Homework #1

Due Thursday, January 28th, 2021 at the beginning of class

You can type the answers in a file or submit a scanned handwritten version. Only .doc(x) and .pdf files will be accepted, no jpeg's! Extra credit problems are labeled with a red header. Show all of your work and make sure your work is your own.

Problem 1: (6 pts) Convert the following **unsigned** binary integers to decimal (show your work):

a. 11001001010110
b. 0001011110
c. 101010110010

Problem 2: (4 pts) Convert the following decimal integers to binary. Assume all numbers are unsigned and must be represented by 12 bits.

a. 823
b. 209

Problem 3: (4 pts) Convert the following to hexadecimal:

a. 1011000101000010111_2 (assume unsigned)
b. 1938_{10}

Problem 4: (2 pts) Convert the following hexadecimal number to decimal.

a. 2FACED

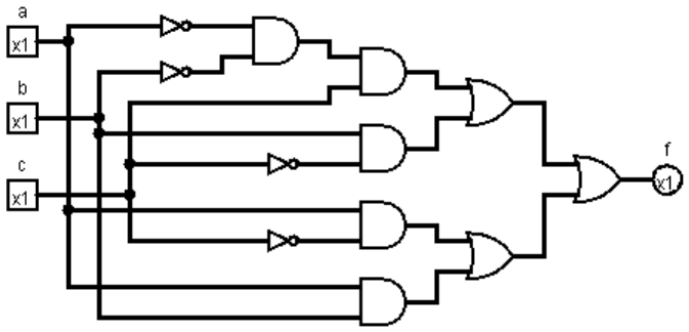
Problem 5: (4 pts) Draw the circuit schematic for the following equation. If ABC = 110, respectively, what is the value of G?

$$G = B(C+A) \oplus ((A'B) + (B+C)')$$

Problem 6: (4 pts) Show through the use of a truth table if the following two functions are equal:

$$Y = B'CD + BC + AB'D + ABD'$$
$$Z = (A + B + C')(B + D)(A + C + D)(B' + C' + D')$$

Problem 7: (4 pts) Which values of **a** and **b** would keep the circuit output value of **f** equal to 0 if **c** equals 1?



Problem 8 (5 pts): Compute the sum of the following pairs of 6-bit **unsigned** integers. The answer is to be stored in a 6-bit location, indicate if the sum produces overflow. Also, show the decimal equivalent of **both** the operands and the result.

a. 101101 + 010101
b. 000101 + 010010

Problem 9: (4 pts) The following decimal integers are to be stored in a 6-bit signed binary format. Show how they are stored.

a. + 20
b. – 30

Problem 10: (4 pts) The following 6-bit signed binary integers were found in a computer. What decimal number do they represent?

a. 110000
b. 011010

Problem 11: (5 pts) Compute the following equations by **first converting each number to signed binary** and performing the addition. Limit each number to 6-bits. Convert the final sum result to decimal. Indicate if overflow occurs. Show all of your work.

a. 7 + 18
b. 12 - 29

Problem 12: (4 pts) A system has one output, F, and four inputs (A, B, C, D), where the first two inputs (A, B) represent one 2-bit **unsigned** binary number (0 through 3 in decimal) and the second two inputs (C, D) represent another **unsigned** binary number (0 through 3 in decimal). F is to be 1 if and only if the decimal result of CD / AB (CD divided by AB) is a whole number or 0 (not a fraction or ∞). Show a truth table for the system.

Extra Credit Problem 13: (4 pts) A "beverage-quantity number system" uses base 12. There are at most four integer digits, with weights ranging from 0 to 11. The multiplier of the digits are 12^3, 12^2, 12^1, and 12^0. Special names are given to the multipliers as follows: 12 = 1 dozen, 12^2 = 1 gross, and 12^3 = 1 great gross.

a. How many beverage cans are in 2 great gross + 7 gross + 4 dozen + 10 cans?
b. Find the representation in base 12 for 6903_{10} beverage cans.

Extra Credit Problem 14: (6 pts) Convert the number decimal number 2021 to unsigned binary and hexadecimal.

Extra Credit Problem 15: (5 pts) Using a Full Adder/Subtractor circuit, design a combinational circuit that compares two 4-bit **signed** numbers A and B to see whether A is greater than B. The circuit has one output **X**, so that **X = 1** if A < B, and **X = 0** if A >= B.

Extra Credit Problem 16: (5 pts) Compute the following equation by **first converting each number to signed binary** and performing the addition. Limit each number to 6-bits. Convert the final sum result to decimal. Indicate if overflow occurs. Show all of your work.

a. -23 - 13