = Set of states

Σ = input alphabet

Γ = set of Tape symbols.

q_0 = Initial state

B = Initial tape symbol

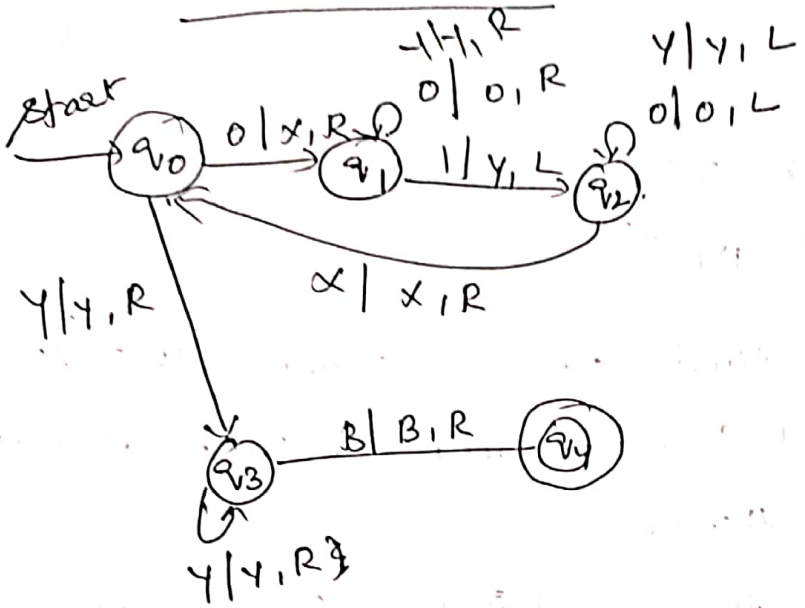
δ = Set of transitions

F = Final state.

$L(m) = \{ w \mid w \in \Sigma^*, \delta(q_0, w\$) \vdash^* \alpha_1 p \alpha_2, p \in F$ and $\alpha_1 \alpha_2 \in \Gamma^* \}$

$L(m)$ is accepted by m

ii) Transition diagram 5m



formal definition

$Q = \{q_0, q_1, q_2, q_3, q_4\}$

$\Sigma = \{0, 1, B\}$

$q_0 = q_0$

$\Gamma = \{0, X, Y, B\}$

$z_0 = B$

$F = \{q_4\}$. 3m

δ

given in transition diagram

$\delta(q_0, 0) = (q_1, X, R)$ $\quad \delta(q_2, X) = (q_0, X, R)$

$\delta(q_0, Y) = (q_3, Y, R)$ $\quad \delta(q_2, Y) = (q_2, Y, L)$

$\delta(q_1, 0) = (q_1, 0, R)$ $\quad \delta(q_3, Y) = (q_3, Y, R)$

$\delta(q_1, 1) = (q_2, Y, L)$ $\quad \delta(q_3, B) = (q_4, B, R)$

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

$\delta(q_2, 0) = (q_2, 0, L)$

iii) $L(m) = \{ w / w \in 0^n 1^n \ \forall\ n \geq 0 \}$ — 2m

iv) given string 000111 — 6m

$(q_0 000111) \vdash (x q_1 00111) \vdash (x0 q_1 0111) \vdash^*$

$(x00 q_2 y11) \vdash (x0 q_2 0y11) \vdash^* (xxx q_1 yy11)$

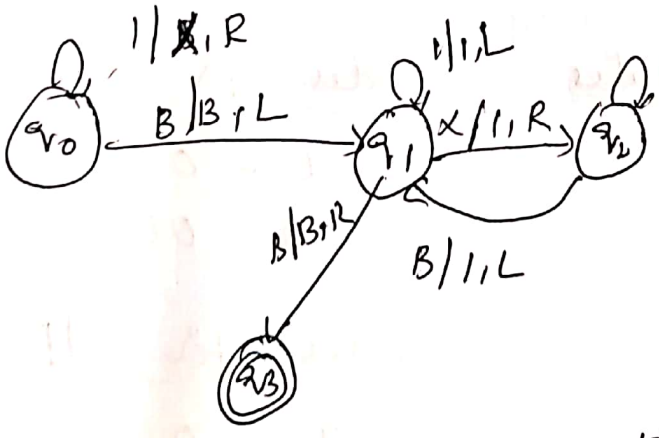
$(xxx y q_1 y1) \vdash (xxxyy q_1 1) \vdash (xxxyy q_2 y)$

$\vdash^* (xxx q_0 yyyB) \vdash (xxx y q_3 yyB) \vdash^*$

$(xxxyyy q_3 B) \vdash (xxxyyyB q_4)$

Reaches to final state. Hence string 000111 accepted by given Tm.

