

ECE 429 / 629 Homework #4

This homework covers COD 4.5, 5.1-5.3.

1. We all know that if a non-negative number stored in a computer is shifted left by n bits, the result is the same as multiplying the number by 2^n . What does shifting a negative number to the left by n bits do for a number stored as two's complement? How about a shift right by n bits?

2. Why doesn't MIPS have a subtract immediate instruction?

3. (a) Although not shown in class, MIPS natively provides a NOR instruction. However, it does not natively provide a NOT instruction which instead is a pseudoinstruction that maps to a native MIPS instruction. Write a MIPS instruction that implements NOT R1, R2.
 (b) Write a sequence of MIPS instructions that implements XOR R1, R2, R3 using only the NOR instruction. Draw a truth table showing the validity of your solution.
 (c) In reality, MIPS does contain an XOR instruction. Using only XOR, write a sequence of MIPS instructions that swaps the values between registers R1 and R2 without touching any other registers or memory.

4. Augment Fig. 5.29 to handle (a) the addi instruction, and (b) the bne instruction. Describe the additional control lines needed (if any), and provide the truth table for all the control lines needed for the instructions.

5. Determine the values of the following control lines for the first four cycles of execution of the following MIPS code using the machine in Fig. 5.29. For each line, specify 0, 1, or X ("don't care").

```

add R1, R2, R3
lw R4, 16(R1)
loop: sub R4, R2, R4
      beq R1, R4, loop
    
```

	1	2	3	4
RegDst				
Jump				
Branch				
MemRead				
MemtoReg				
ALUOp				
MemWrite				
ALUSrc				
RegWrite				