

CPE 323: Introduction to Embedded Computer Systems

Homework I

1 (13)	2 (20)	3 (15)	4 (10)	Total (58)

Problem #1 (13 points)

(a) (5 points)

Fill in the following table specifying the ranges of the following data types.

Type	Minimum	Maximum
8-bit unsigned integers		
16-bit unsigned integers		
8-bit signed integers (2's complement)		
16-bit signed integers (2's complement)		
12-bit signed integers (2's complement)		

(b) (8 points)

Fill in the following table. For integers find their binary, octal, and hexadecimal representation in a 16-bit computer using 2's complement.

Number (decimal)	Binary	Hex	Octal
12,212			
-3,460			

Problem #2 (20 points)

Consider the following arithmetic operations. Find the results and set the flags C, V, N, and Z accordingly. Show your work step-by-step: that means convert the input operands to binary, find the results of arithmetic operations in binary, find the flags, and convert the result back to decimal representation.

(a) 8-bit, two's complement

$$20_{10} + 100_{10}$$

(b) 8-bit, two's complement (hint: implement subtraction through addition and set flags accordingly)

$$(-25)_{10} - 69_{10}$$

Problem #3 (15 points)

(a) (10 points) Convert the following number from decimal to the IEEE 32-bit floating point. Show your work.

-7.275_{10}

(b) (5 points) Could you convert the decimal number 1048576.125 into a single precision float without using any significant bits of the mantissa? Explain your answer.

Solutions:

Problem #4 (10 points)

A string variable is initialized to "Welcome to CPE 323, Fall 2020!". The first character in the string is upper case letter 'W'. Assume the string is terminated by a NULL ASCII character (0x00). How many bytes does this string take in memory (include the terminating NULL character)? Using the ASCII table, fill in the following table by entering hexadecimal values of the characters in the string. How many bytes are needed to store this string in memory?

String	HEX value
Welcome to CPE 323, Fall 2020!	