Tutorial - 9

Q-1 If the regular set A is represented by $A = (01 + 1)^*$ an the regular set B is represented by $B = ((01)^*.1^*)^*$ Show how $A = B$.

Sol – let say we have $(a+b)^*$, so some of the equivalent Regular expressions are →

$$(a^* + b^*)^* = (a^* b^*)^* = (a + b^*)^* = (a^* + b)^*$$

∴ lets say here $a = 01$ and $b = 1$

∴ $(01 + 1)^* = ((01)^* + (1)^*)^* = ((01)^* (1)^*)^*$
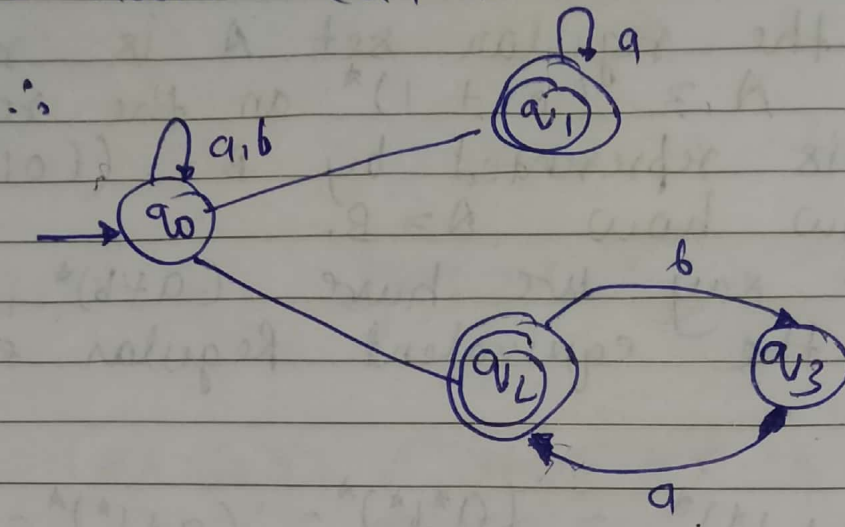
hence, $\boxed{(01 + 1)^* = ((01)^* 1^*)^*}$

Q-2 Give a regular expression that generates the language over the alphabet $\{a, b\}$ where each 'b' in the string is followed by exactly one of three a's.

$L = \{ab, aaab, ab aaa b, abab aaab, \ldots\}$

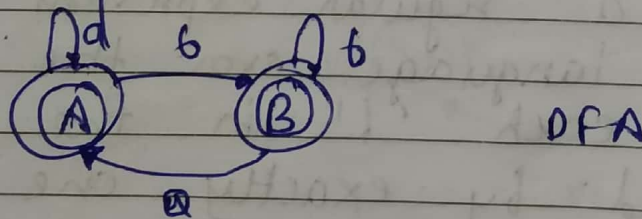$\boxed{R.E. \rightarrow (a^* b + (aaa)^* b)^*}$

Ques-3 Give a grammar that generates the same language as the regular expression

$(a+b)^* (a^* + (ba)^*)$

we have $(a+b)^*(a^*+(ba)^*)$

$\varepsilon(q_0) = \{q_0, q_1, q_2\}$

Q	a	b
$\{q_0, q_1, q_2\}$	$\{q_0, q_1, q_2\}$	$\{q_0, q_1, q_2, q_3\}$
$\{q_0, q_1, q_2, q_3\}$	$\{q_0, q_1, q_2\}$	$\{q_0, q_1, q_2, q_3\}$

DFA

$\therefore$ we have $N = \{A, B\}$ $S = A$

$$T = \{a, b\}$$

$\therefore$ our regular grammar will look like

$A \rightarrow a$ $B \rightarrow b$

$A \rightarrow b$ $B \rightarrow a$

Ques 4 Consider the regular expression $1(0+1)^*101$
Identify whether the following strings
are accepted by this regular expression
or not

