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Programming and Data Structures with Python

Iteration

Find v in list l

if v in l:

≡

```
found = False
for x in l:
    if v == x:
        found = True
```

Examine found

Find ~~first~~ last position of v in l ?

$0, 1, \ldots, \text{len}(l) - 1$

```
found = False
position = -1
index = 0
for x in l:
    if v == x:
        found = True
        position = index
    index = index+1
```

Instead

Iterate through positions

Index i, value l[i]

range(m) → 0, 1, 2, .., m-1

range(len(l))

```
found = False
position = -1
for i in [0, 1, ... ]:
    if v == l[i]:
        found = True
        position = i
```

Numbers

Integers $\mathbb{Z}$ — 2

Reals $\mathbb{R}$ — 2.0

Complex

$\mathbb{Z} \subseteq \mathbb{R}$

$10_{\text{Ten}} < 10_{\text{Two}}$

Representation/storage

Computers use binary representation

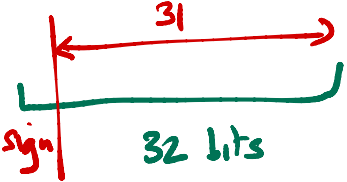
Non negative integer: $n \longrightarrow$ n in base 2

$\Downarrow$

Integers

Value + Sign

0 - +
1 + -



2's complement

$0 - (2^{32} - 1)$

Represent n as $2^{32} - n$

-0, +0 !

4 bits

5 → 8 4 2 1 → 0 1 0 1

-5

$$\begin{array}{r} 10000 \\ -\ 0101 \\ \hline 1011 \\ \hline 10000 \end{array}$$

-0?

$$\begin{array}{r} 10000 \\ -\ 00000 \\ \hline 00000 \end{array}$$

32 bits.

$|N| \leq 2^{31}$

$2^{10} = 1024 \approx 1000$

$2^{30} \approx 10^9$

2^{31} 2×10^9 2 billion = 200 crore

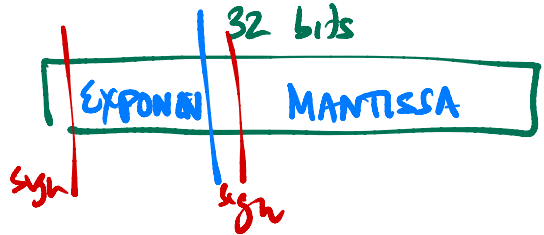
Very big n very small

6.02×10^{23}

Fix the decimal point

Ideally 0.602×10^{24}

mantissa exponent



Integers & "Reals" are different data types

Operations are implemented differently

Reals = "Floating Point"

int float

Arithmetic

+, −, *, / → always produce a float

int $\overset{+}{-}$ int → int

int / int ?

Quotient 7 ÷ 3

Q = 2 ✓

R = 1

7 // 3 − Q

7 % 3 − R

Check if n is prime

2 factors, 1 & n

```
prime = True
for f in range(2,n):
    if n % f == 0
        prime = False
```