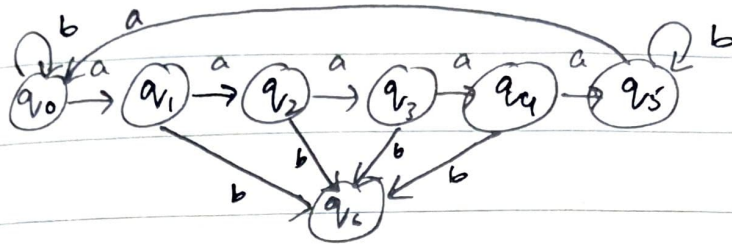


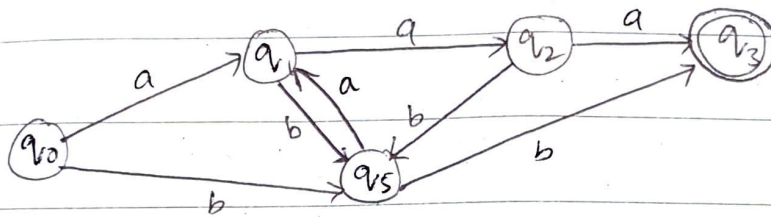
Q1.

(i) $(aaaaa + b)^*$



(ii)

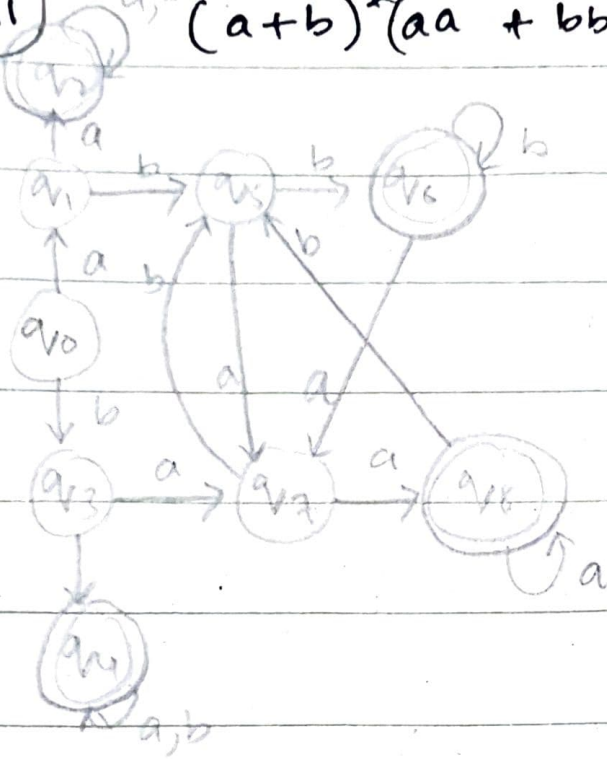
$a^* b b a^* + b^* a a a b^*$



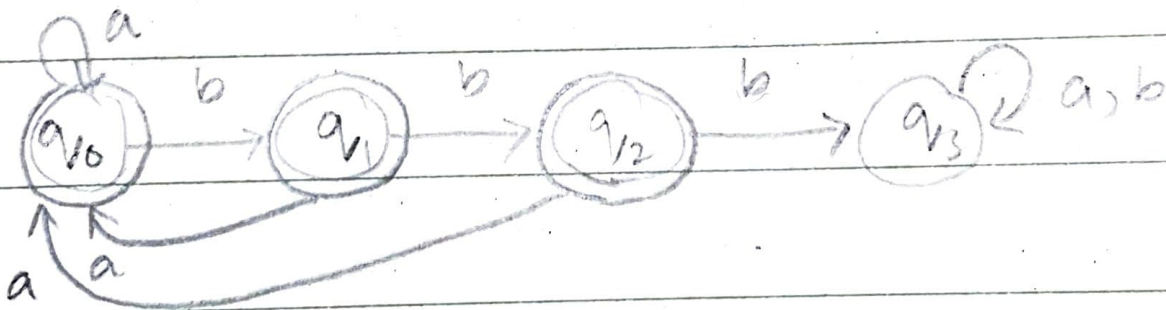
abbaa

13

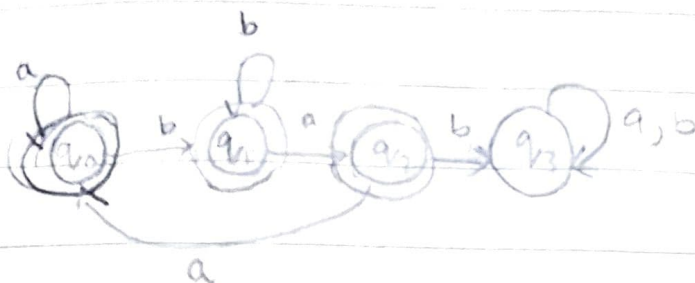
iii) $(a+b)^*(aa+bb) + (aa+bb)(a+b)^*$



iv) $(1 + b + bb)(a + ab + abb)^*$



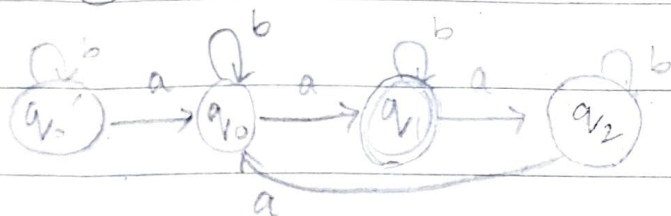
v) $(b^*a^*) + (a^*b^*)(\lambda + a^*)$



babab

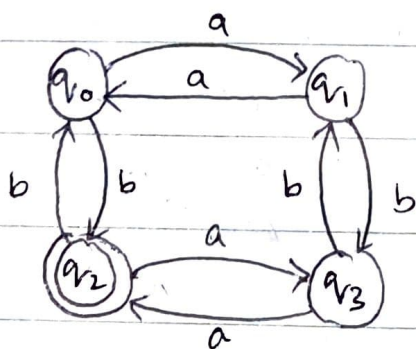
baba x

vi) $ab^*a(b^*ab^*ab^*a)$



bbbaa ✓

vii) $(aa + bb + (ab + ba)(aa + bb)^*(ba + ab))^*(b + (ab + ba)(bb + aa)^*a)$



even \rightarrow a's

odd \rightarrow b's

bbaa ✓

Section B.

Q1.

① ' (' [A-Z] '-' [0-9] [0-9+ε] [0-9+ε] ')' ' , '
 ' (' [1-9] [0-9] [A-Z] ')' ' , ' 'North Karachi'

② ' (' [1-9] [0-9] ')' ' / ' (' [1-9] [0-9] [0-9] ')' ' / '
 ' (' [1-9] [0-9] [0-9] ')' ' , ' (' 'ApT' [1-9] [0-9] [0-9] ')' ' , '
 'Askari4'

Q2.

