Decimal to binary

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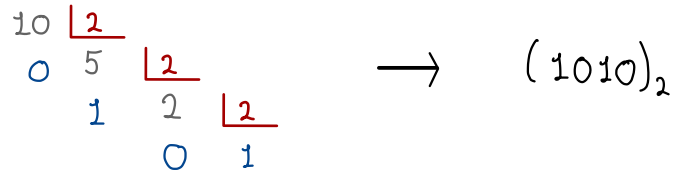
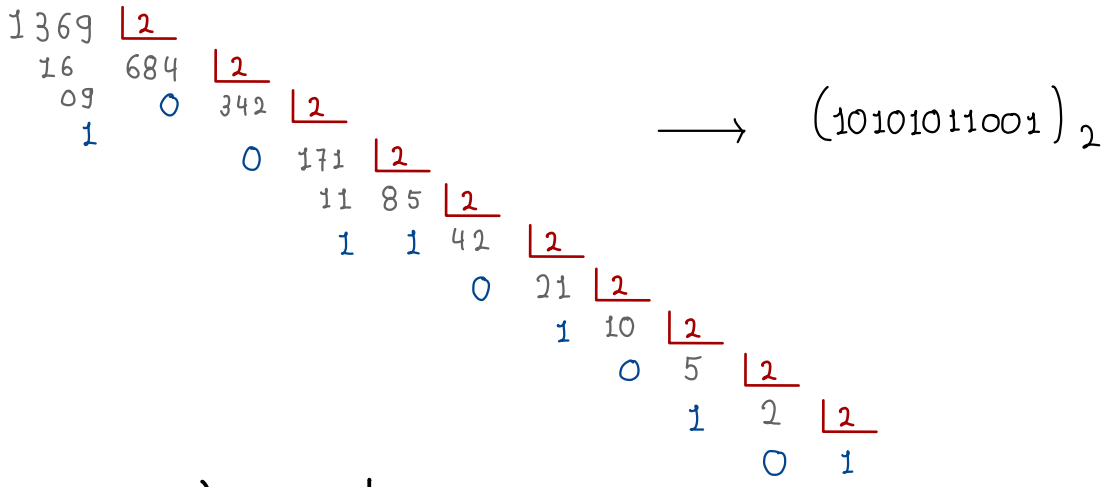
- 00215547
- 03/01/2023

