
None of the problems on this assignment are graded. Instead, after completing it, please fill out the associated Google form. That form is the only graded component.

Cryptography

The cryptography section is placed before the background here because it asks you to explicitly work together.

Exercise 1. *With your newfound abilities in modular arithmetic and the Caesar cipher, encrypt a message of your choice (be civil). Give your message, along with your shift key to a classmate who has not yet been given a message.*

Exercise 2. *Once you have received a message and key decrypt it.*

Math Background

Exercise 3. *Let $A = \{0, 1, 2, 3\}$, $B = \{5, 7, 9, 11\}$, and suppose $f : A \to B$. Write at least one such a function f. Make sure that every element of A is mapped to an element of B, and try to write it with fundamental operations like addition, subtraction, multiplication, division, etc ...*

Exercise 4. *Let $A = \{0, 1, 2, 3\}$, $B = \{5, 7, 9, 11\}$, and suppose $g : B \to A$. Write at least one such a function g. Make sure that every element of B is mapped to an element of A, and try to write it with fundamental operations like addition, subtraction, multiplication, division, etc ...*

Exercise 5. *Consider the following congruence: $x+3 \equiv 5 (mod 26)$. Try and find one solution (value for x). If you can, try and find a formula for all solutions.*

Bonus

Exercise 6. *Both the natural numbers ($\mathbb{N}$) and the integers ($\mathbb{Z}$) are sets of infinite size, but the natural numbers are a subset of the integers. Are the sets the same size? Try to justify why.*

hint: In order to say whether two infinite sets are the same size, you need a suitable definition of size. If you aren't sure, start by looking up what makes two sets the same size.