CS & IT ENGINEERING

Theory of Computation

Regular Languages

Lecture No.- 10

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Recap of Previous Lecture

Topic Regular Language Vs Regular Expression

Topics to be Covered

Topic Regular Language Vs Regular Expression

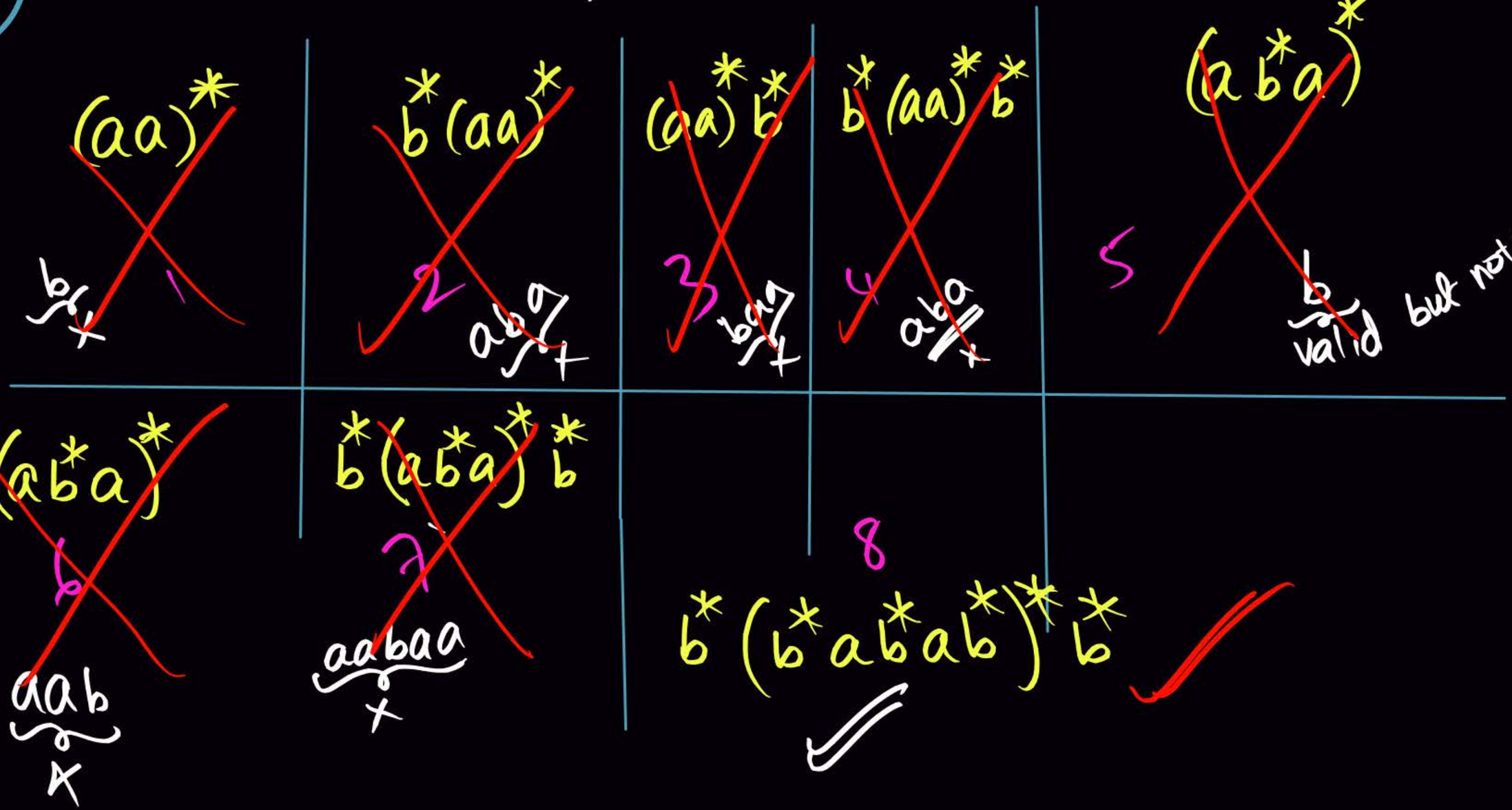
TOPIC: Home work

(39) $\{w \mid w \in \{a,b\}^*,\ n_a(w) = \text{even}\}$

(40) $\{w \mid w \in \{a,b\}^*,\ n_a(w) = \text{odd}\}$

3a

$w \in \{a,b\}^*$, $n_a(w) = \text{even}$



$$= b^* \left(b^* a b^* a b^* \right)^* b^*$$

ε ✓
b ✓
bb ✓
bbb ✓
...
} zero a's

aa ✓
baa ✓
aba ✓
aab ✓
bbaa ✓
baba ✓
aabb ✓
...
} 2 a's

4 a's ✓

ba's ✓

(39)

