Warm-Up: Adders

Prepared by Mark on February 10, 2025

Problem 1:

Fill the following binary addition table.

Hint: s is "sum," c is "carry"

a	b	s	c
0	0	?	?
0	1	?	?
1	0	?	?
1	1	?	?

Problem 2:

Draw a logic circuit that atisfies the above table.

This is called a *half adder*.

Hint: You should need exactly two gates.

Definition 3:

A *full adder* is similar to a half adder, but it has an extra input:

a full adder takes a, b, and c_{in}, and produces s and c_{out}.

Hint: c_{in} is "carry in"

Problem 4:

Use two half adders to construct a full adder.

Problem 5:
How can we add two four-bit binary numbers using the full adder?
We want a four-bit output sum and a one-bit c_{out}.

Problem 6:
Say that all basic logic gates need $1u$ of time to fully switch states.
Note: This is called *gate delay*

How much time does a full adder need to fully switch states?
How about your circuit from Problem 5?

Problem 7: Bonus
Design a faster solution to Problem 5.