

CSE 140 Homework Two

January 24, 2007

*Only **Problem Set Two** will be graded. Turn in only your solutions to **Problem Set Two** which will be due on Feb. 6, 2007 (Tuesday) at 1:00pm*

Problem Set One

- textbook 2.12(b)(c)
- textbook 2.17(a)(b)
- textbook 2.19(a)(c)
- textbook 2.23
- textbook 2.24
- textbook 2.29
- textbook 3.1(a)(d)
- textbook 3.3(a)
- textbook 3.5
- textbook 3.6(a)(c)
- textbook 3.7

Problem Set Two

1 In this problem, we will give you a table containing three pairs of quotients and remainders. Our questions are as follows: first if those results are obtained by restoring division, how many times does the partial remainder **appear** to be negative and how many times does it **appear** to be positive? Then answer the same questions for nonrestoring division. (Please do not include in your answer the initial partial remainder, which is evidently positive; please note that the last *partial* remainder is not necessarily the *final* remainder of the computation; also please count a "0" partial remainder as positive.)

(Part A) Fill in the following table.

quotient	remainder	Number of positive partial remainders		Number of negative partial remainders	
		restoring	nonrestoring	restoring	nonrestoring
010010	001100				
011101	000010				
001010	000100				

(Part B) Briefly tell us how you managed to get the numbers of the positive and negative partial remainders.

2 Say you are given an IEEE-754 single-precision floating point number that has the following format:

$$N = -1^s * 2^e * m \quad (1)$$

Consider doing the operation of **SINGLE BIT LEFT ROTATION** on the binary representation of N . Say that the new number, M , is written in the following format:

$$M = -1^\sigma * 2^\epsilon * \mu \quad (2)$$

What would be the values (*not bit strings*) of σ , ϵ , and μ with respect to s , e , and m ? (You do not have to worry about the cases when the exponent bit string of the initial number, N , or the resultant number, M , are all 0s or all 1s.)

3 It is reputed that the ancient Elamite civilization used a base-20 number system and that they furthermore had developed a computer that represented base-20 numbers! In order to represent a base-20 number they had developed a (somewhat inefficient; it used 6 bits instead of the minimum 5) code as follows:

Decimal#	Code Repr.	Decimal#	Code Repr.
0	000111	10	100011
1	001011	11	100101
2	001101	12	100110
3	001110	13	101001
4	010011	14	101010
5	010101	15	101100
6	010110	16	110001
7	011001	17	110010
8	011010	18	110100
9	011100	19	111000

(While you answer the following questions think of the following **hint**: *How many 1s and 0s does each 6-bit code have?*)

(Part A) Can this code detect any errors?

(Part B) If yes, describe the types of errors that can be detected?

(Part C) Can it correct any errors?

(Part D) If yes, describe the types of errors that can be corrected? Provide a brief explanation for your answer.

4 Using the axioms of Boolean algebra and some of the theorems, prove that the following two Boolean expressions are equivalent by starting from the left-hand expression and arriving at the right-hand expression. For each transformational step, you need to identify the axiom or law, that you are applying.

(1) $ABC' + AB'C' + (A'(E + F'))' + DC' = (A + D)(A + C') + E'F$

(2) $X'Y + XY' = (X'Y' + XY)'$