HKN ECE 120 Midterm 1 Worksheet

Binary Representations

Problem 1

Write these conversions in decimal. Truncate if necessary.

a. Convert 100101_2 to a 6-bit unsigned integer.

b. Convert 100101_2 to a 6-bit signed magnitude integer.

c. Convert 100101_2 to a 6-bit 2's complement integer.

d. Convert 011101110_2 to a 9-bit unsigned integer.

e. Convert 011101110_2 to a 9-bit 2's complement integer.

f. Convert 100100101101_2 to a 11-bit unsigned integer.

g. Convert 100100101101_2 to a 9-bit 2's complement integer.

h. Convert 00101101_2 to a 12-bit unsigned integer.

i. Convert 10111_2 to a 16-bit signed integer.

Problem 2

Write these conversions in binary. Truncate if necessary.

a. Convert 51_{10} to a 8-bit unsigned integer.

b. Convert 51_{10} to a 8-bit signed magnitude integer.

c. Convert 51_{10} to a 8-bit 2's complement integer.

d. Convert -240_{10} to a 9-bit signed magnitude integer.

e. Convert -240_{10} to a 9-bit 2's complement integer.

f. Convert 1171_{10} to a 11-bit unsigned integer.

g. Convert 1171_{10} to a 11-bit 2's complement integer.

h. Convert 65_{10} to a 12-bit unsigned integer.

i. 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 11100100000000000000000

b. 0 10000011 00001000000000000000000

c. 1 10000011 10010100000000000000000

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 ^ 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;
}
```