

CS 580 Homework 3

Due: September 13th 4:10 PM, 2023

Determine the regularity of each of the first eight languages by drawing a DFA or applying the pumping lemma.

1. $\{a^i \mid i \text{ is congruent to } 2 \pmod{5}\}$.
2. $\{x \mid x \text{ has an equal number of } ab \text{ and } ba \text{ substrings}\}$.
3. $\{a^i b^j \mid 0 \leq i < 3 < j\}$.
4. $\{a^i b^j \mid i, j > 0, \text{ and either } i \text{ or } j \text{ is odd, but not both}\}$.
5. $\{xx \mid x \in (a + b)^*\}$.
6. $\{xwx^R \mid x \in (a + b)^*, w \in (a + b), x^R \text{ is the reverse of } x\}$.
7. $\{xwx^R \mid x, w \in (a + b)^*, x^R \text{ is the reverse of } x\}$.
8. $\{a^i \mid i \text{ is prime}\}$.

Decide the correctness of each of the next two statements by proving the statement or providing a counterexample.

9. If $L1 \cup L2$ is regular and $L2$ is regular, then $L1$ is regular.
10. If all proper subsets of L are regular, then L is regular.