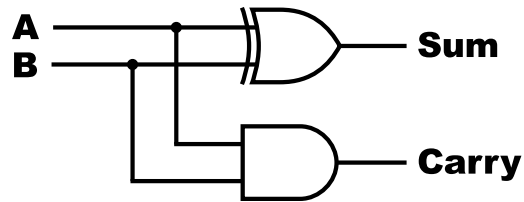


Half Adder

A half adder adds 2 single-digit binary numbers and produces a sum and a carry.



| A | B | Carry | Sum |
|---|---|-------|-----|
| 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 0 |

But if we want to add multiple digits, this only does "half" of the job (hence the name "half adder"). To add multi-digit binary numbers, we need to be able to handle a carry coming in from the previous column and then send our carry out to the next column.

This is exactly the same way we add multi-digit decimal numbers:

| | | | |
|---|-----------|----------|---|
| | Carry out | Carry in | |
| | 0 | 1 | |
| | 0 | 0 | 0 |
| | 2 | 6 | 7 |
| + | | 2 | 8 |
| | | | |
| | 2 | 9 | 5 |
| | Sum | | |

In the middle column, we're adding $6 + 2$. But we have a carry coming in from the column on the right. So we need to add $6 + 2 + 1$ (the carry) and produce 9 (the sum) and 0 (the carry for the next column).