Basics of Algorithmics with Python

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Outlines

- What is an algorithm ? Basic concepts

- What is a program ?

- How can I create my own program with Python ?

An algorithm for what ?

- An algorithm is a « normalized and non ambiguous» description of how a problem can be solved.

- Example : How can I do pancakes ?

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Good Old Fashioned Pancakes

★★★★½ **Read Reviews (7302)**

READY IN
20 mins

Recipe by dakota kelly

"This is a great recipe that I found in my Grandma's recipe book. Judging from the weathered look of this recipe card, this was a family favorite."

Ingredients   Edit and Save

Original recipe makes 8 servings   Change Servings

- ☐ 1 1/2 cups all-purpose flour
- ☐ 3 1/2 teaspoons baking powder
- ☐ 1 teaspoon salt
- ☐ 1 tablespoon white sugar
- ☐ 1 1/4 cups milk
- ☐ 1 egg
- ☐ 3 tablespoons butter, melted

Directions

1. In a large bowl, sift together the flour, baking powder, salt and sugar. Make a well in the center and pour in the milk, egg and melted butter; mix until smooth.

2. Heat a lightly oiled griddle or frying pan over medium high heat. Pour or scoop the batter onto the griddle, using approximately 1/4 cup for each pancake. Brown on both sides and serve hot.

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ers

Well, I probably missed something !
I need a more formalized language !

Let us now take a look on a real programming language !

melted

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Let us ... age !

Some alternatives ?

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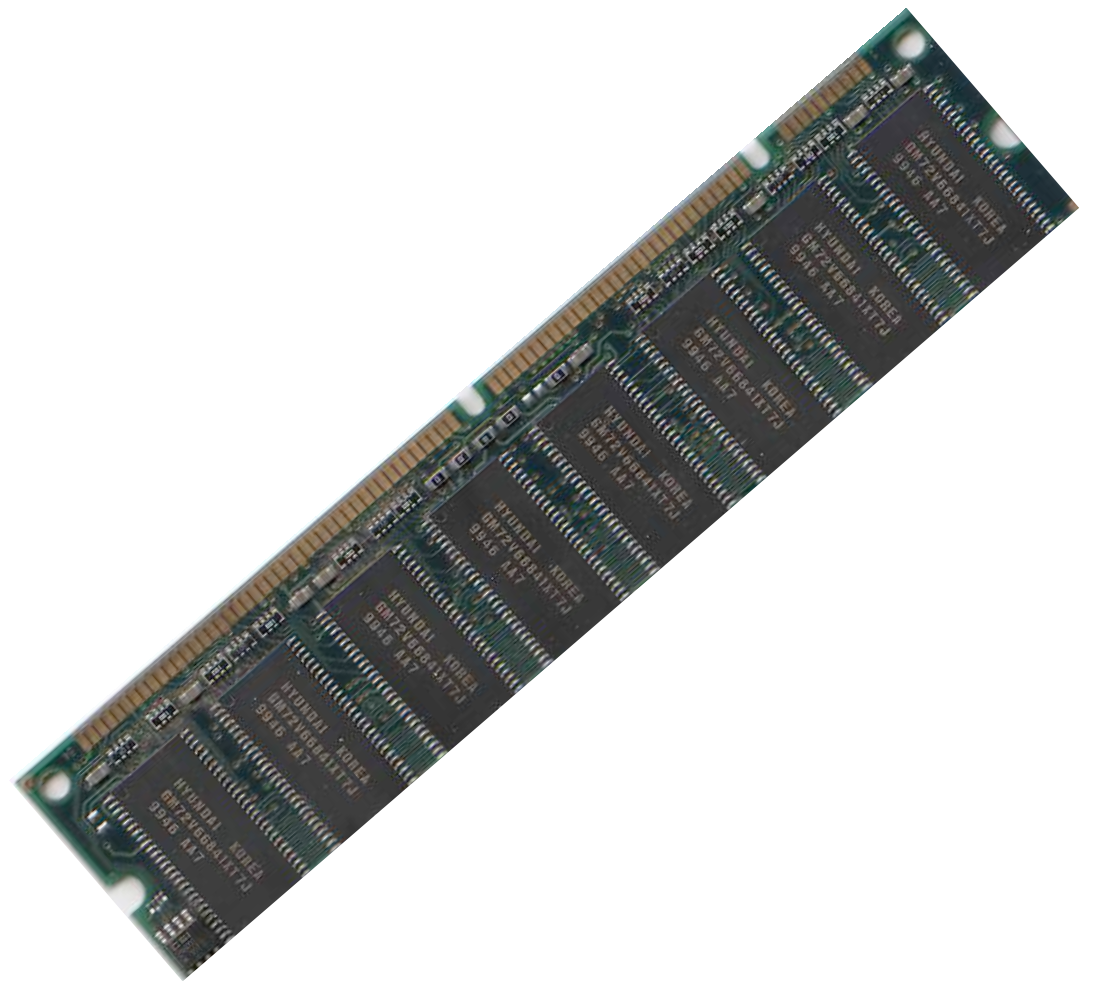
Main ingredient 1 Variables

