

CS46 lab 1

This homework is due at 11:59pm on Sunday, January 23. Write your solution using L^AT_EX. Submit this homework using **github**. This is a **10 point** homework.

This is an individual homework. It's ok to discuss approaches at a high level. In fact, I encourage you to discuss general strategies. However, you should not reveal specific details of a solution, nor should you show your written solution to anyone else. Your write-up is your own. If you use any out-of-class references (anything except class notes, the textbook, or asking Lila), then you **must** cite these in your post-homework survey. Please refer to the course webpage or ask me any questions you have about this policy.

The main **learning goal** of this homework is to cement your understanding of mathematical concepts that we will be using throughout the semester.

1. Give the cardinality of the following sets:

- (a) $\{a\}$
- (b) $\{\ominus, \emptyset\}$
- (c) $\{a, b, c, \{b, \emptyset, \ominus\}\}$
- (d) \emptyset
- (e) $\{\{\emptyset\}, \{a, \emptyset, \ominus\}\}$

2. Set operations.

- (a) If A is a set of size k , how many elements are in the powerset of A ? Explain your answer.
- (b) How many bit strings of length n are there? Explain your answer.
- (c) Let $A = \{a, b, c\}$ and $B = \{\bullet, \otimes, \oplus, a\}$. What are the sets $A \cap B$, $A \cup B$, and $A \times B$? Formally describe them by listing their elements.
- (d) List the elements of the powerset of $A = \{\ominus, \emptyset, \oplus\}$.
- (e) Let $\Sigma = \{a, b\}$. List all strings over Σ of length 3 in short lexicographic order.

3. For each of these requirements, describe a relation (either formally or in English sentences) which is:

- (a) symmetric but not transitive.
- (b) transitive and reflexive but not symmetric.
- (c) reflexive, symmetric, and transitive.

You can pick the domain of each relation, but make sure to specify it in your write-up.