**Exercise 1.** Consider the following language:

$$COMPOSITE_n = \{n \mid n = ab \texttt{ for some integers } a, b \text{ such that } a, b \neq n \text{ and } a, b \neq 1\}$$

What is the smallest class that contains this language (finite, regular, context-free, decidable, recognizable, or unrecognizable)? Prove it.

**Solution:** Your solution here

**Exercise 2.** Consider the following language:

$$\begin{aligned} COMPOSITE_{TM} \;=\; \{\langle M, w\rangle \mid\; & M \texttt{ is a TM and } M \texttt{ halts on } w \texttt{ in} \\ & n = ab \texttt{ steps for some integers } a, b \\ & \text{such that } a, b \neq n \text{ and } a, b \neq 1\} \end{aligned}$$

What is the smallest class that contains this language (finite, regular, context-free, decidable, recognizable, or unrecognizable)? Prove it.

**Solution:** Your solution here

**Exercise 3.** Consider the following language:

$$COMPOSITE_{RE} = \{n \mid n = ab \texttt{ for some regular expressions } a, b\}$$

Note: Yes, a and b are REs and n is ab. This means: "How do we know if n is a regular expression (a) followed by another one (b)?"

What is the smallest class that contains this language (finite, regular, context-free, decidable, recognizable, or unrecognizable)? Prove it.

**Solution:** Your solution here

**Exercise 4.** Describe the primary differences between a Turing reduction ($\leq_T$) and a Mapping reduction ($\leq_m$).

**Solution:** Your solution here

# References

[1] Sipser, Michael. *Introduction to the Theory of Computation.* Course Technology, 2005. ISBN: 9780534950972

[2] Critchlow, Carol and Eck, David *Foundation of computation.*, Critchlow Carol, 2011