- Permit a dialog between the physic memory of the computer and the program (in an abstracted way).

Main ingredient 1
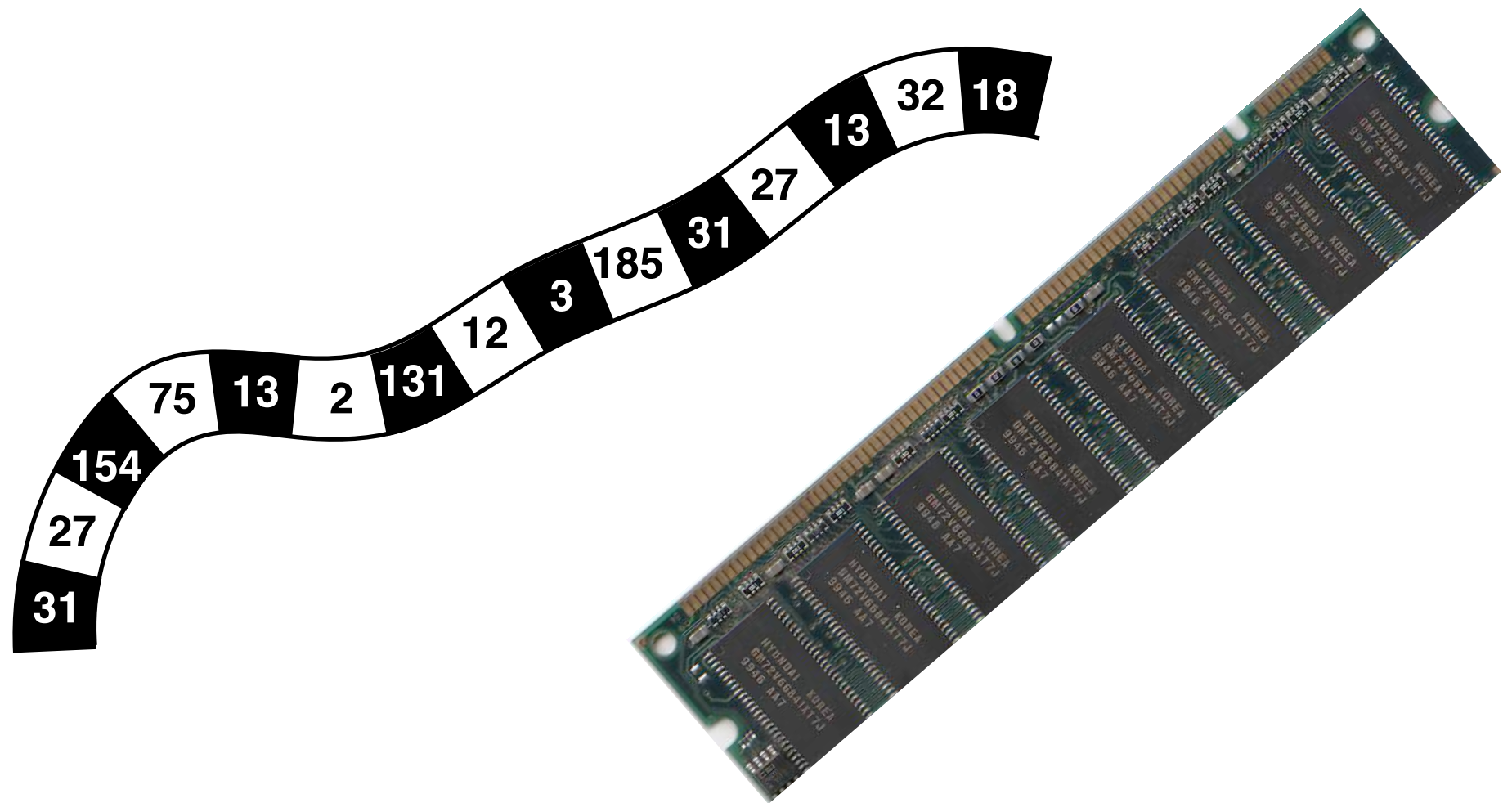