(i) 1101

⇒ Yes, it will be accepted

(ii) 111101

Yes, it will be accepted

(iii) 0101010 1

No, it will not be accepted

(v) 1111 000 00010 1

Yes, it will be acc

v 000 0010 1

No, it will not be accepted

Q-5 Write the regular expression which
corresponds to this grammer:

$$S \rightarrow AB / AS$$
$$A \rightarrow a / aA$$
$$B \rightarrow b$$

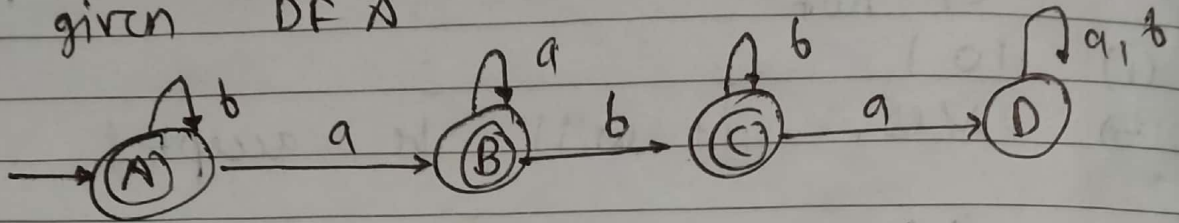$$S \rightarrow Ab / As$$
$$A \rightarrow a / aA$$

$$L = \{ ab, aab, aaab, aaaab, ---\}$$

∴ regular expression corresponding to the

given grammar is $\boxed{RE = a + b}$

Ques-6 Construct regular expression from the given DFA

$A = \varepsilon + bA$ $\Rightarrow$ $A = \varepsilon \cdot b^* = b^*$

$B = aA + aB$ $\Rightarrow$ $B = ab^* + aB = ab^*a^*$

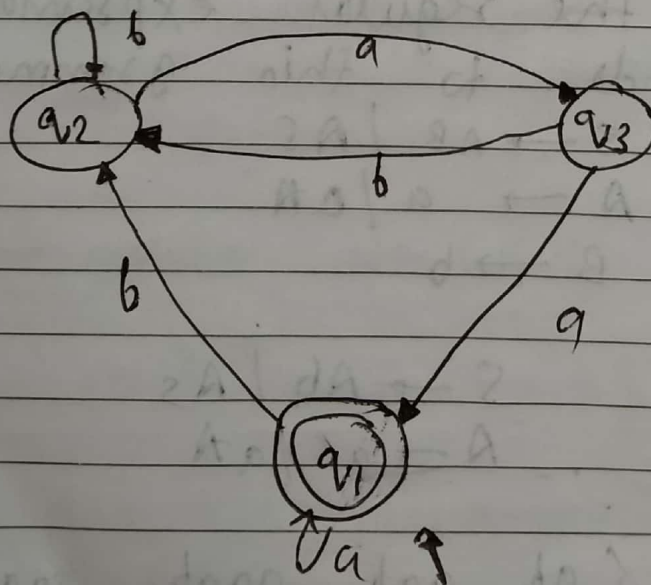$C = bB + bC$ $\Rightarrow$ $C = bab^*a^* + bC =$
$\qquad\qquad\qquad\qquad bab^*a^*b^*$

$P = aC + (a+b)D$

$RE = A \cup B \cup C$
$\quad = b^* + ab^*a^* + bab^*a^*b^*$
$\Rightarrow$ $b^*a^* + bab^*a^*b^*$

Q-7 Construct a regular expression corresponding to the automata given below

$$q_1 = \varepsilon + q_1 a + q_3 a$$
$$q_3 = q_2 a$$
$$q_2 = q_2 b + q_3 b + q_1 b$$

$$q_2 = q_2 b + q_2 ab + q_1 b$$
$$q_2 = q_1 b + q_2 (b + ab)$$

$$R = \theta + RP$$
$$R = \theta P^* \qquad (\text{Ardens theorem})$$

$$q_2 = q_1 b (b + ab)^*$$

$$q_1 = \varepsilon + q_1 a + q_2 aa$$

$$q_1 = \varepsilon + q_1 a + q_1 b (b + ab)^* aa$$

$$q_1 = \varepsilon + q_1 (a + b(a + ab)^* aa)$$
$$R = \theta + RP$$
$$R = \theta P^* \qquad [\text{Arden's theorem}]$$

$$q_1 = \varepsilon [a + b(b + ab)^* aa]^*$$

$$\boxed{R \cdot \varepsilon = [a + b(b + ab)^* aa]^*}$$