Homework #1 Problems

Quiz in Recitations on Monday, September 21 & Wednesday, September 23

Problem 1: Convert the following decimal numbers to binary, octal, and hexadecimal.

(a) 1984 (b) 4000 (c) 8192

Problem 2: Which of the following are valid

(a) hexadecimal numbers?

(b) base 13 numbers?

BED, CAB, DEAD, DECADE, ACCEDED, BAG, DAD

Problem 3: Express the decimal number 100 in all radices from 2 to 9 .

Problem 4: Convert the following numbers. Show all steps.

(a) A3F in hex to a number in base 4.

(b) -27 in decimal to 8-bit binary number in 1's complement form.

(c) 22.2 in base 3 to a decimal number. (You must have at least two digits after decimal point.)

(d) E4.A9 in hex to a number in base 8.

Problem 5: Let numbers be six (6) bits wide including the sign. Negative numbers are stored in 2's complement form. What is the range for negative numbers that can be stored?

Problem 6: Assume that negative numbers are stored in 2's complement form. Perform the three operations, (A - B), (B - A), and (A + B) for the given values of A and B. Obtain the results, and state if we have an overflow/underflow.

(a) Let A = 100011 and B = 001100.

(b) Let A = 110001 and B = 100111.

Problem 7: Consider two decimal numbers A and B, where A = 42 and B = 12 (show steps).

(a) First convert A and B to 8-bit wide unsigned binary numbers.

(b) Calculate A + B in sign-magnitude binary.

(c) What is the 1's complement of B?

(d) What is the 2's complement of B?

(e) Calculate A - B by adding A and the 2's complement of B.

(f) Calculate B - A in binary. Negative numbers must be in 2's complement form.

Problem 8: Consider the following addition problems for 3-bit binary numbers. Negative numbers are in 2's complement form. For each sum, state:

(i) Whether the sign bit of the result is 1.

(ii)Whether an overflow/underflow has occurred.

000 + 000 ; 010 + 010 ; 100 + 001 ; 101 + 110 ; 111 + 100 .

Problem 9: Given the bit pattern: 1010 1100 1011 0101 0011 0000 0011 1000, what value does it represent, assuming that it is,

(a) a 2's complement integer?

(b) an unsigned integer?

(c) a single precision floating-point number?

Problem 10: The following binary floating-point numbers consist of a sign bit; an excess-64, radix-2 exponent; and a 16-bit fraction. Assume that the fractional parts have an implicit leading "0." that is not included in the number (rather than the usual "normalized" implicit "1."). Now normalize the numbers and write them back in the same excess-64 with 16-bit fraction form.

(a) 010000000001010100000001

(b) 001111110000001111111111

(c) 010000111000000000000000

Problem 11: Convert (- 110011.1011) in binary to single precision IEEE format

(a) State the normalized number.

(b) Write the number in IEEE format (sign, exponent and significand).

(c) IEEE format number in HEX.

Problem 12: Show the binary representation for the following decimal floating point values in IEEE single and double precision format.

(a) 7.4 (b) -13/64 (c) 6.125

Problem 13: Convert the hexadecimal numbers to IEEE single precision format, and then to decimal.

(a)B54B7F10 (b) 43D00000 (c) C20C0000 (d) 42055555

Problem 14: Perform addition (0.0111 + 0.111) for these two binary numbers.

(a) Normalize the binary numbers (normalization only) in single precision IEEE format.

(b) Align the exponents and perform addition.

(c) Normalize the result and convert it to IEEE format. Show all steps. State all bits that are important (biased exponent and fraction in binary)

Problem 15: Explain how this subtraction (2.75 - 8.625) will be performed? Begin by explaining how these numbers are stored in IEEE single precision format. Show important steps.

Problem 16: Consider a machine with a 32-bit word (4 bytes in a word). Bytes are numbered 0, 1, 2, 3, ... , and words are numbered 0, 1, 2, ... , *etc*. Word-0 contains byte-0, byte-1, byte-2 and byte-3. Word-1 contains byte-4, byte-5, byte-6, and byte-7, *etc*.

(a) The byte numbered 406 would belong to what word?_____ (word-number)

(b) This memory is organized using big endian byte order, what would be the least significant byte (one that holds the Least Significant Bit) of Word-20? _____ (byte-number)