Professor Fearing EECS150/Problem Set 1 Fall 1997

Due at 5 pm, Fri. Sep. 5 in box outside 218 Cory Hall

Reading Katz: App. A, 5.1, Ch. 1, 2:2.2, 2.5, 3.1.1

1. (15 pts) Perform the following number system conversions:

a. $1011001_2 = ?_8 = ?_{10} = ?_{16}$ b. $10.11_2 = ?_8 = ?_{10} = ?_{16}$

c. $?_2 = ?_8 = 105_{10} = ?_{16}$ d. $?_2 = ?_8 = ?_{10} = 8A.F_{16}$

e. $?_2 = ?_8 = ?_{10} = 214_{16}$

2. (10 pts) Arithmetic:

Showing your calculations, add 108_{10} and 117_{10} in base 2, 10, and sixteen.

Showing your calculations, multiply 113_4 and 23_4 in base 2, 10, and sixteen.

3. (15 pts) Modulo arithmetic. Calculate the following:

a. $155_{10} \pmod 8 = ?_{10}$ b. $155_{10} \pmod 4 = ?_{10}$

c. Does $x \pmod 8$ plus $y \pmod 8$ equal $(x + y) \pmod 8$?

4. (20 pts) Reduce the following Boolean expressions using theorems and identities:

a. $F = AB(C + \bar{C}) + A\bar{B}$

b. $F = \underline{A\bar{B} + A\bar{C} +} \; \bar{B}\bar{B}$

c. $F = \overline{A(B + C)}D$

d. $F = \overline{A \cdot \bar{B} \cdot \bar{C}}$

5. (20 pts) Implement $F.H = AB + C\bar{D}$ with all inputs asserted high (i.e. inputs are $A.H, B.H, C.H, D.H$) using:

a. AND, OR, and INVERTER gates.

b. only NAND gates

c. only NOR gates

6. (20 pts) Subtractor.

a. Write the truth table for a one-bit full subtractor which has inputs A, B, BorrowIn, and outputs D and BorrowOut.

b. Write the logic equations for D and BorrowOut.

c. Implement logic for D and BorrowOut using AND, OR, and INVERTER gates.