

# HKN ECE 120 Midterm 1 Worksheet

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## Binary Representations

### Problem 1

Write these conversions in decimal. Truncate if necessary.

- Convert  $100101_2$  to a 6-bit unsigned integer.
- Convert  $100101_2$  to a 6-bit signed magnitude integer.
- Convert  $100101_2$  to a 6-bit 2's complement integer.
- Convert  $011101110_2$  to a 9-bit unsigned integer.
- Convert  $011101110_2$  to a 9-bit 2's complement integer.
- Convert  $100100101101_2$  to a 11-bit unsigned integer.
- Convert  $100100101101_2$  to a 9-bit 2's complement integer.
- Convert  $001011101_2$  to a 12-bit unsigned integer.
- Convert  $10111_2$  to a 16-bit signed integer.

### Problem 2

Write these conversions in binary. Truncate if necessary.

- Convert  $51_{10}$  to a 8-bit unsigned integer.
- Convert  $51_{10}$  to a 8-bit signed magnitude integer.
- Convert  $51_{10}$  to a 8-bit 2's complement integer.
- Convert  $-240_{10}$  to a 9-bit signed magnitude integer.
- Convert  $-240_{10}$  to a 9-bit 2's complement integer.
- Convert  $1171_{10}$  to a 11-bit unsigned integer.
- Convert  $1171_{10}$  to a 11-bit 2's complement integer.
- Convert  $65_{10}$  to a 12-bit unsigned integer.
- Convert  $-23309_{10}$  to a 16-bit 2's complement integer.

## Other Representations

### Problem 1

Convert these binary values to hexadecimal.

- a. 0010101101010110
- b. 1001010010001111
- c. 0011110000010010
- d. 1011111011101111
- e. 1111000000001101

### Problem 2

Convert these hexadecimal values to binary.

- a. x37A5
- b. x2009
- c. x1F06
- d. x2FFE
- e. xDEADBEEF

### Problem 3

Convert these hexadecimal values to ASCII.

- a. x4A
- b. x2F
- c. x0D
- d. x4045
- e. x6E6F

### Problem 4

Convert these ASCII characters to binary.

- a. 'i'
- b. ''
- c. 'M'
- d. '!'
- e. "bob"

## Problem 5

True or False?

- a. An integer with 11 hexadecimal values is at most a 88-bit integer.
- b. The shortest hexadecimal string that we can encode any 69-bit unsigned integer into is 18 characters long.
- c. All uppercase letters in ASCII start with the binary string 0100.
- d. All lowercase letters in ASCII start with the binary string 011.
- e. There is an ASCII character that directly corresponds to x8A.
- f. ASCII characters are usually stored as signed 8-bit integers.
- g. The control characters in ASCII were originally used as special codes for teletypes, keyboards used for electrical telegraphs.

## Binary Operations

### Problem 1

Perform the following operations.

- a.  $1_2$  AND  $0_2$
- b.  $1_2$  OR  $0_2$
- c.  $10010010_2$  AND  $01111011_2$
- d.  $001010_2$  OR  $111101_2$
- e.  $x8618$  AND  $x7507$
- f.  $1_2$  XOR  $1_2$
- g.  $xCA09$  XOR  $x0990$
- h. NOT  $1001110100110101_2$
- i.  $1001001101_2$  NAND  $0110101110_2$
- j.  $100011_2$  NOR  $001000_2$
- k.  $x908$  XNOR  $xA51$

### Problem 2

Perform the following operations on unsigned integers. Assume the number of bits given. Indicate when there is an overflow for operations that have it.

- a.  $100100_2 + 010101_2$
- b.  $011101_2 + 111011_2$
- c.  $1111000_2 \ll 2$
- d.  $1111000_2 \gg 2$
- e.  $000100_2 \gg 2$

### Problem 3

Perform the following operations on signed integers. Assume the number of bits given. Indicate when there is an overflow for operations that have it.

- a.  $110010_2 + 110001_2$
- b.  $11011010_2 + 011010110_2$
- c.  $1001_2 - 1010_2$

d.  $011101_2 - 111011_2$

e.  $1111000_2 \ll 2$

f.  $1111000_2 \gg 2$

g.  $000100_2 \gg 2$

## IEEE 754 Floating Point

### Problem 1

Convert the following decimal representations to IEEE-754 floating point.

- a. 3.625
- b. -18.5
- c. 42.3125

### Problem 2

Convert the following IEEE-754 floating point representations to decimal.

- a. 0 10000001 1110010000000000000000
- b. 0 10000011 0000100000000000000000
- c. 1 10000011 1001010000000000000000

## C Basics

### Problem 1

Declare the following variables:

- a. The signed integer -10 named  $x$ .
- b. The character 'p' named  $P$ .
- c. The decimal 0.536 as a float named  $y$ .
- d. The unsigned integer 235 named  $ux$ .
- e. The decimal 0.46668 as a double named  $dy$ .

### Problem 2

Evaluate the following expressions in C. Assume that the variable  $a$  has been declared as 0xECEB and  $b$  has been declared as 0x2345.

- a.  $a \& b$
- b.  $a \wedge b$
- c.  $\sim a$
- d.  $a | b$

## C Programming

### Problem 1

Write code in C for the following tasks. Assume that age is already initialized to 0 and is of type int.

- a. Print a prompt message asking the user to input their age.
- b. Store the input in the variable age.
- c. Print twice of the age you received as an input to the console.

### Problem 2

Consider the following C code.

```
int main() {
    for (int i = 0; i < 10; i++) {
        printf("%d\n", i);

        if (i == 10) {
            printf("Now i is 10.");
        }
    }
    return 0;
}
```

- a. How many times does the program print to the console?
- b. What is the output of this program?

### Problem 3

What does the following C code print?

```
int main() {
    int x = 10;
    if (x = 5) {
        printf("x is 5.");
    } else {
        printf("x is not 5.");
    }
    return 0;
}
```

### Problem 4

What does the following C code print?

```
int main() {  
    int i = 90;  
    while (i >= 3) {  
        printf("%d ", i);  
        i = i/3;  
    }  
    return 0;  
}
```