Addition of two 1's-complement numbers N_1 and N_2

A) Case 1

N1 and N2 are both positive.

RULE 1:

When N1 and N2 are both positive, add the numbers.

a) If the left most bit (i.e. sign bit) of the resulting number is a 0, it indicates that the answer is correct.

b) If the left most bit (i.e. sign bit) of the resulting number is a 1, it indicates an overflow (i.e. the answer is incorrect).

ex

(+17) : 010001

+(+10) : 001010

(+27) : 011011

(+17) : 010001

(+18) : 010010

+

(-28) : 100011

1's

overflow

011100

35

$-31 < N < +31$ for $n=6$

B) Case 2

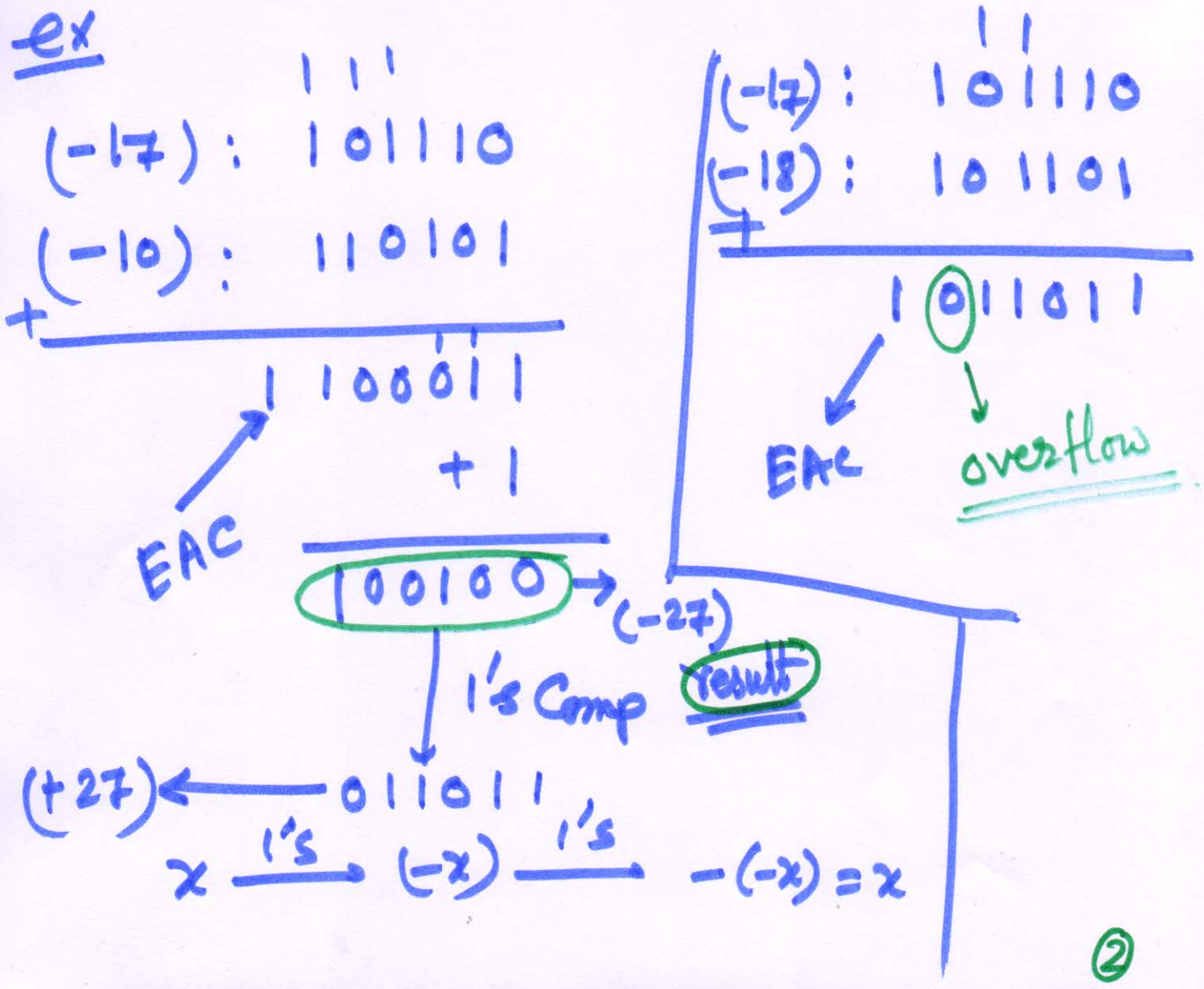
N1 and N2 are both negative.