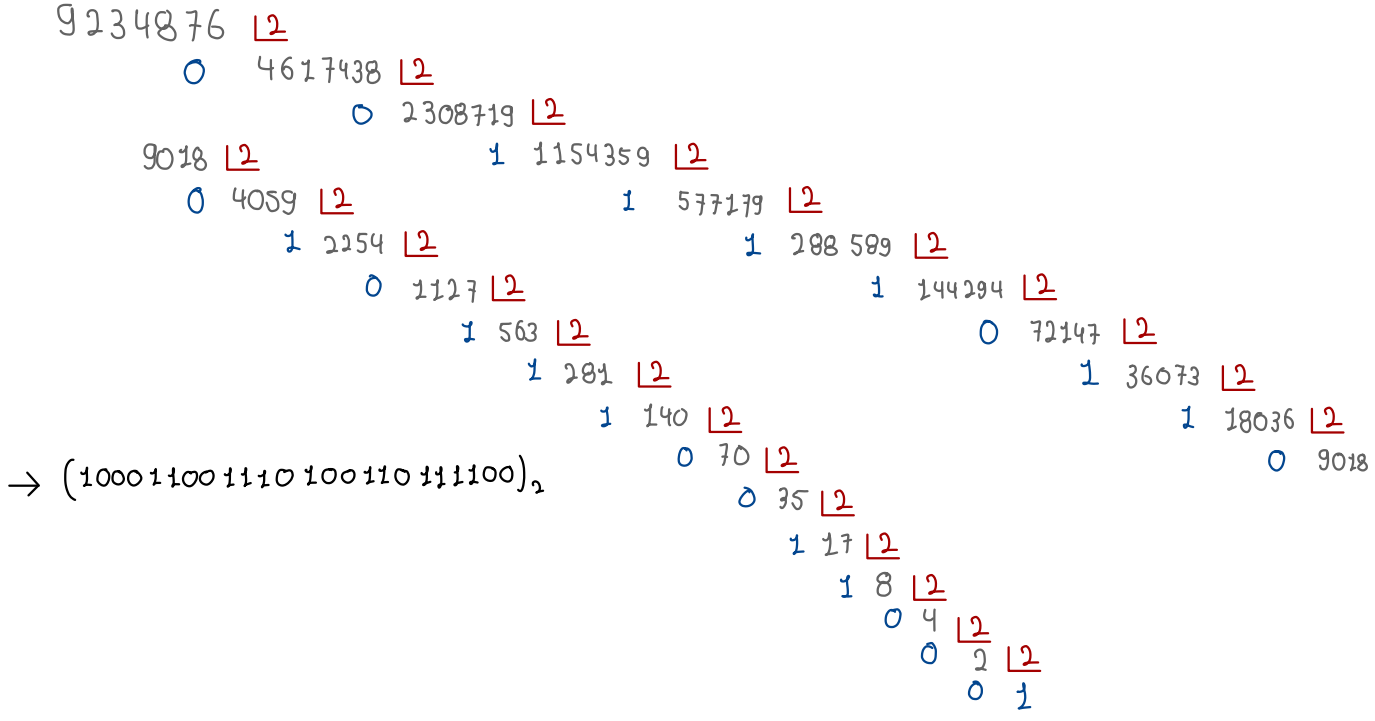
$(10)_{10} \rightarrow$ binary



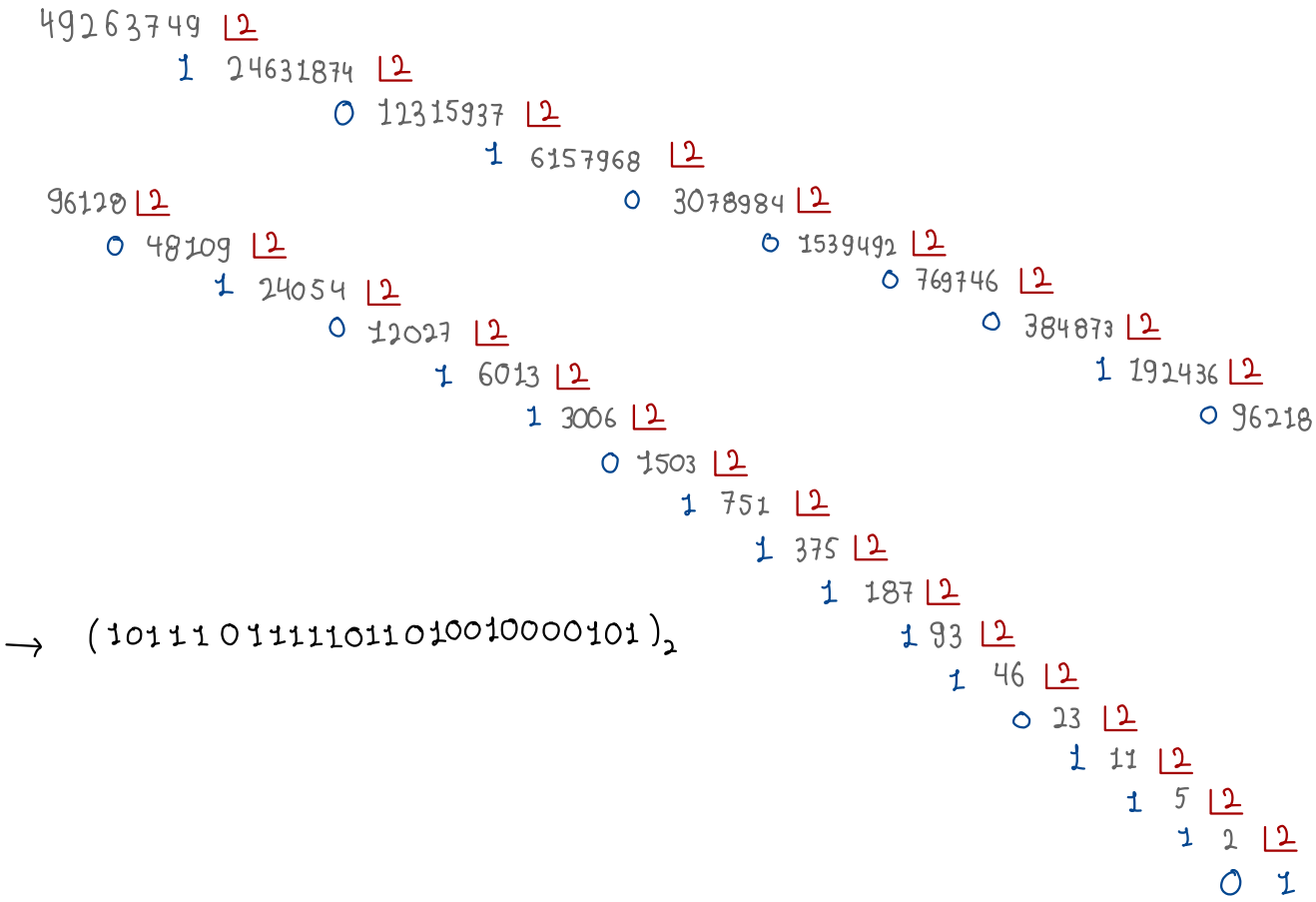
$(1369)_{10} \rightarrow$ binary



$(9234876)_{10} \rightarrow$ binary



$(49\,263\,749)_{10} \rightarrow$ binary

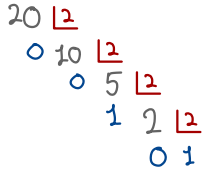


$\rightarrow (10111011111011010010000101)_2$

Decimal to binary (2's complement)

