

Collatz conjecture

Start with a ^{positive} integer n . Follow these steps:

- repeat...
- ① if $n = 1$, stop.
 - ② if n is even, divide by 2.
 - ③ if n is odd, set $n = 3n + 1$.

Conjecture: the above process terminates in a finite # of steps for all $n \in \mathbb{Z}^+$.

$$6 \xrightarrow{\textcircled{2}} 3 \xrightarrow{\textcircled{3}} 10 \xrightarrow{\textcircled{2}} 5 \xrightarrow{\textcircled{3}} 16 \xrightarrow{\textcircled{2}} 8$$

$$\xrightarrow{\textcircled{2}} 4 \xrightarrow{\textcircled{2}} 2 \xrightarrow{\textcircled{2}} 1 \quad \text{stop because } \textcircled{1}. \quad \checkmark$$

New topic: functions

Kind of like functions from math class...

Math class

$$f: \mathbb{R} \rightarrow \mathbb{R}$$

$$f(10.2)$$

$$f(x) = x^2 + 3$$

$$f: \mathbb{R} \times \mathbb{Z} \rightarrow \mathbb{Z}$$

Programming (C/C++)

```
double f(double x);
```

```
f(10.2);
```

```
double f(double x) {  
    return x*x + 3;  
}
```

```
int f(double x, int y);
```

Important: in C/C++, functions might not be deterministic, and might further have side-effects.

Views of functions:

- Intra-program communication
(contrast w/ in/cout which
give interprogram communication..)
- Organizational tool...