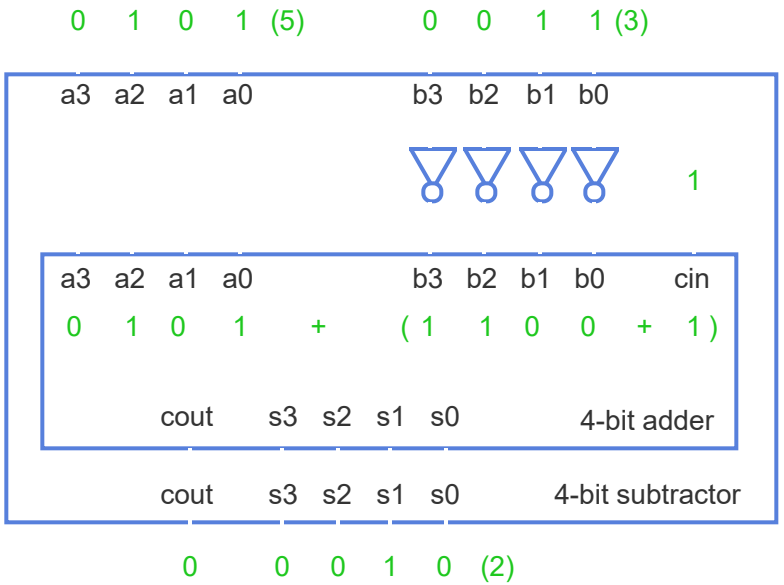
4.2 Subtractors

A ***subtractor*** computes A - B, where A and B are N-bit numbers, such as 8-bit numbers. If numbers are represented using tv representation, a subtractor can be built using an adder. Inverting B's bits and setting the adder's carry-in to 1 adds B's com

PARTICIPATION ACTIVITY 4.2.1: A 4-bit subtractor.

Start ☐ 2x speed

Note: A is a3a2a1a0. B is b3b2b1b0.



A - B is A + (-B)

a3a2a1a0 - b3b2b1b0

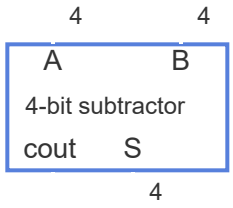
5 - 3 = 5 + (-3)

= 0101 + ((0011)' + 1)

= 0101 + (1100 + 1)

= 0010

Block symbol



PARTICIPATION ACTIVITY 4.2.2: Subtractor.

1) An adder can be used to perform subtraction if input B is represented in two's complement.
   - ○ True
   - ○ False

2) For a subtractor built from an adder, the adder is configured to subtract by setting the adder's cin bit to ___.
   - ○ 0
   - ○ 1

3) To perform 7 - 2 using a 4-bit subtractor, A is 0111 and B is _____.
   - ○ 0010
   - ○ 1110

Because two's-complement representation performs subtraction by complementing and adding, a single adder circuit can addition or subtraction, thus saving circuit size.

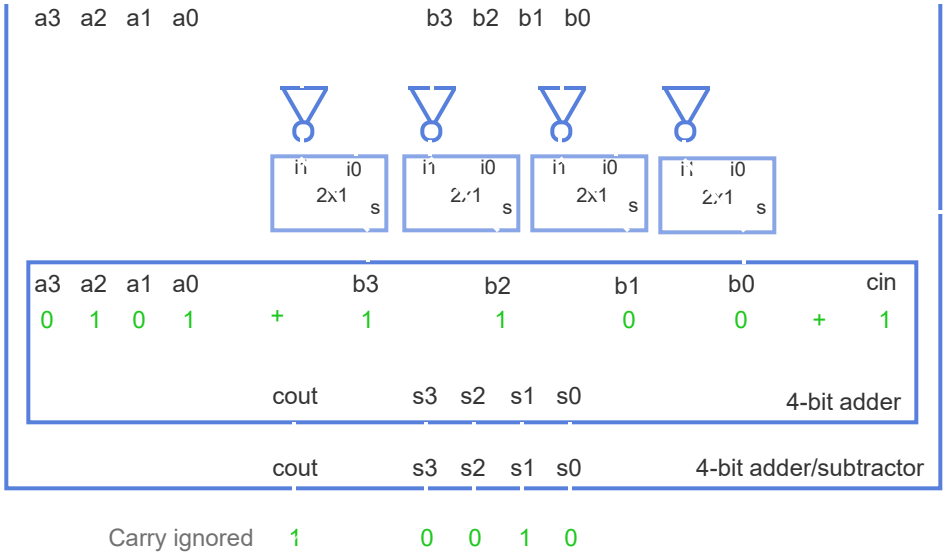
PARTICIPATION ACTIVITY 4.2.3: A 4-bit adder/subtractor.

Start ☐ 2x speed

Note: A is a3a2a1a0. B is b3b2b1b0.

0 1 0 1 0 0 1 1

sub = 0: addition



0011 (3) + 0100 (4)

0111 (7)

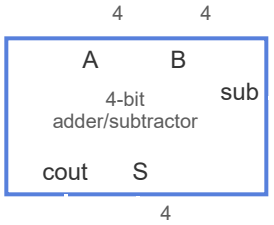
sub = 1: subtraction

0101 (5) - 0011 (3)

0101(5) + 1101 (-3)

0010 (2)

Block symbol



PARTICIPATION ACTIVITY 4.2.4: Adder/subtractor.

Consider a 4-bit adder/subtractor (seen in the animation above).

1) If sub is 0, what is the adder/subtractor component configured to do?

- Addition
- Subtraction
- sub does not determine the circuit's operation.

2) Which of the following operations are

not valid?

- 5 - 3
- (-5) - (-3)
- -5 + 3
- None of the above.

3) Configure the adder/subtractor to perform the following operation: 7 - 2

- a3a2a1a0 = 0111
  b3b2b1b0 = 0010
  sub = 0
- a3a2a1a0 = 0111
  b3b2b1b0 = 0010
  sub = 1
- a3a2a1a0 = 0010
  b3b2b1b0 = 0111
  sub = 1

Provide feedback on this section