$(-20)_{10} \rightarrow$ binary (2's complement)

Positive value:



$\longrightarrow (20)_{10} \rightarrow (10100)_2$

1's complement

$$\begin{array}{r} 10100 \\ \hline 01011 \end{array} \quad (\text{flip bits})$$

2's complement

$$\begin{array}{r} 01011 \\ +\,1 \\ \hline 01100 \end{array}$$

$\rightarrow \overline{(101100)_2}$

6 digits

$(-1025)_{10}$ → binary (2's complement)

Positive value:

1025 |2
1 512 |2
0 256 |2
0 128 |2
0 64 |2
0 32 |2
0 16 |2
0 8 |2
0 4 |2
0 2 |2
0 1

→ $(10000000001)_2$

1's complement: 10000000001 → 01111111110

2's complement: 01111111110 + 1 = 01111111111 → $-(10111111111)_2$

12 digits

$(-3925)_{10}$ → binary (2's complement)

Positive value:

3925 |2
1 1962 |2
0 981 |2
1 490 |2
0 245 |2
1 122 |2
0 61 |2
1 30 |2
0 15 |2
1 7 |2
1 3 |2
1 1

→ $(111101010101)_2$

1's complement

111101010101 → 000010101010

2's complement: 000010101010 + 1 = 000010101011 → $-(1000010101011)_2$

13 digits

$(-104596)_{10}$ → binary (2's complement)

Positive value:

104596 |2
0 52298 |2
0 26149 |2
1 13074 |2
0 6537 |2
1 3268 |2
0 1634 |2
0 817 |2
1 408 |2
0 204 |2
0 102 |2
0 51 |2
1 25 |2
1 12 |2
0 6 |2
0 3 |2
1 1

→ $(11001100010010100)_2$

1's complement

1100110001001 0100

¬

0011001110110 1011

2's complement

0011001110110 1011

+ 1

0011001110110 1100

$-$

$(1\ 0011001110110\ 1100)_2$

18 digits

Unsigned binary to Hex

- $(1100\ 1111\ 0101\ 0110\ 0110\ 1110\ 1101\ 1000\ 0010\ 1001)_2$

Long method

1. Binary to decimal: → 890508335145

2. Decimal to Hex:

890508335145 |16
9 55656770946 |16
2 3478548184 |16
8 217409261 |16
13 13588078 |16
14 849254 |16
6 53078 |16
6 3317 |16
5 207 |16
15 12

→ CF566ED829

Short Method

1100	1111	0101	0110	0110	1110	1101	1000	0010	1001
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
12	15	5	6	6	14	13	8	2	9

→ CF566ED829

- $(1000\ 0111\ 1000\ 1110\ 0111\ 1000\ 1110\ 0011\ 1111\ 0011)_2$

Long method

1. Binary to decimal: → 582206678003

2. Decimal to Hex:

582206678003 |16
3 36387997375 |16
15 2274244835 |16
3 142140302 |16
14 8883768 |16
8 555235 |16
3 34702 |16
14 2168 |16
8 135 |16
7 8

→ 878E38E3F3

Short Method

1000	0111	1000	1110	0111	1000	1110	0011	1111	0011
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
8	7	8	14	3	8	14	3	15	3

→ 878E38E3F3

- $(1010\ 1101\ 0101\ 1100\ 0110\ 0101\ 0100\ 1010\ 1010\ 1010)_2$

Long method

1. Binary to decimal: → 744579484330

2. Decimal to Hex:

744579484330 |16
10 46536217770 |16
10 2908513610 |16
44380 |16
12 2773 |16
5 173 |16
13 10
10 181782100 |16
4 11361381 |16
5 710086 |16
6 44380

→ AD5C654AAA

Short Method

1010	1101	0101	1100	0110	0101	0100	1010	1010	1010
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
10	13	5	12	6	5	4	10	10	10

→ AD5C654AAA

- $(1010\ 0010\ 1010\ 1010\ 1010\ 1010\ 1011\ 1111\ 1100\ 0000)_2$

Long method

1. Binary to decimal: → 698648018880

2. Decimal to Hex:

698648018880 |16
0 43679050118 0 |16
12 272400 3323 |16
15 17055633 63 |16
41642 |16
10 2602 |16
10 162 |16
2 10
11 1066052 2 |16
10 66628 2 |16
10 41642

→ A2AAAABFC0

Short Method

1010	0010	1010	1010	1010	1010	1011	1111	1100	0000
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
10	2	10	10	10	10	11	15	12	0

→ A2AAABFC0

Signed Binary to octal

- $(111\ 111\ 000\ 001\ 111\ 100\ 000\ 001\ 110\ 101\ 011)_2$

Long method (Negative number)

