UNCA CSCI 255
Exam 1 Fall 2010
7 October, 2010

This is a closed book and closed notes exam. It is to be turned in by 4:25 pm. Calculators, PDA's, cell phones, and any other electronic or communication devices may not be used during this exam.

Name:________________________________

If you want partial credit for imperfect answers, explain the reason for your answer!

Problem 1 (12 points) Decimal to two's complement conversion
Convert the following four signed decimal numbers into seven-bit two's complement representation.

52	**-10**
80	**-52**

Problem 2 (12 points) Two's complement to decimal conversion
Convert the following four six-bit two's complement numbers into signed decimal representation.

111100	**000111**
010101	**100111**

Problem 3 (10 points) Adding
Add the following pairs of eight-bit two's complement numbers **and indicate which additions result in an overflow**.

00110101 + 10111010	00100010 + 01101100
10001010 + 10110110	11101010 + 10101010

Problem 4 (6 points) Ranges
What is the number of different values that can be represented by 9 binary digits?

What is the greatest number that be represented in 9-bit two's complement notation?

What is the smallest number that can be represented in 9-bit two's complement notation?

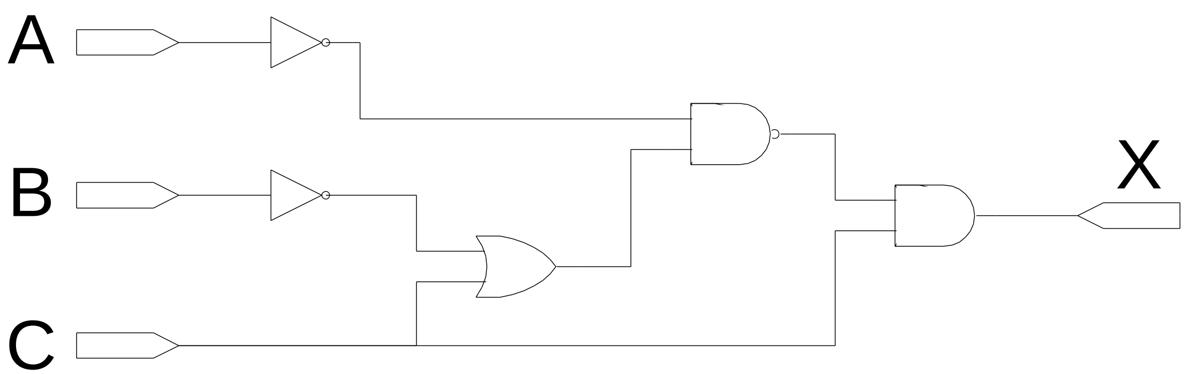
Problem 5 (10 points) Memories
A 4 MB memory has a 16-bit word size. How many words are contained in this memory?

A memory has 256 words. Each word contains 32 bits. How many bytes are contained in this memory?

A computer memory has a 32 bit words stored in 4M locations. What is the size of this memory in bytes?

How many bits are required to address the 4M words of this memory?

Problem 6 (10 points) Gates to truth
Give the truth table for the gate-level circuit shown below. The three inputs are on the left, the output is on the right.



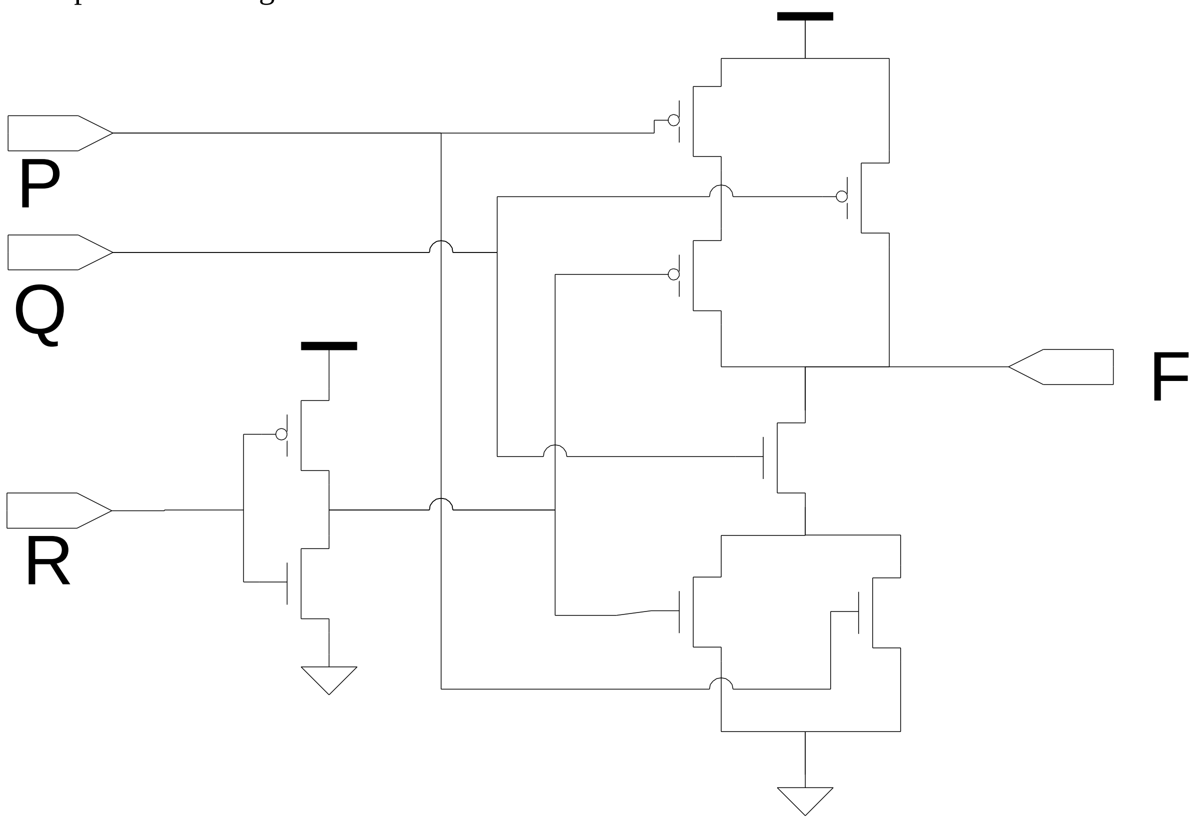
A	B	C	X
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Problem 7 (5 points) Bitwise operations
Perform the following bit-wise logical operations on 8-bit numbers expressed as two hexadecimal digits. Your answer should also be expressed in hexadecimal.

