Don't Panic! Make assumptions if necessary, write them down, and proceed. Write your answers on this sheet or on the back if you need more room. Open books and notes. You may use your computer but only for access to the class web site. If I can't decode your writing then your answer is wrong.

1. Show (step by step) how to evaluate 0x432 – 0x123 using 12-bit twos-complement arithmetic. State your final answer in hex.

2. Complement 0xA6F and give your answer as a 12-bit hex number.

3. What decimal number does 0xFF3 represent on a 12-bit 2's-complement computer?

4. In a 12-bit 2's complement computer what is the most negative number we can represent? What value do we get if we negate this number?

5. I have a boolean variable, X (its value is 0 or 1). I want to place the value of X into the 4th bit of a variable Y counting from the bottom (the bit corresponding to 2^3). Show how to accomplish this without branching or knowing the value of X. No need to show me the exact instructions, math or C notation will be fine.

6. What is the new value of the PC (program counter) after a MIPS BEQ instruction when the comparison is true.

7. To help me debug my MIPS assembly programs I'd like to have a function that prints the address of the current instruction. Where can my function get this information? Note, the PC is not directly readable.

8. In an R-type instruction what is the shamt field?

9. Show the truth table for a function that takes 3 bits in and outputs 1 if the number of 1 bits in the input is odd.

10. Write the sum-of-products equation for this truth table:

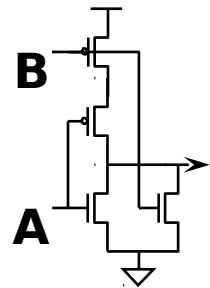| A	B	Out
0	0	1
0	1	0
1	0	1
1	1	0

11. Implement the above table using NAND gates.
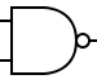
12. Convert the 16-bit 2's-complement number 0x8123 to a 32-bit 2's-complement number by sign extension.

13. What is a leaf function? How would knowing a function is a leaf help me optimize its implementation?

14. What function does this collection of transistors implement?

15. Why must a non-leaf function save the RA register?

16. What gets saved on the stack in the MIPS calling convention?