Cpr E 281 RC06
WEEK 8
ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Recitation Material for Week 8
Tasks to do in the recitation section
Assigned Date: Seventh Week

T1. Review HW06 problems and solve any problems that the students point out they had difficulties with.

T2. Answer any general questions about HW07.

T3. Solve the following problems.

1. Problem 3.6 from the book: Prove that the XOR operation is associative:

   X ^ (Y ^ Z) = (X ^ Y) ^ Z

2. Problem 3.8 from the book: Prove the validity of the simple rule for finding the 2's complement of a number (the rule states that scanning a number from right to left: all 0s and the first 1 are copied; all remaining bits are complemented).

3. Problem 3.9 from the book: Prove the validity of the expression for Overflow = c_n ^ c_{n+1} for addition of n-bit signed numbers.

4. Convert the following numbers to IEEE 754 single-precision floating-point:
   The binary number 101010.
   The decimal number 13.1875.
   The decimal number -768.
   The decimal number 0.8

5. Convert the following IEEE 754 single-precision floating-point numbers to decimal:
   1 10000011 01100000000000000000000

   1 01111010 10100000000000000000000

6. Convert $BEC00000_{16}$ (a 32-bit floating-point number in IEEE 754 format) to decimal.

7. Convert the number 101.1_2 to IEEE 754-single precision floating-point number.

8. Given a six-bit unsigned value A, show how to determine the quotient and remainder from the division operation A / 4. What is the minimum number of bits required to express the quotient and the remainder? If A were an n-bit number, how many bits would be required to express the quotient and remainder from the division operation A / 2^m?

9. Design a circuit that will take a four-bit input A and calculate 7*A using only full-adders and half-adders. (Hint: start with multiple-bit adders and then replace each component with its underlying components)

10. To illustrate the complexity of division by a number that is not a power of 2, suppose that we wish to take a three-bit value A and determine the quotient and the remainder of division from the operation A/3. What is the minimum number of bits required to express the quotient and the remainder? Design a circuit diagram for this circuit with AND gates, OR gates, and NOT gates. Show how this circuit can be used to determine the quotient and remainder with a four-bit input B and the operation B/3.