$= b^*(b^*ab^*ab^*)^*b^*$

$= (b^*ab^*ab^*)^*b^*$

$= b^*(b^*ab^*ab^*)^*$

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

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

$= b^*(ab^*ab^*)^*$

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

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

Important

$n_a(w) = \text{even}$

$b^*(b^*ab^*ab^*)^*b^*$

$b^*(\,)^0 b^* = b^*$

$b^*(b^*ab^*ab^*)^1 b^* = b^*ab^*ab^*$

$b^*(\text{——})^2 b^* = b^*b^*ab^*ab^*b^*ab^*ab^*b^*$

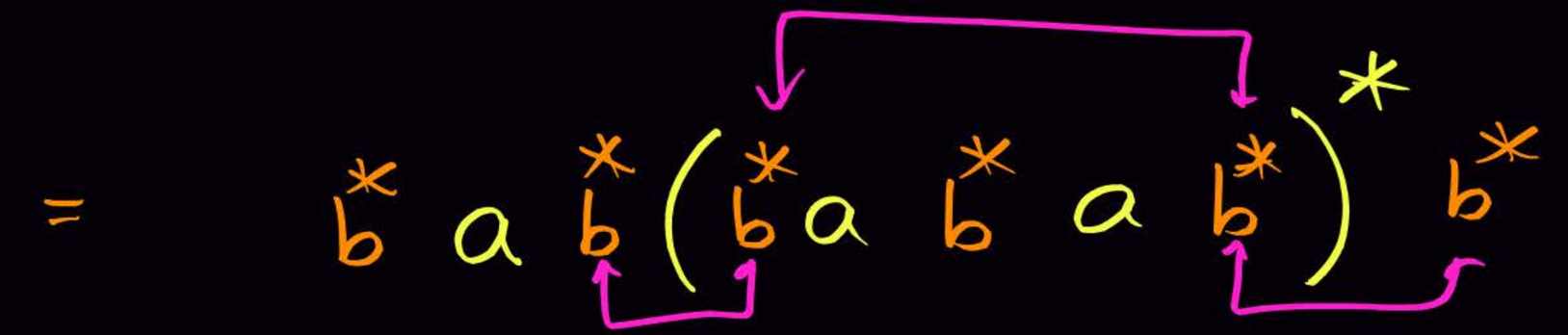
$= b^*ab^*ab^*ab^*ab^*$

$b^*.b^* = b^*$

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

$= b^*(ab^*ab^*)^*$

(40) $n_a(w) = \text{odd}, \quad w \in \{a,b\}^*$



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

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

TOPIC:

(41) $\{ w \mid w \in a^*, n_a(w) = \text{even} \}$

$$R = (aa)^*$$

(42) $\{ w \mid w \in a^*, n_a(w) = \text{odd} \}$

$$R = a(aa)^*$$

$$= (aa)^* a$$

$$n_a(w) = \text{odd}$$

$$= a, a^3, a^5, a^7, a^9, \ldots$$

$$= a(aa)^*$$

$$= (aa)^* a$$

$n_a(w) = \text{even}$

$= \{\varepsilon, aa, a^4, a^6, a^8, \ldots\}$

$= (aa)^*$

$\downarrow$

$(aa)^0 = \varepsilon$

$(aa)^1 = a^2$

$(aa)^2 = a^4$

TOPIC:

(43) $\{w \mid w \in \{a,b\}^*,\ n_a(w) \text{ is multiple of } 3\}$

$= b^*\left(b^* a b^* a b^* a b^*\right)^* b^*$

(44) $\{w \mid w \in \{a,b\}^*,\ n_a(w) = 3n+1,\ n \geq 0\}$

$= b^* a b^*\left(b^* a b^* a b^* a b^*\right)^* b^*$

$n_a(w)\%3 = 1$

$= a^1 (aaa)^*$

$= (aaa)^* a^1$

TOPIC:

$$n_a(w) \% 3 = 1$$

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

1 + 3n = 3n+1 as

$$\#_a(w) = 1 \quad (n=0)$$
$$= 4 \quad (n=1)$$
$$= 7 \quad n=2$$
$$= 10 \quad n=3$$
$$= 13 \quad n=4$$
$$\vdots$$
$$= 3n+1$$

TOPIC: Home work

(45) $\{w \mid w \in \{a,b\}^*, \; n_a(w) \% 3 = 2\}$

(46) $\{w \mid w \in \{a,b\}^*, \; n_a(w) \% 5 = 1\}$

2 mins Summary

Topic Regular Languages

Topic Regular Expressions

THANK - YOU