(comp [A-Z]* + imp [A-Z]*) (20+ [A-Z]*) (virus)

Q3.

$V_{\text{cons}} = \{b, c, d, f, g, h, j, k, l, m, n, p, q, r, s, t, v, w, x, y, z\}$

$V_{\text{vow}} = \{a, e, i, o, u\}$

$$(\cancel{V_{\text{cons}} \cdot V_{\text{vow}}})^+ (\cancel{V_{\text{cons}} + \epsilon}) + (\cancel{V_{\text{vow}} \cdot V_{\text{cons}}})^+ (\cancel{V_{\text{vow}} + \epsilon})$$

$$\Rightarrow (V_{\text{con}} \cdot V_{\text{vow}})^* (V_{\text{con}} + \lambda)$$

Q4.

$$\Sigma_1 = \{A-Z\} \quad \Sigma_2 = \{a-z\} \quad \Sigma_3 = \{0-9\}$$

$$\Sigma_4 = \{!, @, \#, \$, \%, \wedge, \&, * \}$$

$$\left((\Sigma_1 + \Sigma_2 + \Sigma_3 + \Sigma_4)^+ \cdot \left((\Sigma_1 \Sigma_3 \Sigma_4) + (\Sigma_1 \Sigma_4 \Sigma_3) + (\Sigma_3 \Sigma_4 \Sigma_1) + (\Sigma_3 \Sigma_1 \Sigma_4) + (\Sigma_4 \Sigma_3 \Sigma_1) \right. \right. \\ \left. \left. + (\Sigma_4 \Sigma_3 \Sigma_3) \right)^+ \cdot (\text{ } \Sigma_1 + \Sigma_2 + \Sigma_3 + \Sigma_4)^* \right)^+$$