RULE 2:

When two negative numbers are added, an end-around-carry (EAC) always occurs. This EAC is added to the least significant bit (LSB) position.

a) If the left most bit (i.e. sign bit) of the resulting number is a 1, it indicates that the answer is correct. It signifies that the resulting number is negative, and to obtain its decimal value, take 1's-complement of the resulting number first and then convert it to decimal.

b) If the left most bit (i.e. sign bit) of the resulting number is a 0, it indicates an overflow (i.e. the answer is incorrect).



C) Case 3

N1 and N2 have different signs.

RULE 3:

Two numbers, N1 and N2, of unlike signs are added and

a) If the positive number is larger, an EAC always occurs. This EAC is added to LSB position.

b) If the negative number is larger, there is no such carry. The left most bit (i.e. sign bit) of the resulting number turns out to be a 1 signifying a negative resulting number whose decimal value could be obtained by taking 1's-complement of the resulting number first and then converting the result to decimal.

ex

```
          1     1
(+17) :  0 1 0 0 0 1
(-10) :  1 1 0 1 0 1
+ ---------------------
        1 0 0 0 1 1 0
        ↓          + 1
       EAC ---------------
(+7)  ←  0 0 0 1 1 1
```

```
          1 1 1
(-17) :  1 0 1 1 1 0
(+10) :  0 0 1 0 1 0
+ ---------------------
(-7)  ←  1 1 1 0 0 0
               |  1's Comp
               ↓
(+7)  ←  0 0 0 1 1 1
```

Addition of two 2's-complement numbers N1 and N2

A) Case 1

N1 and N2 are both positive.

RULE 1:

When N1 and N2 are both positive, add the numbers.

a) If the left most bit (i.e. sign bit) of the resulting number is a 0, it indicates that the answer is correct.

b) If the left most bit (i.e. sign bit) of the resulting number is a 1, it indicates an overflow (i.e. the answer is incorrect).

- The rule is same as that for the 1's-complement system.

