

ENR145 Assignment #1

Due: 1/23/25 9:00 pm

1) Be familiar with the binary number system

1.1) Practice, until you can write out the binary numbers and its decimal equivalents without the help of this look-up table:

| 4-Bit Binary Numbers | Decimal Equivalents |
|----------------------------|------------------------|
| 0000 | 0 |
| 0001 | 1 |
| 0010 | 2 |
| 0011 | 3 |
| 0100 | 4 |
| 0101 | 5 |
| 0110 | 6 |
| 0111 | 7 |
| 1000 | 8 |
| 1001 | 9 |
| 1010 | 10 |

1.2) Practice addition, subtraction, and multiplication of two binary numbers:

Try out AI tutoring for this task, use Gemini (or any AI of your choice), and prompt the following message:

help me practice addition, subtraction, and multiplication of two binary numbers

What you will get (I hope) will be something like that:



Binary math is a fantastic way to understand how computers actually "think." It follows the same logic as the decimal system we use every day, but with only two digits: 0 and 1.

Here is a quick guide on the rules for each operation, followed by some practice problems we can do together.

Summary of rules skipped.

Practice Problems

Let's try one of each. Grab a piece of paper and see if you can solve these. I've included the decimal equivalents in parentheses so you can check your work!

| Operation | Problem (Binary) | Decimal Equivalent |
|----------------|------------------|--------------------|
| Addition | $1011 + 1101$ | $11 + 13$ |
| Subtraction | $1110 - 0101$ | $14 - 5$ |
| Multiplication | 101×11 | 5×3 |

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Would you like to try solving these first, or would you like me to walk you through the step-by-step solution for the addition problem?

The AI will guide you through as you wish. Once you are comfortable with the binary math. To finish the task, prompt it to give a list of 10 addition, subtraction, and multiply to practice.

Here's what I got:

That's a great way to build muscle memory! I've organized these into a mix of easy and challenging problems.

Grab a pencil and paper—it's usually easier to track your "carries" and "borrows" when you write them out vertically.

Binary Practice Set

| # | Addition | Subtraction | Multiplication |
|----|------------------|------------------|-------------------|
| 1 | $101 + 10$ | $110 - 01$ | 10×11 |
| 2 | $111 + 111$ | $101 - 11$ | 11×11 |
| 3 | $1010 + 0101$ | $1111 - 1010$ | 101×10 |
| 4 | $1101 + 1011$ | $1000 - 0001$ | 110×11 |
| 5 | $1111 + 0001$ | $1010 - 0110$ | 100×101 |
| 6 | $1001 + 1001$ | $1100 - 1001$ | 111×101 |
| 7 | $11011 + 101$ | $10111 - 111$ | 1011×11 |
| 8 | $10101 + 1111$ | $11001 - 1111$ | 1010×101 |
| 9 | $11111 + 11111$ | $10000 - 01011$ | 1101×11 |
| 10 | $101010 + 10101$ | $111000 - 10101$ | 111×111 |

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And AI can even check the answer for you.

As a proof of efforts, please take screen shorts of the practice set you got, and the answer check generated by AI after you submitted your work. Please submit the screenshots in a slides format.

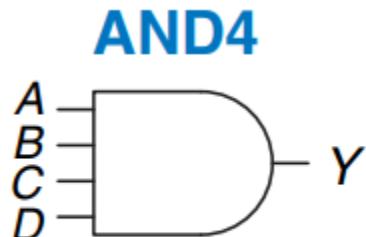
- 1.3) Work out this problem on your own (no AI, but you can use python to do the base conversion). Write down/type out/screen shot the whole process:

The solutions to the quadratic equation $x^2 - 11x + 22 = 0$ are $x = 3$ and $x = 6$. What is the base of the numbers?

2) Logic gates:

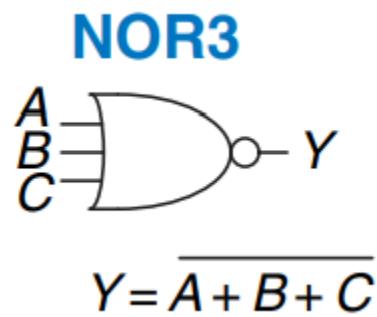
Get familiar with the AND, OR, NOT and XOR gate. The symbol, the truth table, and find out the truth table given a logic gate combo:

2.1) What will be the truth table of this four-input AND gate?



$$Y = ABCD$$

2.2) What will be the truth table of this three-input NOR gate?



$$Y = \overline{A + B + C}$$

Work out this problem on your own (no AI, no google), submit the clearly labeled truth table in slides.