Number System Conversions and Boolean Algebra

CS230 Tutorial 01
Converting TO Decimal

The index of position of a digit represents the power of the base it must be multiplied by during conversion.

REMEMBER: indices start at 0.

Exercise 1: Convert the following to decimal.

a. 10110110 (base 2, binary)
b. 34106 (base 7)
c. 1D4FA (base 16, hexadecimal)
Converting FROM Decimal

Repeated long division by the base. That is all.

REMEMBER: the difference between quotient and remainder.

Exercise 2: Convert 4128 from decimal, to…

a. Base 2 (binary)
b. Base 4
c. Base 16 (hexadecimal)
Converting from binary to hex

Here consider the binary numbers in sets of 4: each 4 digits represents one hex digit.

Exercise 3: Convert the following from binary to hexadecimal.

a. 1011
b. 110010011010
c. 100111101
Converting from hex to binary

This is the logical opposite of converting from binary to hex: each hex digit represents 4 binary digits.

Exercise 4: Convert the following from hexadecimal to binary.

a. 0x1A4
b. 0x58C7
c. 0xFD09
Truth Tables

Remember the order of Boolean operations is:
1. NOT (think negation)
2. AND (think multiplication)
3. OR (think addition)

Exercise 5: Create a truth table for the following Boolean expression.

\[ \neg A \land \neg B \lor B \land (A \lor C) \]
Distributive Law

The distributive law for AND is as follows:

\[ A \land (B \lor C) = (A \land B) \lor (A \land C) \]

Exercise 6: Prove or disprove that the distributive law works equivalently for OR (hint: use a truth table).
Simple Application of Boolean Algebra

Exercise 7: Using the basic Boolean algebra skills learned so far (distributive laws, etc.), show that the following expressions are equal:

a. \((\neg A \lor \neg B) \land (A \lor B) = (A \land \neg B) \lor (\neg A \land B)\)
b. \((C \land A) \lor (C \land \neg A \land B) = C \land (A \lor B)\)

Things to note:
1. When it says “use Boolean algebra”, don’t use a truth table
2. Show every step of your proof (this is extra important on assignments: we can’t give part marks if you don’t show your work)