1. Binary to decimal: → 130153557

2. Decimal to Octal:

130153557 |8
5 16269194 |8
2 2033649 |8
1 254206 |8
6 31775 |8
7 3971 |8
3 496 |8
0 62 |8
6 7

→ − 760376125

Short Method (Negative number)

2's complement: 000 000 111 110 000 011 111 110 001 010 101

000	000	111	110	000	011	111	110	001	010	101
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
/	/	− 7	6	0	3	7	6	1	2	5

→ − 760376125

- $(010\ 101\ 010\ 101\ 111\ 111\ 111\ 111\ 110\ 000\ 000)_2$

Long method (Positive number)

1. Binary to decimal: → 286470504

2. Decimal to Octal:

286470504 |8
0 35808688 |8
0 4476086 |8
6 559135 |8
7 69891 |8
7 8723 |8
7 1090 |8
7 136 |8
5 17 |8
2 2 |8
5 2

→ 25257777600

Short Method (Negative number)

010	101	010	101	111	111	111	111	110	000	000
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
2	5	2	5	7	7	7	7	6	0	0

→ 25257777600

- $(1110001110\ 000\ 001\ 111\ 111\ 100\ 000\ 101\ 010)_2$

Long method (Negative number)

1. Binary to decimal: → 1912080342

2. Decimal to Octal:

1912080342 | 8
6 239010042 | 8
2 29876255 | 8
7 3734531 | 8
3 466816 | 8
0 58352 | 8
0 7294 | 8
6 911 | 8
7 113 | 8
1 14 | 8
6 1

→ − 16176003726

Short Method (Negative number)

2's complement: 001 110 001 111 110 000 000 011 111 010 110

001	110	001	111	110	000	000	011	111	010	110
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
1	6	1	7	6	0	0	3	7	2	6

→ − 16176003726

- $(1010\ 101\ 010\ 100\ 000\ 101\ 010\ 101\ 011\ 111\ 000)_2$

Long method (Negative number)

1. Binary to decimal: → 572944424

2. Decimal to Octal:

572944424 | 8
0 71618553 | 8
1 8951994 | 8
4 1118993 | 8
2 139874 | 8
5 17484 | 8
2 2185 | 8
7 273 | 8
3 34 | 8
5 4 | 8
2 5

→ − 5253725240

Short Method (Negative number)

2's complement: 101 010 101 011 111 010 101 010 100 001 000

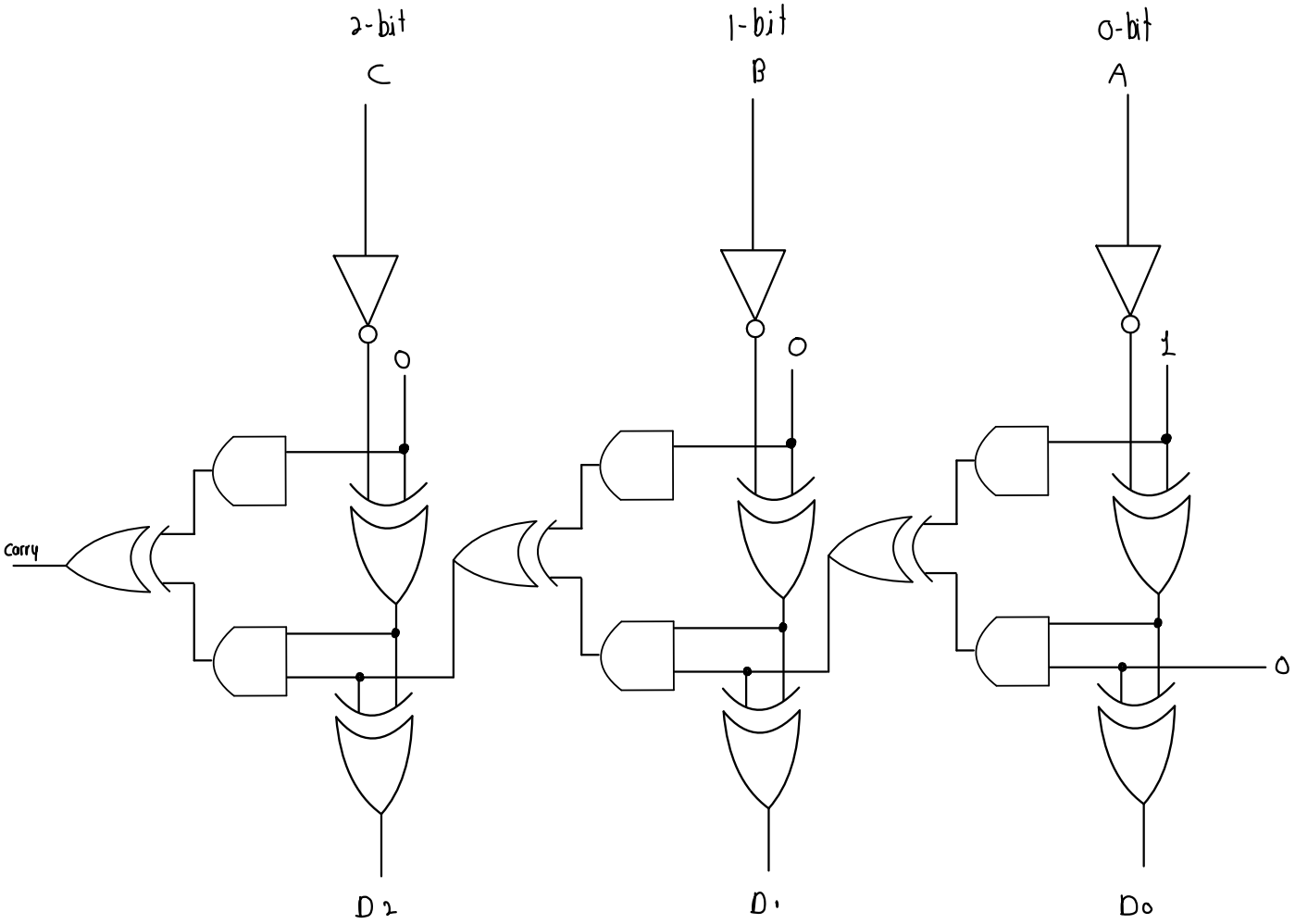
101	010	101	011	111	010	101	010	100	001	000
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
5	2	5	3	7	2	5	2	4	1	0