B) Case 2

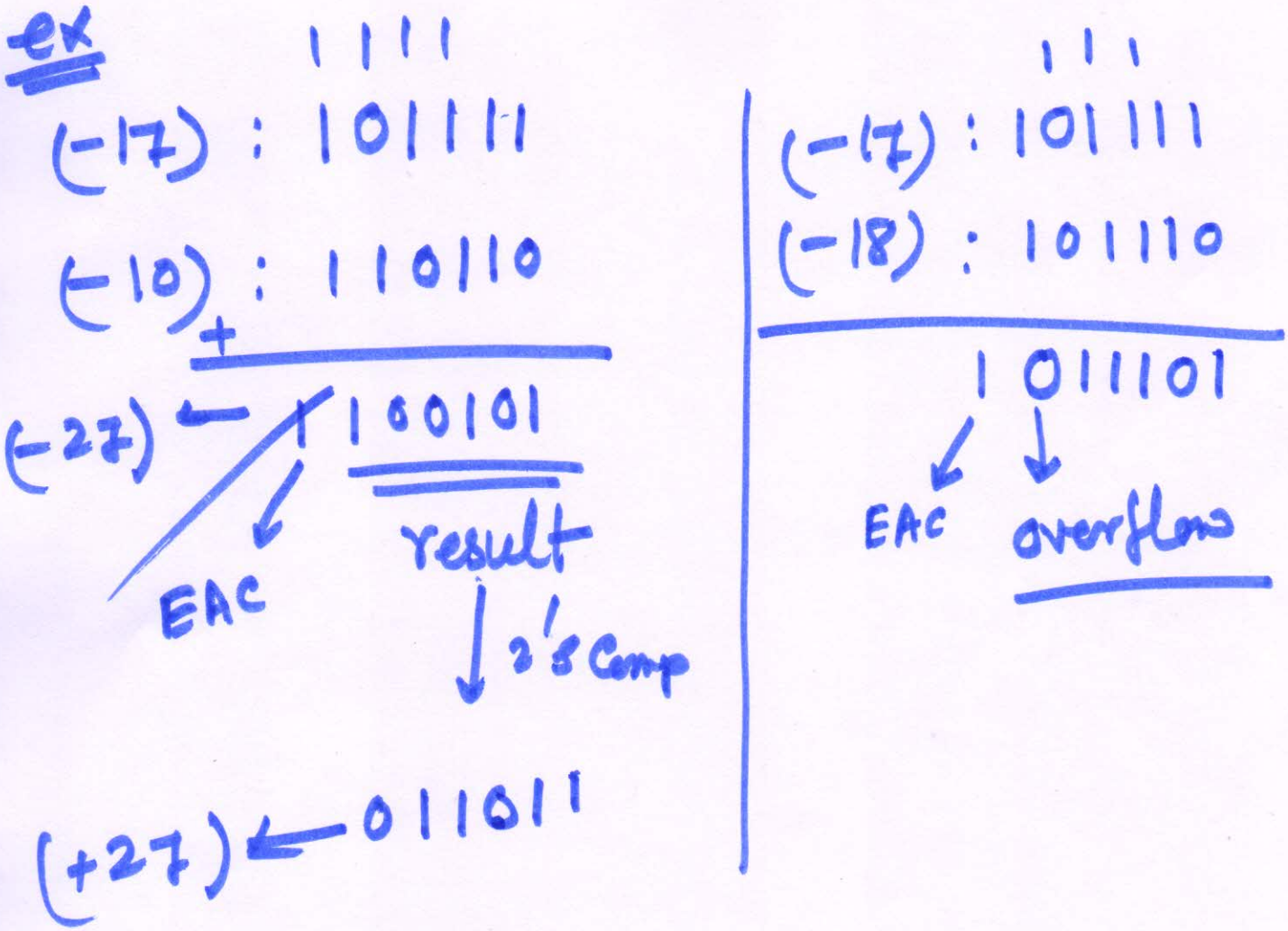
N1 and N2 are both negative.

RULE 2:

When two negative numbers are added, an EAC always occurs, but it must be disregarded.

a) If the left most bit (i.e. sign bit) of the resulting number is a 1, it indicates that the answer is correct. It signifies that the resulting number is negative, and to obtain its decimal value, take 2's-complement of the resulting number first and then convert it to decimal.

b) If the left most bit (i.e. sign bit) of the resulting number is a 0, it indicates an overflow (i.e. the answer is incorrect).



C) Case 3

N1 and N2 have different signs.

RULE 3:

Two numbers, N1 and N2, of unlike signs are added.

a) If the positive number is larger, an EAC always occurs. The EAC is ignored.

b) If the negative number is larger, there is no such carry. The left most bit (i.e. sign bit) of the resulting number turns out to be a 1 signifying a negative resulting number whose decimal value could be obtained by taking 2's-complement of the resulting number first and then converting the result to decimal.

ex

```
          1
(+17) :  010001
(-10) :  110110
+ ----------------
(+7)  : 1 000111
        ↓
       EAC
   (neglected)
```

```
          111
(-17) :  101111
(+10) :  001010
+ ----------------
(-7)  :  111001
(no EAC)    | 2's Comp
            ↓
(+7) ← 000111
```