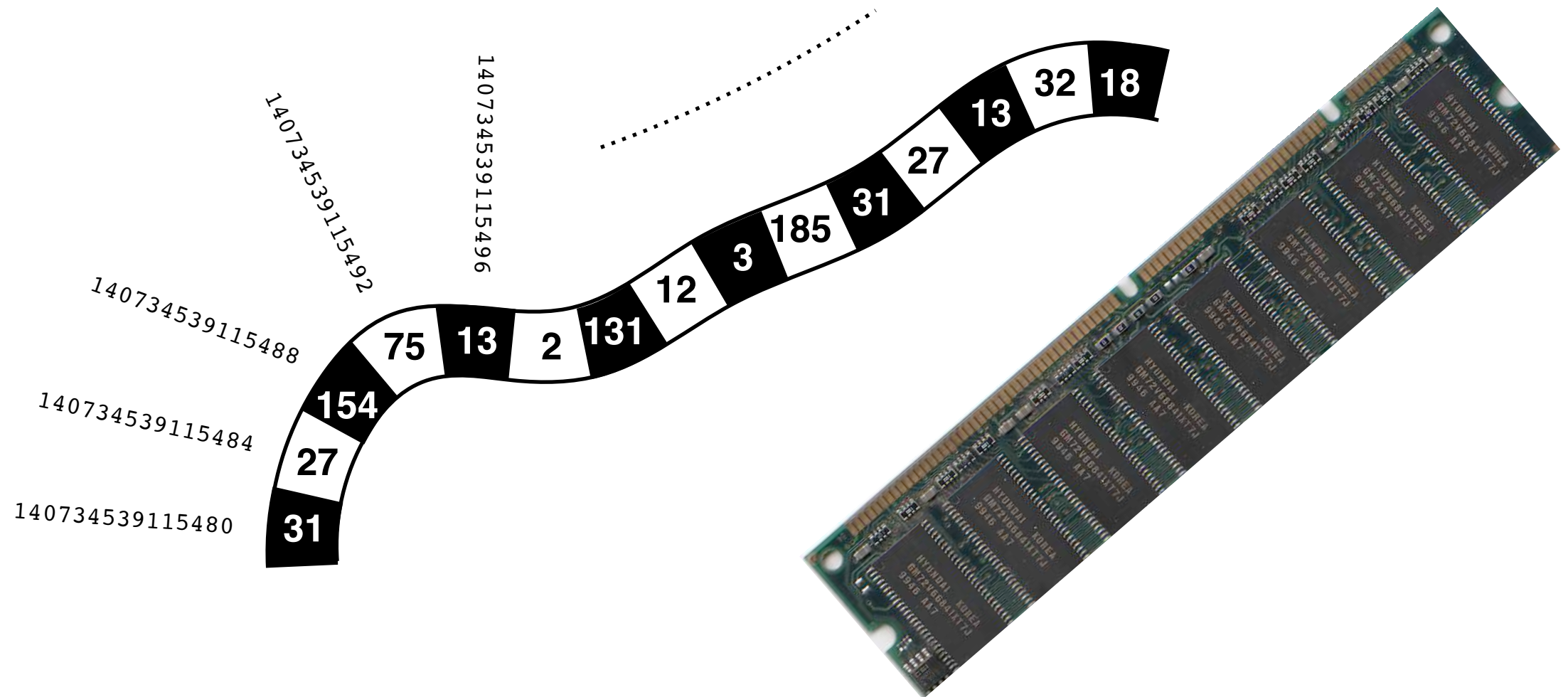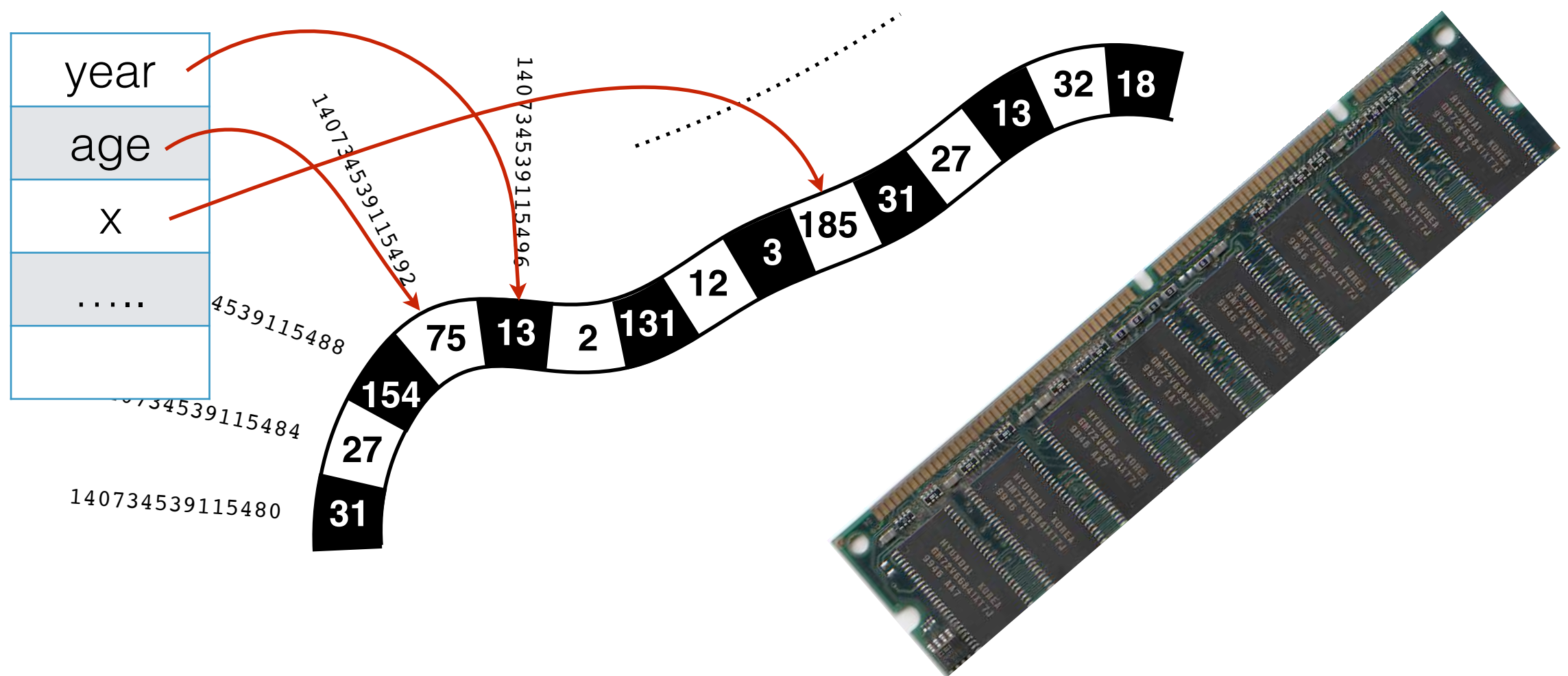# Variables