3i) Given scenario is for Turing machine which computes $f(n) = 2n$. — 12m



ii) Tm is acting as computing device as it calculates the $f(n) = 2n$. — 6m

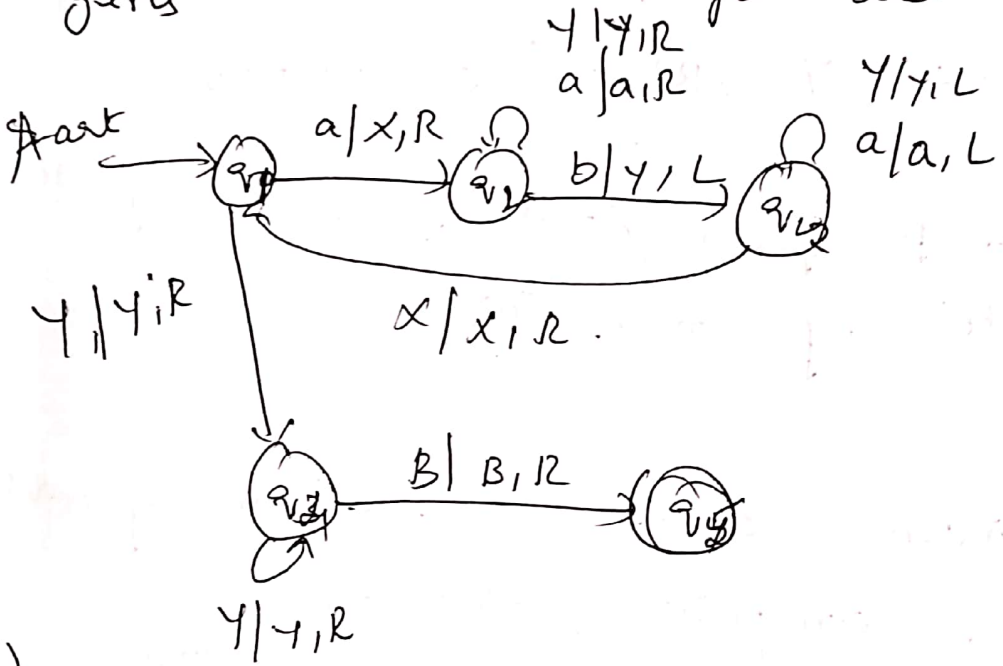
If $n = 2$ the result is 4 i.e., 4 symbols will be there by the Tm halts.

iii) B & C

iv) C

4) 12 m

i) Turing machine for the given Scenario accepts the language $a^n b^n$ where 'a' represents boys and 'b' represents girls



ii)

Codes for states

$q_0 \Rightarrow 0$

$q_1 \rightarrow 00$

$q_2 - 000$

$q_3 - 0000$

$q_4 - 00000$

Codes for Dm

L – 0

R – 00

codes for Tape symbols

a – 0

b – 00

B – 000

X – 0000

Y – 00000

$(q_0, a) =$ (4)

$C_1 = 0^1|0^1|0^2|0^4|0^2$ (5)

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

$C_2 = 0^1|0^5|0^4|0^5|0^2$

$\delta(q_2, a) = (q_2, a, R) \Rightarrow C_3 = 0^2|0^1|0^2|0^1|0^2$

$\delta(q_2, Y) = (q_2, Y, R)$ $C_4 = 0^2|0^5|0^2|0^5|0^2$

$\delta(q_2, b) = (q_3, Y, L)$ $C_5 = 0^2|0^2|0^3|0^5|0^1$

$\delta(q_3, a) = (q_3, a, L)$ $C_6 = 0^3|0^1|0^3|0^1|0^1$

$\delta(q_3, Y) = (q_3, Y, L)$ $C_7 = 0^3|0^5|0^3|0^5|0^1$

$\delta(q_3, X) = (q_0, X, R)$ $C_8 = 0^3|0^4|0^1|0^4|0^2$

$\delta(q_3, B) = (q_5, B, R) = C_9 = 0^4|0^3|0^5|0^3|0^2$

$\delta(q_4, Y) = (q_4, Y, R) \Rightarrow C_{10} = 0^4|0^5|0^4|0^5|0^2$

Tm is $\angle C_1 || C_2 || C_3 || C_4 || C_5 || C_6 || C_7 || C_8 || C_9 || C_{10}$