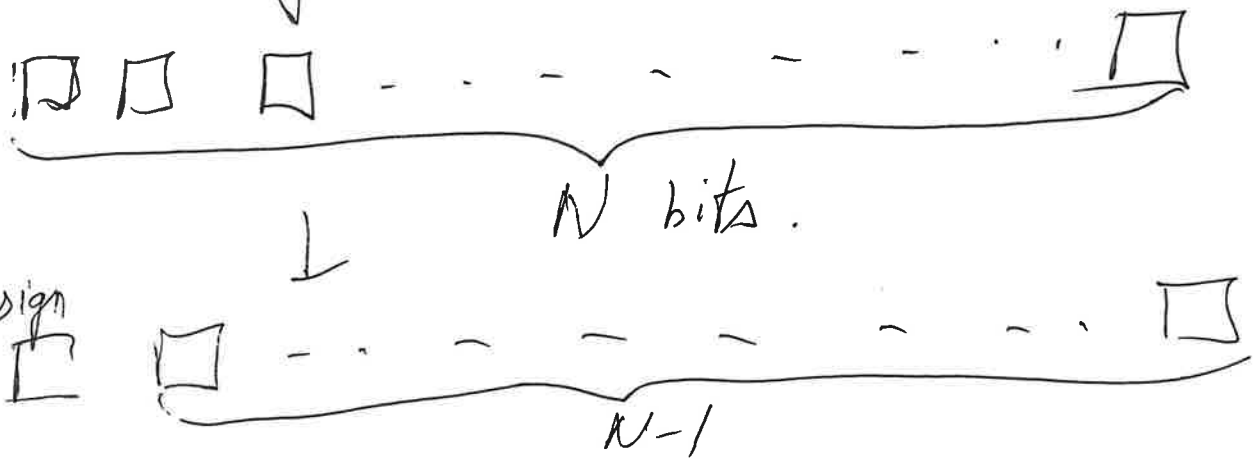
Discussion 2 1/12/26

$(101)_{10}$ → next one: 102

$(101)_2$ → next one $(110)_2$

$(100)_2$ → next one $(101)_2$
→ previous one $(011)_2$

N bits
- to represent unsigned integers
  - largest one: $2^N - 1$
  - # of numbers: 2^N
- to represent signed integers:
  - largest one: $2^{N-1} - 1$



On N bits:

how many positive numbers: 2^{N-1}

how many negative numbers: 2^{N-1}

$$2^{N-1} + 2^{N-1} - 1$$

$$2^N - 1$$

Exercise 2 :

Let $A = (1010)_2$ and $B = (11011)_2$ (both unsigned integers).

Can you find the binary representation (unsigned) of the number C such that $A + C = B$

Solution:

$$A = (1010)_2 = (10)_{10}$$

$$B = (11011)_2 = (27)_{10}$$

In decimal: $10 + C = 27 \rightarrow C = (17)_{10}$

$$C = (17)_{10} = (10001)_2$$

Exercise 3

Let $A = \#89$ and $B = (1111111)_2$

Find the hexadecimal representation of the number X that satisfies

$$X + B = A.$$

In base 10:

$$B = (1111111)_2 = (127)_{10}$$

$$A = \#89 = 8 \times 16 + 9 = (137)_{10}$$

$$X = (137)_{10} - (127)_{10} = (10)_{10}$$

$$X = \#A.$$

Exercise 4 We are on the island of knights and knaves. We meet Sue and Bob

Sue: Bob is a knave

Bob: We are both knights.

(4)

Sue	Bob	S_1	S_2	
(K)	K	(F)	T	X
K	N	T	F	
N	(K)	F	(F)	X
(N)	N	(T)	F	X

K: knight

N: knave

Conclusion: Sue is a knight and Bob is a knave.

Exercise 5: We are still on the island of knights and knaves. We meet 3 people, Sue, Bob, and Mel.

Sue: "Only a knave would say that Bob is a knave." → Bob is a knight

Bob: "It is false that Mel is a knave". → Mel is a knight

Mel: "Bob would tell that I am a knave".

Sue	Bob	Mel	S_1	S_2	S_3	
K	K	K	T	T	F	X
K	K	N	T	F	T	X
K	N	K	F	T	T	X
K	N	N	F	F	F	X
N	K	K	T	T	F	X
N	K	N	T	F	T	X
N	N	K	F	T	T	X
N	N	N	F	F	F	X

K: Knight
N: Knave

Conclusion: Sue, Bob, and Mel are knaves