→ − 5253725240

2. Boolean Circuits

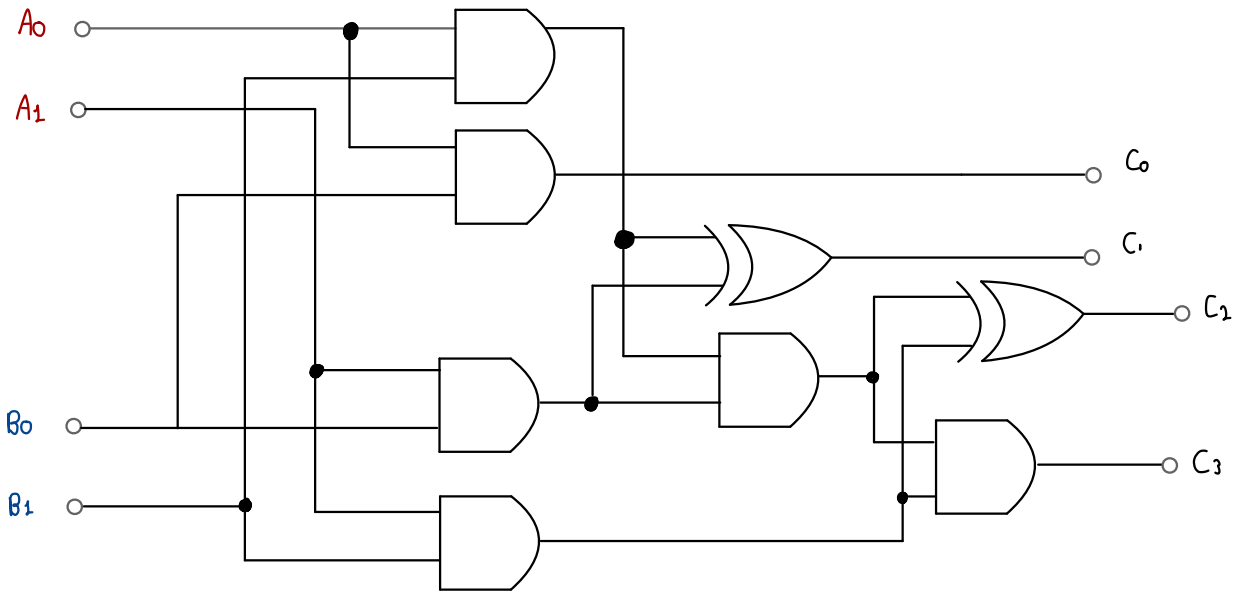
Circuit and truth table for:

