

EE 231
Exam 1
September 24, 2008

Name: _____

No calculators allowed. Show all work. Partial credit will be given. No credit will be given if an answer appears with no supporting work.

1. You are tasked with designing a digital thermometer, which will display temperatures from -60° F to $+140^{\circ}$ F. (The system displays the temperature to the nearest degree, so you will not need to display fractions of a degree.) The numbers will be stored in a register in signed 2's complement form. What is the minimum number of bits your register will need to hold numbers from -60 to +140? Explain your reasoning.

2. Convert the following decimal number to hexadecimal. You only need to keep two digits to the right of the decimal point:
 $(73.28)_{10}$

3. For this problem, assume all numbers are held in 8-bit registers in a digital system, and the numbers are represented in 2's complement form.
 - (a) Convert $(+87)_{10}$ to a 2's complement 8-bit hex number.

 - (b) Convert $(-95)_{10}$ to a 2's complement 8-bit hex number.

 - (c) Use the results from (a) and (b) to perform the following operation using 2's complements:
 $(+87)_{10} - (-95)_{10}$

 - (d) Convert the answer to of Part (c) to its decimal equivalent.

4. Use Boolean algebra to simplify the following expressions to a minimum number of literals:

(a) $(xy + yz' + x'z)(x + z)$

(b) $(x'y' + z)' + z + xy + wz$

5. Consider the following truth table:

x	y	z	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

- Write the the function F as a sum of minterms.
- Use Boolean algebra to reduce the expression to a minimum sum of products.
- Write the the function F as a product of maxterms.