

# Intro to Computer Science Theory: Homework 6

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## Problem 1

Give regular expressions for the following languages:

1. The set of all strings over  $\{0, 1\}$  that begin and end with the same character.

$$(0(0 \cup 1)^*0) \cup (1(0 \cup 1)^*1) \cup 0 \cup 1$$

2. The set of all strings over  $\{a, b\}$  containing at most two occurrences of the substring “aa” (where “aaa” is considered two occurrences).

$$\left( (ab \cup b)^* aa (b \cup ba)^* b^+ aa (b \cup ba)^* \right) \cup \left( (ab \cup b)^* aaa (b \cup ba)^* \right)$$

3. The set of strings over  $\{a, b\}$  where the number of b’s is even and the number of a’s is odd.

$$(a \cup bab \cup bba \cup baaab \cup baaba \cup bbbab \cup bbbba)(bb \cup aa \cup abab \cup baba \cup abba \cup baab)^*$$

4. The set of all strings over  $\{0, 1, 2\}$  that contain each character at least once.

$$\begin{aligned} & \left( 0(0 \cup 1 \cup 2)^*1(0 \cup 1 \cup 2)^*2 \right) \cup \\ & \left( 0(0 \cup 1 \cup 2)^*2(0 \cup 1 \cup 2)^*1 \right) \cup \\ & \left( 1(0 \cup 1 \cup 2)^*0(0 \cup 1 \cup 2)^*2 \right) \cup \\ & \left( 1(0 \cup 1 \cup 2)^*2(0 \cup 1 \cup 2)^*0 \right) \cup \\ & \left( 2(0 \cup 1 \cup 2)^*0(0 \cup 1 \cup 2)^*1 \right) \cup \\ & \left( 2(0 \cup 1 \cup 2)^*1(0 \cup 1 \cup 2)^*0 \right) \end{aligned}$$

5. The set of all strings over  $\{0, 1\}$  where the number of “01” substrings equals the number of “10” substrings.

*No idea*

## Problem 2

For each regular expression, list all the strings of length three in the language described by the expression.

1.  $b^*(abb^*)^*a^*$

*abb, bbb, bba, baa, aaa*

2.  $b^*(ab)^*a^*$

*bab, aba, bbb, bba, baa, aaa*

3.  $0^*(1 \cup 01)^*1^*$

*000, 001, 011, 111, 101*

4.  $(b^* \cup a^*)(b^* \cup a^*)(b^* \cup a^*)$

*aaa, aab, aba, abb, baa, bab, bba, bbb*

5.  $0^*1(0^*10^*1)^*0^*$

*001, 010, 011, 100, 101, 110*

If you have any questions, comments, or concerns, please contact me at [alvin@omgimanerd.tech](mailto:alvin@omgimanerd.tech)