- Multiplication of two binary numbers of length 2 bits



A	B	C	D_0	D_1	D_2
0	0	0	0	0	0
0	0	1	1	1	1
0	1	0	1	1	0
0	1	1	1	0	1
1	0	0	1	0	0
1	0	1	0	1	1
1	1	0	0	1	0
1	1	1	0	0	1

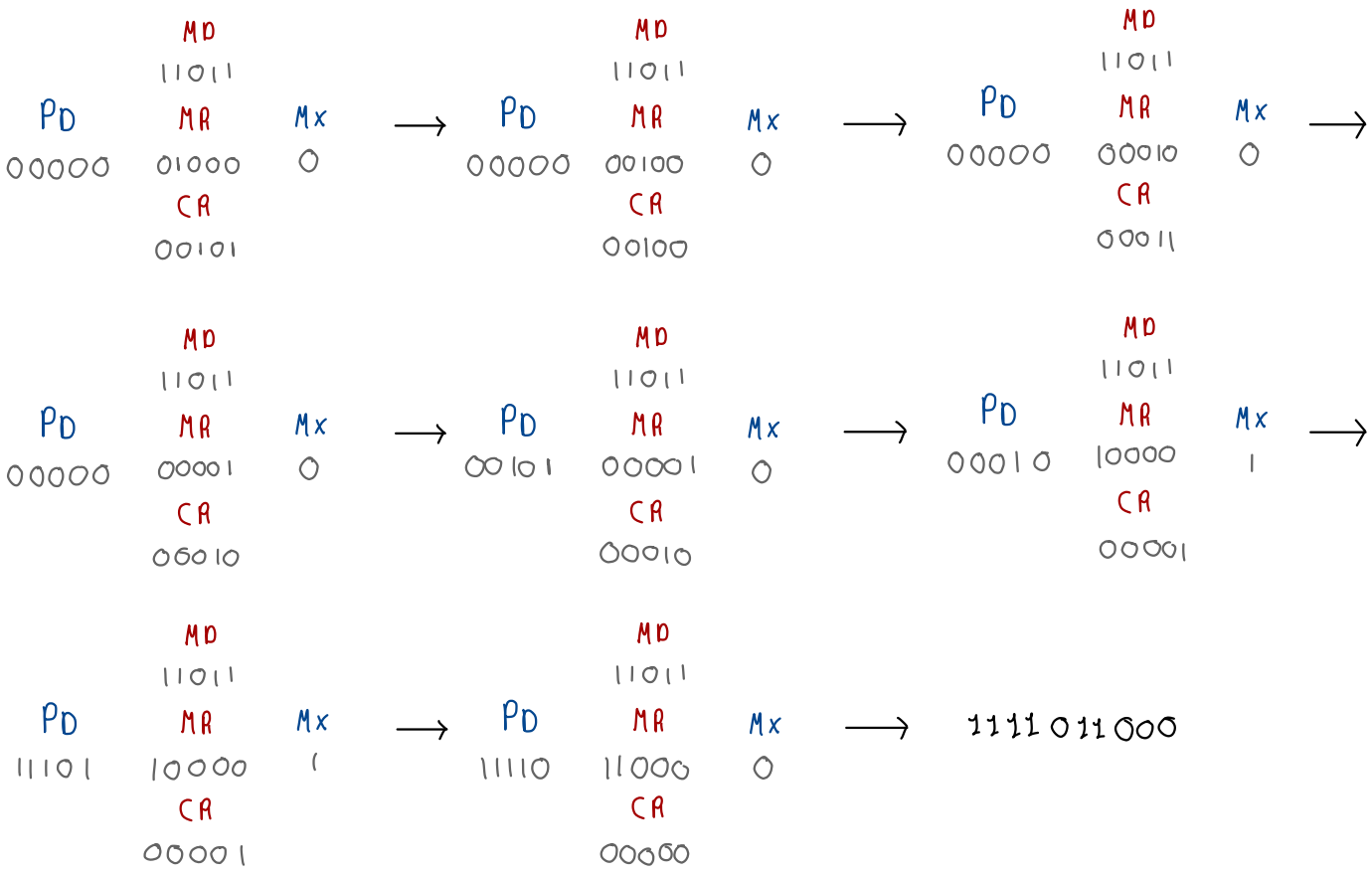
- Two's complement for a binary number of length 3 bits



