Decimal equivalent of 2s complement.

$B: b_{m-1} b_{m-2} \cdots b_0$

$$= -b_{m-1} 2^{m-1} + \sum_{i=0}^{m-2} b_i 2^i$$

Multiplication.

$$A \times B = \underline{-A b_{m-1} 2^{m-1}} + \sum_{i=0}^{m-2} (A b_i) 2^i \leftarrow$$

$$A b_i = 0 \quad b_i = 0$$
$$= A \quad b_i = 1.$$

If $b_{m-1} = 1$; add 2s complement of A

'm' partial products to be added.

Reduce the number of partial products using MBE

$b_{2i+1} \; b_{2i} \; b_{2i-1}$; Depending on these bits add

$i = 0, 1, 2 ..$

0, A, 2A, −A, −2A.

examples

Array.

A	1 1 0 1	(−3)
B	1 0 1 1	(−5)

```
1 1 1 1 1 1 0 1 }
1 1 1 1 1 0 1   }
0 0 0 0 0 0
0 0 0 1 1
-----------------
. . 0 0 0 1 1 1 1
```

0 1 1 1 1	(15)
1 0 1 1 0	(−10)

```
0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 1 1
0 0 0 1 1 1 1
0 0 0 0 0 0
1 0 0 0 1
-------------------
1 0 1 1 0 1 0 1 0.
```

↗ (−256 + 64 + 32 + 10)

```
    1 1 0 1
  1 0 1 1 0
-------------
0 0 0 0 1 1
0 0 1 1
-------------
0 0 1 1 1 1
```

$$-2\overset{1}{b_{2i+1}} + \overset{0}{b_{2i}} + \overset{1}{b_{2i-1}}$$

PP1 : $-2+1 = -1 \times A$

PP2 : $-A$

$($ $+$ $(-2b_1 + b_0)2^0$

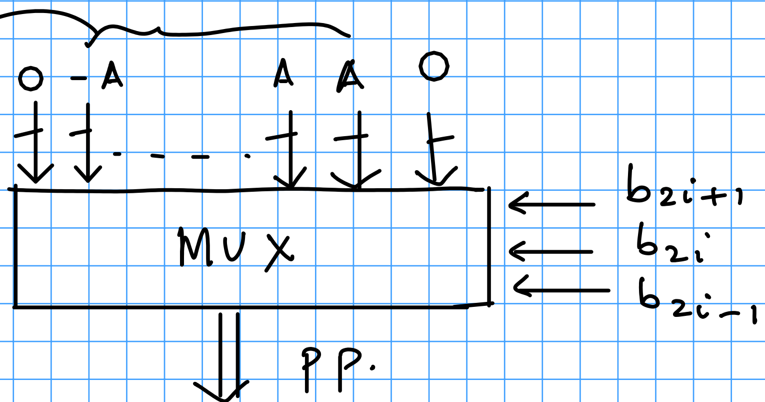
```
        0 1 1 1 1
    1 1 0 1 1 0 0
---------------------
1 1 1 1 0 0 0 1 0      (-2A)
0 0 1 1 1 1 0 0 0      (2A)
1 0 0 0 1 0 0 0 0      (-A)
---------------------
1 0 1 1 0 1 0 1 0
```

Array multiplier : Homework.

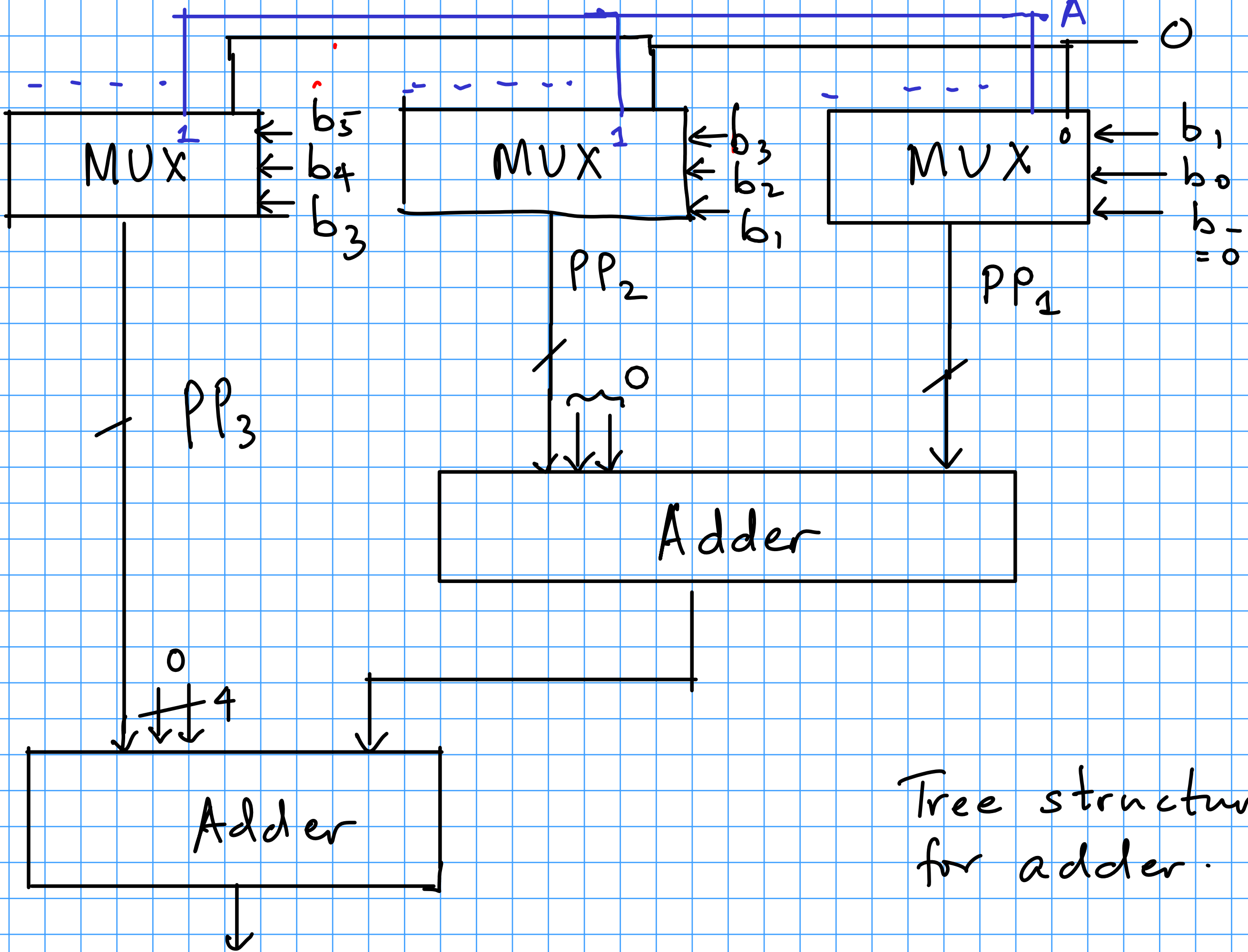
1. Twos complement of A.
2. Sign extension, 3. shift left.

A : n bits
B : m bits

With sign extension



# of bits in product : $n+m-1$



Tree structure for adder.

Faster than array structure; but needs MUXes ;