Regular Expression

* $0+1$
* $(0+1)^*$ / $(0^*1^*)^*$ * $0+1$
* 0^*1^*
* $(0+1)^*1$
* $0^*1^* + (ab)^*$

7.

10

0ab1

* Construct Regular Expressions that generates the following languages.

① $L = \{ w \in \{0,1\}^* : w \text{ contains "101" as a substring} \}$

$$(0+1)^* 101 (0+1)^*$$

② $L = \{ w \in \{0,1\}^* : w \text{ starts with "101"} \}$

$$101(0+1)^*$$

(3) $L = \{w \in \{0,1\}^* : w \text{ ends with "101"}\}$

$$(0+1)^*101$$

(4) $L = \{w \in \{0,1\}^* : w \text{ contains "00" or "11"}\}$

$$(0+1)^*00(0+1)^* + (0+1)^*11(0+1)^*$$

or,

$$(0+1)^*(00+11)(0+1)^*$$

(5) $L = \{w \in \{0,1\}^* : w \text{ contains "00" or "11"}\}$

$$(0+1)^*00(0+1)^*11(0+1)^*$$

$$+$$

$$(0+1)^*11(0+1)^*00(0+1)^*$$

(6) $L = \{w \in \{0,1\}^* : w \text{ contains at least two 1's}\}$

$$(0+1)^*1(0+1)^*1(0+1)^*$$

(7) $L = \{w \in \{0,1\}^* : w \text{ contains exactly two 1's}\}$

$$0^*10^*10^*$$

(8) $L = \{w \in \{0,1\}^* : w \text{ contains at most two 1's}\}$

$0^* + 0^*10^* + 0^*10^*10^*$

or, $0^*(\epsilon+1)0^*(\epsilon+1)0^*$

(9) $L = \{w \in \{0,1\}^* : \text{length of } w \text{ is even / multiple of } 2\}$

0, 2, 4, 6.

$((0+1)(0+1))^* \longrightarrow$

(10) $L = \{w \in \{0,1\}^* : \text{length of } w \text{ is odd}\}$

1, 3, 5, 7, 9 . . . .

$(0+1)((0+1)(0+1))^*$

$\epsilon, 2, 4 \rightarrow 1, 3, 5,$

(11) $L = \{w \in \{0,1\}^* : \text{length of } w \text{ is multiple of } 3\}$

$((0+1)(0+1)(0+1))^*$

(12) $L = \{w \in \{0,1\}^* : \text{length of } w \text{ is } \boxed{\text{not}} \text{ multiple of } 3\}$

$((0+1)(0+1)(0+1))^*(0+1)\{\epsilon + 0 + 1\}$

$= ((0+1)(0+1)(0+1))^*(0+1+00+01+10+11)$

(13) $L = \{w \in \{0,1\}^* : \text{Number of 1's in } w \text{ is multiple of } 3\}$

$0^* + (0^*10^*10^*10^*)^*$

or, $0^*(0^*1\,0^*1\,0^*1\,0^*)^*$

(14) $L = \{w \in \{0,1\}^* : w$ starts and ends with different symbol$\}$

$$0(0+1)^*1 + 1(0+1)^*0$$

(15) $L = \{w \in \{0,1\}^* : w$ starts and ends with same symbol$\}$

$$0(0+1)^*0 + 1(0+1)^*1 + 0 + 1$$

(16) $L = \{w \in \{0,1\}^* : w$ doesn't end with $01\}$

$$(0+1)^*(00+11+10) + 0 + 1 + \epsilon$$

(17) $L = \{w \in \{0,1\}^* : w$ doesn't contain $00\}$

$$(1^*(01)^*)^* + (1^*(01)^*)^*0$$

$$\Rightarrow (1^*(01)^*)^*(0+\epsilon)$$

$$(1+01)^* + (1+01)^*0$$

$$\Rightarrow (1+01)^*(\epsilon+0)$$

(18) $L = \{w \in \{0,1\}^* : w$ doesn't contain $10\}$

0^*1^*

(19) $L = \{w \in \{0,1\}^* : w \text{ doesn't contain } 01\}$

1^*0^*

(20) $L = \{w \in \{0,1\}^* : w \text{ contains } 0 \text{ in every 3rd position}\}$

√ $((0+1)(0+1)0)^*(0+1)(0+1) +$

√ $((0+1)(0+1)0)^* +$

√ $((0+1)(0+1)0)^*(0+1)$

Or,

$$((0+1)(0+1)0)^*\left((0+1)(0+1) + \epsilon + (0+1)\right)$$

$+ \epsilon$

$$\Rightarrow \left((0+1)(0+1)0\right)^* \left((0+1)(0+1+\epsilon) \right)$$

$$\Rightarrow \left((0+1)(0+1)0\right)^* (0+1+\epsilon)(0+1+\epsilon)$$