Date 6/11/2023. Cycle test - 3 Set A

(1) Part A 10m

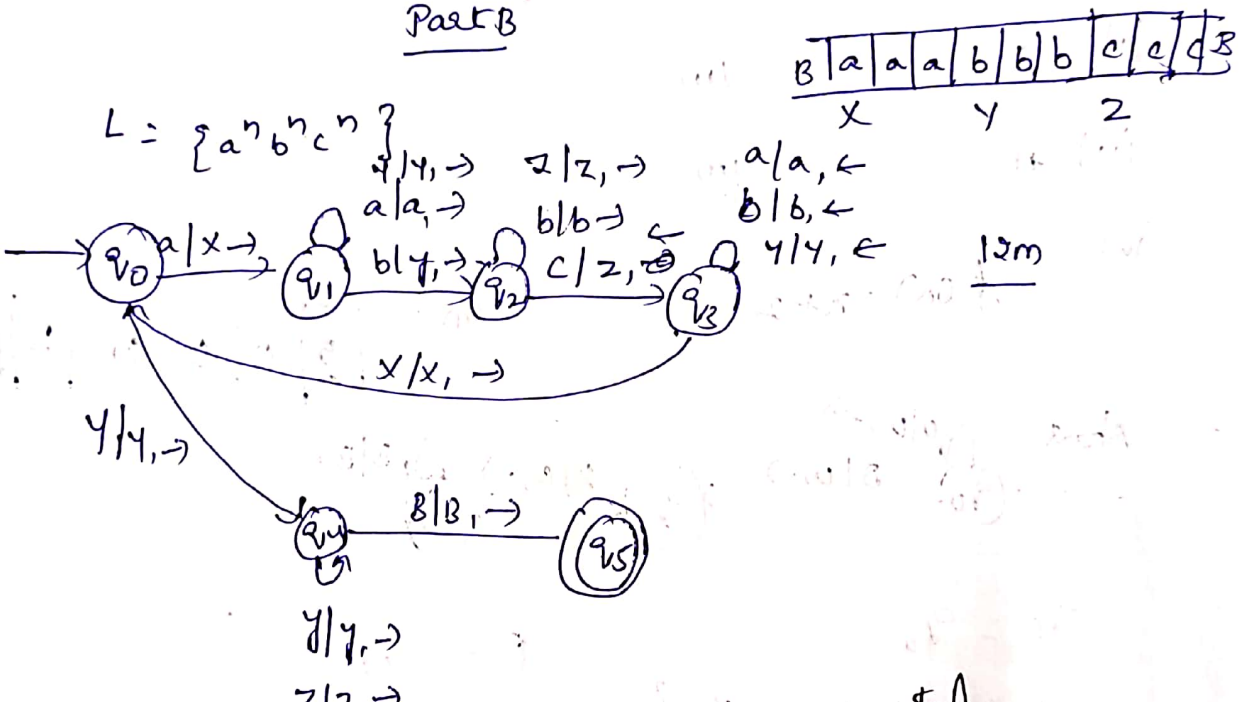
i	A	B
1	ab	a
2	bab	ba
3	bbaaa	bab

$|x_2 x_1 x_3| \neq |y_2 y_1 y_3|$ (Lengths are not same)

In this case, there is no PCP solution. Hence and also no modified pcp solution.

Part B

(2) i) $L = \{a^n b^n c^n\}$



12m

ii) → string not accepted 6m

$(q_0, aabbbccc)$

$\vdash x q_0 aabbbccc \vdash xaq_1 abbbccc \vdash xaaq_1 bbbccc$

$\vdash xaayq_2 bbccc \vdash xaaybq_2 bccc \vdash xaaybbq_2 ccc$

$\vdash xaaybbzq_3 cc \vdash xaaybbzcq_3 c \vdash xaaybbzc q_3 c$

$\vdash xaaybbzcc q_3 \vdash^* xaaybbzcc q_0 \vdash^* xxaybbzcc$

$\vdash^* xxyybzzq_3 c \vdash xxyybzzcq_3 \vdash^* xxyybzzc$

No transition for b on q_4. Hence stops at q_4.

Hence the string not accepted by given Tm

iii) TRUE

iv) D

1m

1m

(3) i) multi tape Turing machine is more powerful than a single tape Turing machine because it has more storage space, can perform certain computations more efficiently in terms of time complexity. However ~~can recognise more languages~~, Single tape, multi tape Tms are equivalent in recognising languages.