`AND(16,5A) -->`	
`OR (16,5A) -->`	

This is the same as the Java operations `0x16 & 0x5A` and `0x16 | 0x5A`.

Problem 8 (10 points) Transistors to Truth
Give the truth table for the transistor-level circuit shown below. The three inputs are on the left, the output is on the right.



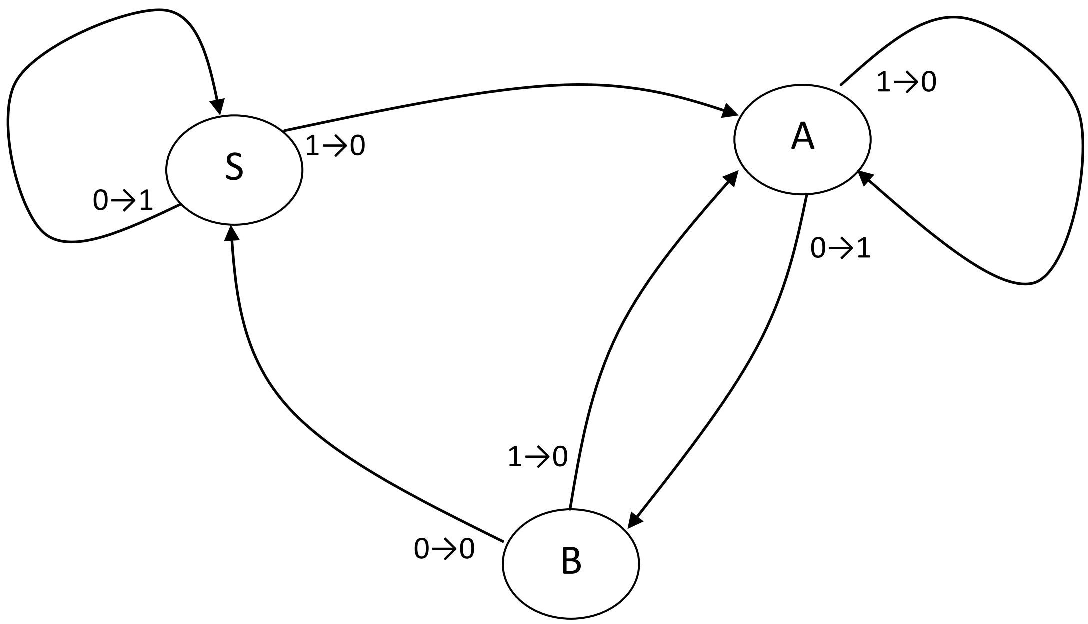
P	Q	R	F
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

Problem 9 (15 points) Truth to Gates

Draw a circuit, at the gate level, that will implement the following truth table, where A, B, and C are inputs and where Z is the single output.

A	B	C	Z
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Problem 10 (10 points) Finite State Machine
Use the following finite state machine for answering this problem.



First, fill in the following state transition table using the state names, S, A, and B.

Present state	Input	Next State	Output
S	0		
S	1		
A	0		
A	1		
B	0		
B	1		

Now assuming that S is encoded with the two binary bits 00, A with the binary bits 01, and B with the binary bits 10; complete the following state transition table at the binary level. This is similar to what you did in lab on Monday.

Present state		Input	Next state		Output
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			