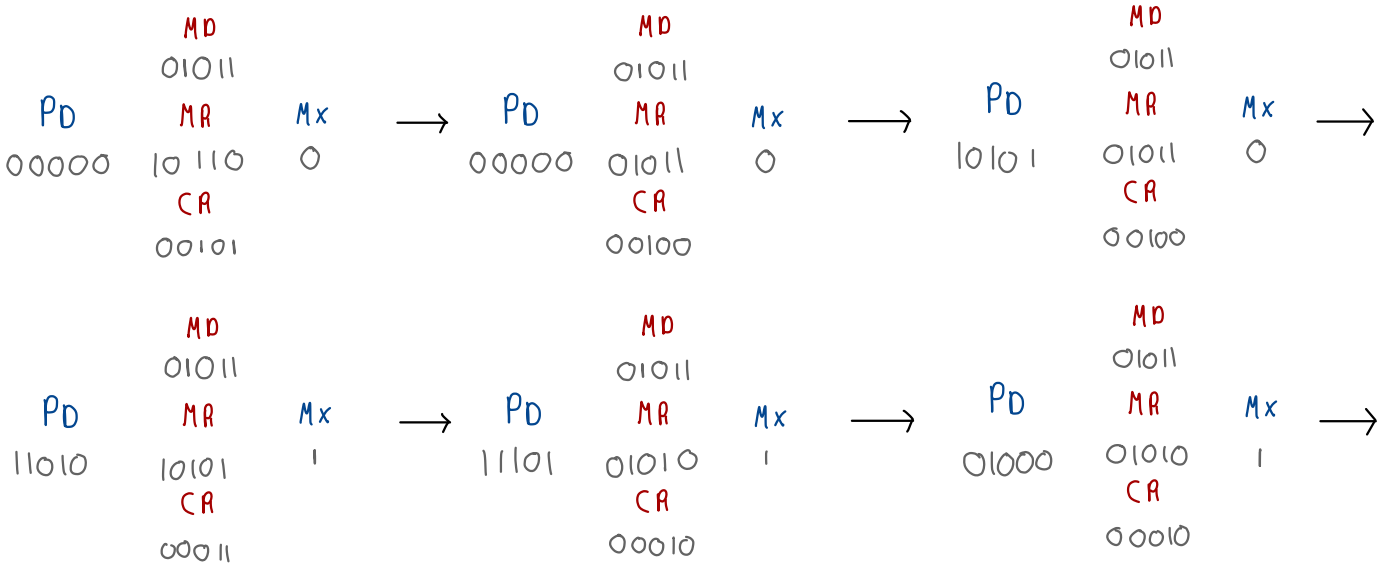
A_0	A_1	B_0	B_1	C_0	C_1	C_2	C_3
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0
0	0	1	0	0	0	0	0
0	0	1	1	0	0	0	0
0	1	0	0	0	0	0	0
0	1	0	1	0	0	0	1
0	1	1	0	0	0	1	0
0	1	1	1	0	0	1	1
1	0	0	0	0	0	0	0
1	0	0	1	0	0	1	0
1	0	1	0	0	1	0	0
1	0	1	1	0	1	1	0
1	1	0	0	0	0	0	0
1	1	0	1	0	0	1	1
1	1	1	0	0	1	1	0
1	1	1	1	1	0	0	1

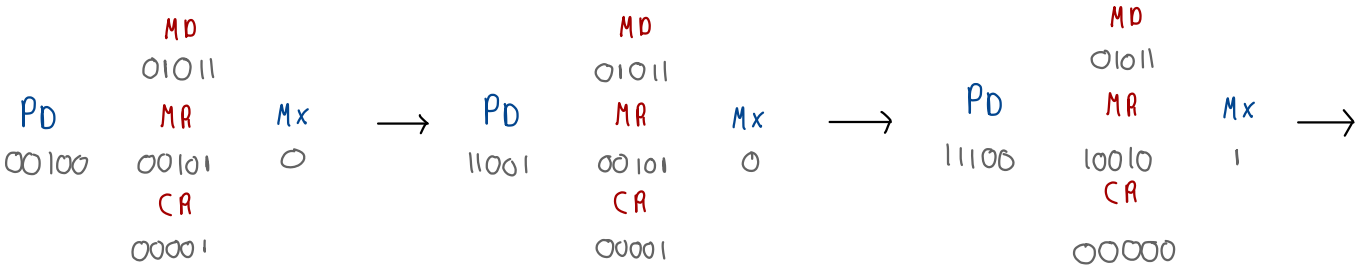
3. Binary Multiplication

- -5×8 : $5 \rightarrow 00101$ $\xrightarrow{2's}$ 11011 MD
  $8 \rightarrow 01000$ MR



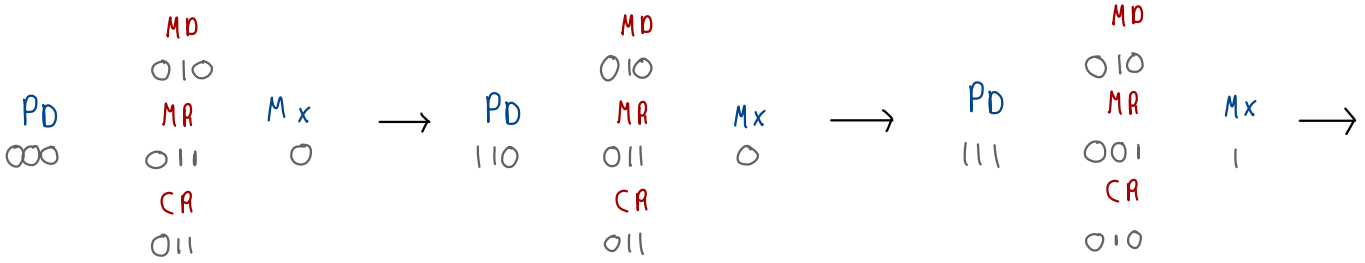
- $11 \times (-10)$: $11 \rightarrow 01011$ MD
  $10 \rightarrow 01010$ $\xrightarrow{2's}$ 10110 MR

