

Reading 1

1.1 Why Study digital design?

- An embedded system is a computing system embedded within another device such as an automobile.

1.2 Boolean Algebra and Equations

- Mostly review from Discrete Math Boolean lecture and logic
- A Boolean equation has a boolean variable (left side), an equal sign, and a Boolean expression (right side).
- Digital designer shorthand notation for Boolean operators.

Operation	Shorthand	Notes
a AND b	ab	Intentionally looks like multiplication. Known as <u>abutment</u> .
a OR b	a+b	Intentionally looks like addition
NOT a	a'	a' is also called the <u>complement</u> of a.

- Digital circuits are sometimes called logic circuits because of the roots in Boolean algebra's logic operations of AND, OR, and NOT.
- In Boolean algebra, a function is a relation of an inputs values to an outputs values.

2.1 General Number bases

• Popular Bases:

- 2 : Binary
- 8 : Octal
- 16 : Hexadecimal
- 10 : Decimal

* Each digit in a base B is weighted by a power of B , as below. Each digit can be 0 to $B-1$.

$$\begin{array}{cccc} \overline{\quad} & \overline{\quad} & \overline{\quad} & \overline{\quad} \\ B^3 & B^2 & B^1 & B^0 \end{array} \qquad \begin{array}{cccc} \overline{\quad} & \overline{\quad} & \overline{\quad} & \overline{\quad} \\ V & W & Y & Z \\ B^3 & B^2 & B^1 & B^0 \end{array}$$

$$(V \times B^3) + (W \times B^2) + (Y \times B^1) + (Z \times B^0)$$

• Decimal to any base algorithm:

1. Divide decimal by base
2. put remainder in the rightmost digit
3. This process repeats with the quotient and the next digit, until quotient is 0.

Ex Convert 73_{10} to base -5:

1. $73/5 = 14$ rem 3 ← rightmost digit
2. $14/5 = 2$ rem 4 ← directly to the left of 3
3. $2/5 = 0$ rem 2 ← directly to the left of 4
4. Stop because quotient = 0 is step 3

So 73_{10} is 243_5

• To go from base B to C , first convert the base B number to decimal and then convert the decimal number to base C .