6m

ii) C

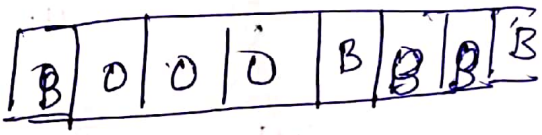
1m

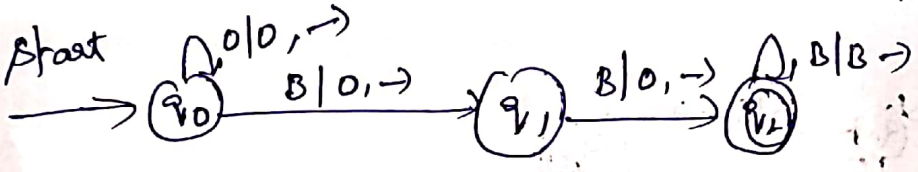
iii) A

1m

iv) $f(x) = x+2$

12m





$q_0 = q_0$

$F = q_2$

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

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

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

δ

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

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

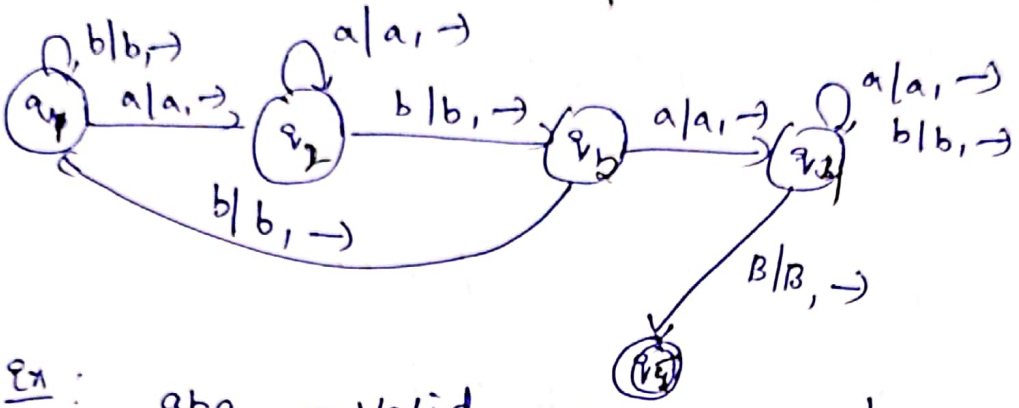
$\delta(q_1, B) = (q_2, 0, R)$

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

i) a — 1m

ii) a — 1m

iii) Tm - aba as a substring : 8m



Ex: aba — valid 4m

$(q_0, \sqcup ba) \vdash (aq_1 ba) \vdash (abq_2 a) \vdash (abaq_3) \vdash (abaq_4)$

iv) To encode states 6m

q_0 - D

q_1 - DD

q_2 - 000

q_3 - 0000

q_4 - 00000

encode Dm

L = D_1 - 0

R - D_2 - 00

encode Γ

a → 0 - x_1

b → 00 - x_2

B ⇒ 000 - x_3

δ

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

$C_1 : 0^1 | 0^1 | 0^2 | 0^1 | 0^2$

$\delta(q_0, b) = (q_0, b, R)$

$C_2 : 0^1 | 0^2 | 0^1 | 0^2 | 0^2$

$\delta(q_1, a) = (q_{21}, a, R)$

$C_3 : 0^2 | 0^1 | 0^2 | 0^1 | 0^2$

$\delta(q_1, b) = (q_{21}, b, R)$

$C_4 : 0^2 | 0^2 | 0^3 | 0^2 | 0^2$

$\delta(q_{22}, a) = (q_{33}, a, R)$

$C_5 = 0^3 | 0^1 | 0^4 | 0^1 | 0^2$

$\delta(q_{22}, b) = (q_{44}, b, R)$

$C_6 = 0^3 | 0^2 | 0^1 | 0^2 | 0^2$

$\delta(q_{33}, a) = (q_{33}, a, R)$

$C_7 = 0^4 | 0^1 | 0^4 | 0^1 | 0^2$

$\delta(q_{33}, b) = (q_{33}, b, R)$

$C_8 = 0^4 | 0^2 | 0^4 | 0^2 | 0^2$

$\delta(q_{33}, B) = (q_{55}, B, R)$

$C_9 = 0^4 | 0^{12} | 0^5 | 0^3 | 0^2$.

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