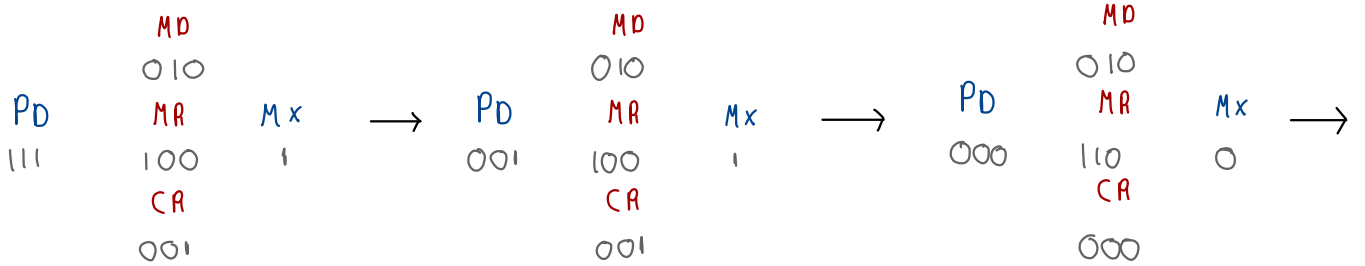




$\longrightarrow$ 1111001001O

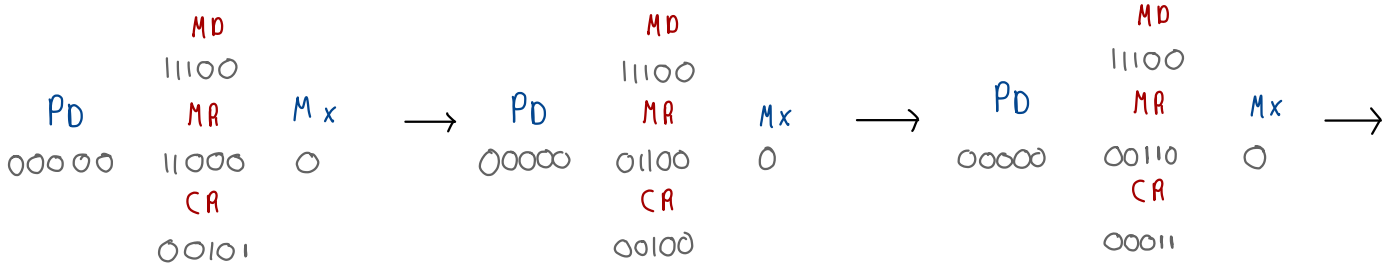
- 2 × 3: 2 → 010 MD
  3 → 011 MR

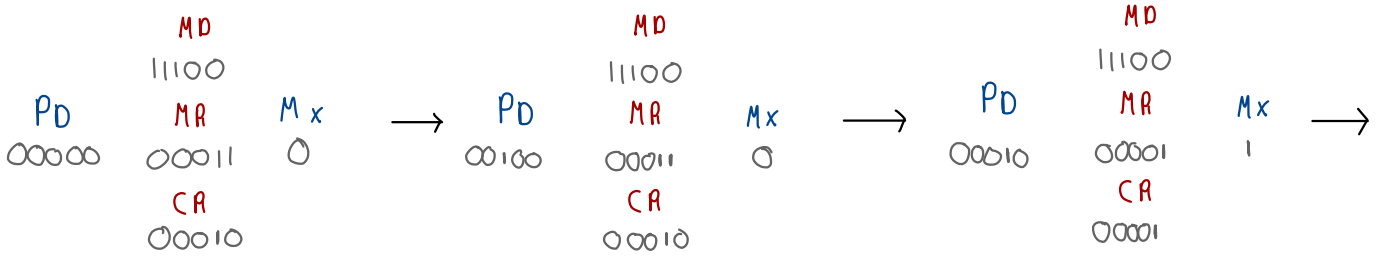


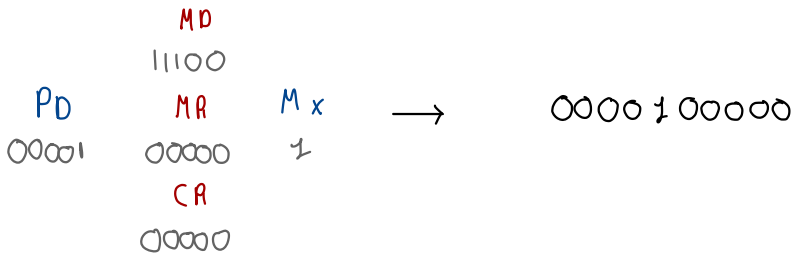


$\longrightarrow$ 000110

- (-4) × (-8): 4 → 00100 $\xrightarrow{2's}$ 11100 MD
  8 → 01000 $\xrightarrow{2's}$ 11000 MR






MD
11100
PD
MR
Mx
00001
00000
1
CR
00000
0000100000