

- $$\begin{array}{r}
 +7 \\
 -3 \\
 \hline
 +4
 \end{array}$$
- Bitwise operations:
- The diagram shows the addition of 7 and -3 using 8-bit two's complement. The 8th bit is the sign bit. The 7th bit is the carry bit. The 6th bit is the carry bit. The 5th bit is the carry bit. The 4th bit is the carry bit. The 3rd bit is the carry bit. The 2nd bit is the carry bit. The 1st bit is the carry bit. The 0th bit is the carry bit.

A hand-drawn logic circuit diagram. It features two input lines labeled 'A' and 'B'. Line 'A' connects to the top input of an XOR gate and the top input of an AND gate. Line 'B' connects to the bottom input of the XOR gate and the bottom input of the AND gate. The XOR gate has a curved output line labeled 'S'. The AND gate has a straight output line labeled 'C'.

The diagrams show the progression of a bubble sort algorithm on the array [5, 4, 3, 2, 1]:

- Diagram 1:** Initial array [5, 4, 3, 2, 1]. The number 5 is being compared with 4. An arrow points to the space between them, indicating a swap.
- Diagram 2:** After the first swap, the array is [4, 5, 3, 2, 1]. The number 4 is being compared with 3. An arrow points to the space between them, indicating a swap.
- Diagram 3:** After the second swap, the array is [3, 4, 5, 2, 1]. The number 3 is being compared with 2. An arrow points to the space between them, indicating a swap.
- Diagram 4:** After the third swap, the array is [2, 3, 4, 5, 1]. The number 2 is being compared with 1. An arrow points to the space between them, indicating a swap.

$2^2 = 4$  possibilities  $\begin{matrix} \nearrow 0 \\ \searrow 3 \end{matrix}$

A	B	$\bar{A}$	$\bar{B}$
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

The diagram illustrates a 2-bit ripple-carry adder. It consists of two stages of full-adder logic. The first stage takes inputs A<sub>1</sub> and B<sub>1</sub> and produces a sum bit S<sub>1</sub> and a carry bit C<sub>2</sub>. The second stage takes inputs A<sub>2</sub> and B<sub>2</sub> and produces a sum bit S<sub>2</sub> and a carry-out bit C<sub>OUT</sub>. The carry bit C<sub>2</sub> from the first stage is connected to the carry input of the second stage. The sum bits S<sub>1</sub> and S<sub>2</sub> are the final outputs of the adder.

$$2^3 = 8 \begin{array}{l} \diagup 0 \\ \diagdown 7 \end{array}$$

A	B	C <sub>IN</sub>	C <sub>OUT</sub>	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

$$\begin{array}{r} +7 \\ +3 \\ \hline +10 \end{array}$$

1 1 1 ✓  
 0 1 1 1 ← A  
 0 0 1 1 ← B  
 1 0 1 0 ✓

Full Adder 4 bits working

The diagram illustrates a 4-bit ripple-carry adder. It consists of four full adder blocks connected in series. The first block takes inputs  $B_0$  and  $A_0$  and a carry-in of 0. It produces a sum output  $S_1$  and a carry-out. The second block takes inputs  $B_1$  and  $A_1$  and the carry-in from the first block. It produces a sum output  $S_0$  and a carry-out. The third block takes inputs  $B_2$  and  $A_2$  and the carry-in from the second block. It produces a sum output  $S_1$  and a carry-out. The fourth block takes inputs  $B_3$  and  $A_3$  and the carry-in from the third block. It produces a sum output  $S_0$  and a final carry-out of 0. A blue bracket underlines the sum outputs  $S_1, S_0, S_1, S_0$ .