

CSE2312 (Fall 2022)

Homework #1

Notes:

All numbers are in base-10 unless otherwise noted.

If part of a problem is not solvable, explain why in the answer area.

The 0x number prefix indicates the number is base-16 as in the C language.

The target date to complete this homework set is August 30, 2022.

This homework set will not be graded, but please solve all of the problems to prepare for the quizzes and exams.

1. Convert the following numbers between bases:

a. $10111011 \text{ (base-2)} = \underline{\hspace{2cm}} \text{ (base-10)}$

b. $10111011 \text{ (base-2)} = \underline{\hspace{2cm}} \text{ (base-16)}$

c. $0x5249 = 5249 \text{ (base-16)} = \underline{\hspace{3cm}} \text{ (base-2)}$

d. $0x5249 = 5249 \text{ (base-16)} = \underline{\hspace{2cm}} \text{ (base-10)}$

e. $16383 = \underline{\hspace{3cm}} \text{ (base-2)}$

f. $4095 = \underline{\hspace{2cm}} \text{ (base-16)}$

2. What is the range of the following C99 variable types assuming the processor uses two's complement arithmetic for signed number representation?

a. uint8_t _____ to _____

b. uint16_t _____ to _____

c. uint32_t _____ to _____

d. int8_t _____ to _____

e. int16_t _____ to _____

f. int32_t _____ to _____

3. Write the binary representation of the C99 variables given below.

Example: for `uint8_t x = 13`, the answer would be answer is: 0000 1101 (base-2)

a. `uint8_t x = 27;`

b. `uint8_t x = 122;`

c. `uint8_t x = 215;`

d. `uint8_t x = 40;`

e. `int8_t x = -40;`

f. `int8_t x = -103;`

g. `int8_t x = 103;`

h. `uint16_t x = 13000;`

i. `int16_t x = 13000;`

j. `int16_t x = -13000;`

k. `uint32_t x = 262144;`

l. `int32_t x = -50;`

m. `int32_t x = 50;`

4. Write the status of the Carry (C), Zero (Z), Negative/Sign (N), and Overflow (V) flags after an 8-bit ALU performs an ADD operation on the following 8-bit arguments (a and b):

Hint: Remember that the ALU just sees bits and does not know if the numbers represent signed or unsigned numbers.

a. `uint8_t a = 91, uint8_t b = 23`

b. `uint8_t a = 102, uint8_t b = 3`

c. `int8_t a = 32, int8_t b = -22`

d. `int8_t a = -32, int8_t b = 22`

e. `int8_t a = 100, int8_t b = -100`

f. `int8_t a = -130, int8_t b = 100`

g. `int8_t a = -32, int8_t b = 72`

5. Assuming an 8-bit ALU, show the status of the Zero (Z) and Negative/Sign (N) flags and the result after each operation. Note the bases carefully.

a. $\text{arg1} = 33$, $\text{arg2} = 2$; $\text{result} = \text{arg1 OR arg2}$

b. $\text{arg1} = 0x23$, $\text{arg2} = 0x14$; $\text{result} = \text{arg1 OR arg2}$

c. $\text{arg1} = 0x2C$, $\text{arg2} = 0x78$; $\text{result} = \text{arg1 AND arg2}$

d. $\text{arg1} = 0xA5$; $\text{result} = \text{NOT arg1}$

e. $\text{arg1} = 29$; $\text{result} = \text{NEG arg1}$