# Assignment 2

COSC 2334.001

1. – What is the definition of position number systems? Describe the formula **D**.

**Relative to the ones place you need to multiply the number in its position by the base of the number system by its place. For example in 300 for decimal for the 3 you would put down 3*10^2 witch would equal 300 because the tens and ones place are worth nothing.**

What are the corresponding binary, octal, and hexadecimal numbers of **$61453_{10}$** ?

**1111 0000 0000 1101 | 170 075 | F00D**

What are the corresponding octal, binary, and decimal numbers of **$EABC_{16}$**?

**165 274 | 1110 1010 1011 1100 | 60092**

2. Each of the following arithmetic operations is correct in at least one number system. Determine possible radices of the numbers in each operation.
   - $1234 + 5432 = 6666$ **Decimal, Octal, Hexadecimal**
   - $41/3 = 13$ **Octal**
   - $33/3 = 11$ **Decimal, Octal, Hexadecimal**

3. – What is the negative number representation in signed-magnitude and two's complement systems?

**Signed magnitude.**

**(1111 1101)2 = (x^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^0)2 = -125**

**Two's complements**

**(1111 1101)2 = (1000 0010)2 + 1 = -3**

If a system only deals with 8 bits, does -128 exist in signed-magnitude or two's complement system? Why and why not?

**-128 exists in a two's complement system because there is no negative zero, so you must add one extra value in order to get rid of this. Meaning there IS -128 in an 8bit system.**

– Write the 8-bit signed-magnitude and two's complement representations for each of these decimal numbers:

• +18, +115, -49, -3, -100

| Signed-magnitude | Two's Complement |
|---|---|
| **18 = 0001 0010** | **= 0000 0010** |
| **115 = 0111 0011** | **= 0111 0011** |
| **-49 = 1011 0001** | **= 0100 1111** |
| **-3 = 1000 0011** | **=0111 1101** |
| **-100 = 1110 0100** | **= 0001 1100** |

4. – State overflow for addition and subtraction rules for unsigned, signed-magnitude, and two's complement systems.

– Indicate whether or not overflow occurs when adding the following 8-bit two's complement numbers:

• 1101 0100 + 1010 1011= **01 0111 1111 = 127 (OVERFLOW)**

• 10111001 + 11010110 = **01 1000 1111 = -113 (OVERFLOW)**

• 01011101 + 00100001 = **0111 1110 = 126 (NOT overflow)**

• 00100110 + 01011010 = **1000 0000 = -128 (OVERFLOW)**

5. – How many digital logic values there are? describing them.

**There are two, high and low. High represents 1 and low represents 0. These values differentiate depending on voltage.**

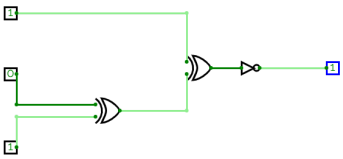
– Describe combinational circuits and sequential circuits. What is the difference between them? – What are the seven basic logic gates?

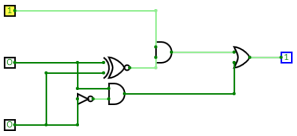
**A combinational circuit is made of many different logic gates to produce a unique output. A sequential circuit is a lot like a combinational circuit except it continuously loops back to itself.**

– Construct a combinational circuit based on the functions

$$F_1 = ((X \oplus Y) \oplus Z)'$$

$$F_2 = (X' \cdot Y) + ((X \oplus Y)' \cdot Z)$$





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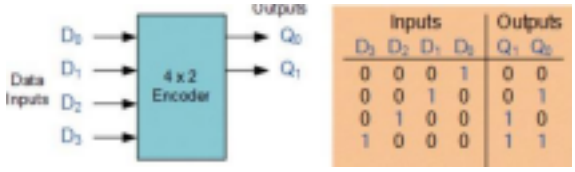
6. Design a 4-2 priority encoder based on the following truth table by AND, OR, and NOT gates.




| Inputs | | | | Outputs | |
|---|---|---|---|---|---|
| $D_3$ | $D_2$ | $D_1$ | $D_0$ | $Q_1$ | $Q_0$ |
| 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 |

**Fig. 1.** The logic and block of 4:2
Encoder

Q1 = d1 OR d3

Q2 = d2 OR d3