

# Lab 06 - Ones and Twos Complement

In this lab, you've learned about how computers store and process numbers, specifically negative numbers. In addition, you have learned how to implement a full signed integer system with the Two's Complement number representation.

## Rubric

Item	Description	Value
Summary Answers	Your writings about what you learned in this lab.	25%
Question 1	Your answers to the question	25%
Question 2	Your answers to the question	25%
Question 3	Your answers to the question	25%

## Lab Summary

Summarize your learnings from the lab here.

We learned how to code a half subtractor, then used the full adder to implement the one's complement and the two's complement. We figured out the difference between the adder and the subtractor.

## Lab Questions

1 - Explain the differences between our Half Adder from last lab and the Half Subtractor from this lab.

The half adder and the Half subtractors main difference is the adder has a carry and the subtractor as a borrow. The carry = A AND B but the borrow = NOT A AND B.

2 - What about the end around carry of One's Complement makes it hard to use and implement?

It requires additional logic for the carry and if calculated wrong is can lean to cascading errors in the carry in various additions.

### 3 - What is the edge case and problem with Two's Complement number representation?

The edge case is the most negative number. It is represented by  $-2^{(n-1)}$  to  $2^{(n-1)}-1$  and the most negative number, which is  $-2^{(n-1)}$ , does not have a positive counterpart creating an asymmetric range. The problem is the overflow and the sign extraction. The overflow happens when adding two numbers when they are both positive or both negative. The sign extraction requires replicating the most significant bit into the new order of bits.

## Code Submission

Upload a .zip of all your code or a public repository on GitHub.