Multibit Subtractor

To use a full-adder to subtract, we invert the second input (b), and set the carry-in = 1.
If we invert every b_i input in a multibit adder and set the carry-in to be 1, we have a multibit subtractor.

Combining subtraction and addition

If we take a 2–1 multiplexor and set the inputs to be b_i and NOT(b_i), then the select line chooses which output goes to the multibit input.
We can then use the carry-in as the select line, and have a multiplexor for each b digit in the multibit adder/subtractor.
Then setting the carry-in to be 1 gives us subtraction, and setting it to 0 gives us addition.

Some Theory

Rules of Boolean algebra

1. Closure Rule: There are 2 operators which operate on pairs of elements, producing a result belonging to the set {true, false}:
    i. . (AND)
    ii. + (OR)
2. These operators are commutative:
    i. A.B = B.A
    ii. A+B = B+A
3. They are distributive:
    i. A . (B+C) = (A.B) + (A.C)
    ii. A + (B.C) = (A+B) . (A+C)
4. There are two identity elements:
    i. 1.A = A

   ii. 0+A = A

5. For each A there is an inverse A' such that:
   i. A.A' = 0
   ii. A+A' = 1

Theorems

- T1: A.0 = 0
- T2: A+1 = 1
- T3: A.A = A
- T4: A+A = A
- T5: A + (A.B) = A
- T6: A + (A'.B) = A+B
- T7: A.B.C = A . (B.C) = (A.B) . C
- T8: A+B+C = A+(B+C) = (A+B) + C
- T9: (A.B)' = A' + B'
- T10: (A+B)' = A' . B'
- T11: (A')' = A