



This quiz is worth a total of **100 points**.

In accordance with the Georgia Institute of Technology Honor Code, I have neither given nor received aid on this quiz.

Signature: \_\_\_\_\_

**Please make sure all of your answers are contained within the answer boxes or the fill-in lines.** Do not write your work in the answer boxes. You have been provided with extra paper for your scratch work. You will **NOT** be given credit for showing work. Having anything except the answer inside the boxes or above the fill-in lines reduces autograder performance and might cause incorrect results. **Make sure to write your name, username, and answers legibly. You will not receive credit for illegible answers.**

### Digital Logic: Truth Table from Expression

- Complete the empty entries in the truth table with respect to the following boolean expression.

$$S = (A \& B) \mid C$$

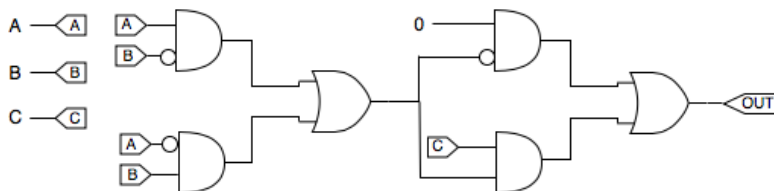
A	B	C	S
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

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### Digital Logic: Truth Table from Circuit

- Complete the empty entries in the following truth table with respect to the circuit shown below.

*Note:* The 0 indicates a zero constant.



A	B	C	OUT
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

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### Short Answer

- For the following questions please answer in the space provided.

- Given a multiplexer with  $n$  select bits, what's the maximum number of outputs? \_\_\_\_\_ 5
- Given a decoder with  $n$  select bits, what's the maximum number of outputs? \_\_\_\_\_ 5
- Find an expression equivalent to  $(!A \& !B)$  with  $\leq 2$  bitwise operators  $(!, \&, |)$  \_\_\_\_\_ 5

### Multiple Choice

- For the following questions please fill-in the appropriate circle.

- Which operator should one use to set bits? ☐ AND ☐ OR ☐ XOR ☐ ADD 4
- Which operator should one use to clear bits? ☐ AND ☐ OR ☐ XOR ☐ ADD 4
- Which operator should one use to toggle bits? ☐ AND ☐ OR ☐ XOR ☐ ADD 4



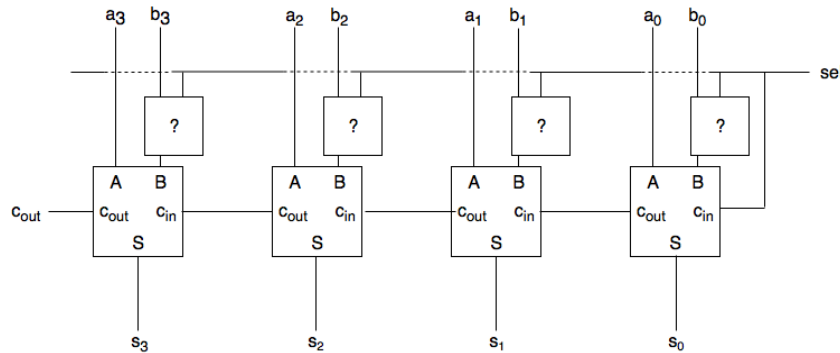


## Digital Logic: Adding and Subtracting

5. Consider the following diagram of a 4-bit adder-subtractor composed of four 1-bit full-adders. When the `sel` input is 0 the circuit should compute the operation  $A + B$ . When the `sel` input is 1 the circuit should compute the operation  $A - B$ .

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*Hint:* The `sel` input is connected both to the marked components and to the  $c_{in}$  of the first adder.



Which component should be inserted for the boxes with '?'s: ☐ AND ☐ OR ☐ XOR ☐ ADD

## Bitmasking

6. Write a function which extracts a range of bits from a 32-bit 2's complement integer such that:

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- `num` is a 32-bit 2's complement integer
- `s` is the starting bit to grab
- `n` is the number of bits to return

This must be completed in one line without multiplication, addition, subtraction, division or modulus.

*Warning:* Make sure your answer is of the form `"return ... ;"`

```
public static int bitRange(int num, int s, int n)
{
}
}
```

## Digital Logic: Circuit from Expression

7. Consider the following boolean expression with three inputs and one output:  $Z = \overline{(\overline{A} \mid (B \& \overline{C}))}$ .

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Draw the corresponding circuit. **You are allowed (but not required) to simplify the expression!**

You may use any of the following symbols: NOT ( $\neg$ ) AND ( $\square$ ) OR ( $\sqcup$ ) XOR ( $\boxplus$ ).

*Warning:* If we cannot distinguish between your gates, you will receive NO credit.

A

B

Z

C