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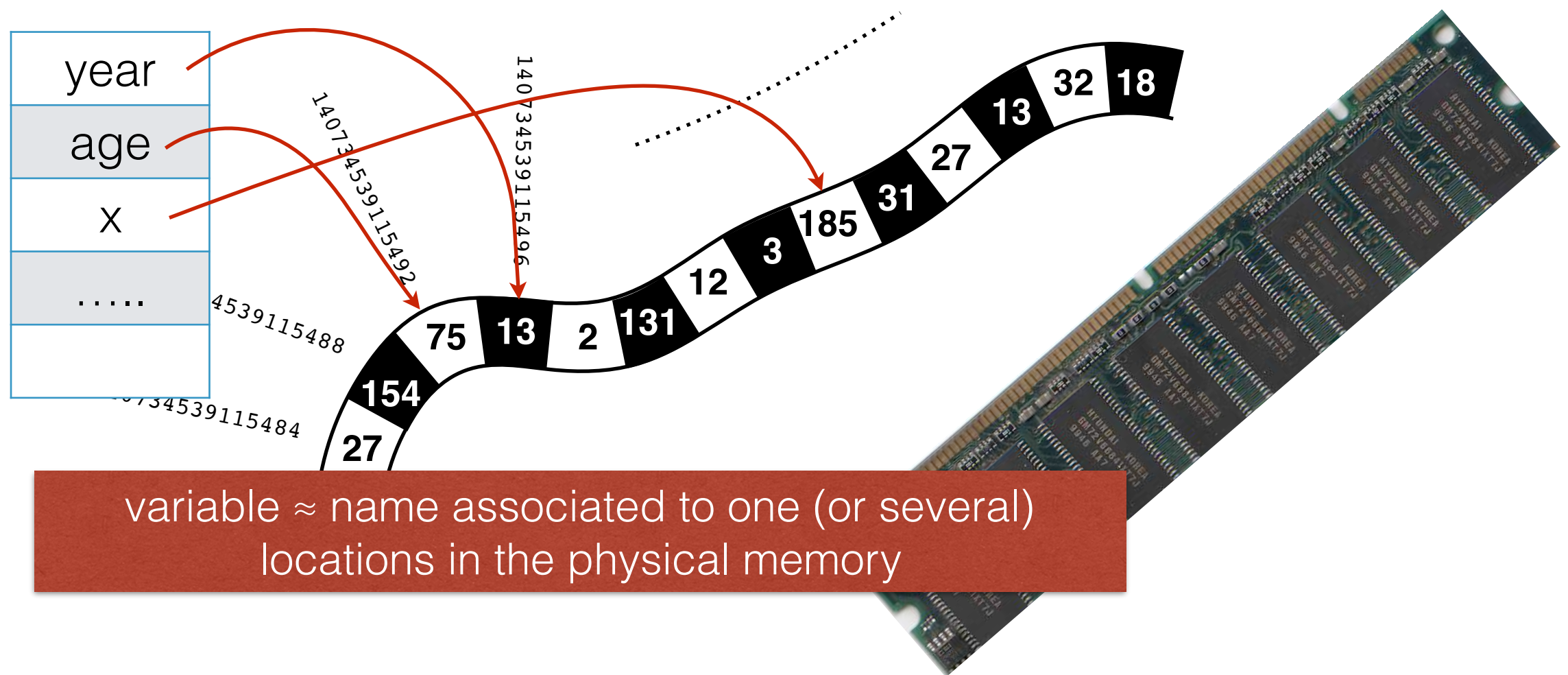# Variables

Main ingredient 1
Variables

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Variables

variable ≈ name associated to one (or several) locations in the physical memory

Main ingredient 1 Variables

- Variables « stores » a **value** of a given **type**.

- 3 simple types: numbers (int or floats), strings or booleans.

- x = 5.0

- s = "Hello"

- b = True

Main ingredient 2
Instructions

- x = *expression*   *Modifies the memory/value of x*

- x = input()   *Ask the user for a value to attribute to x*

- print(x)   *Report the value of x to the user*

What is a program ?
Imperative paradigm

1. Encode an unsolved problem in memory (ask the user for some values)

2. Perform all required computations to solve the problem (the values of variables are changed one by one by some instructions)

3. Prove to the user that the problem is solved by printing the values of some variables

What is a program ?

Imperative paradigm

Description of the problem: how much will I pay for some pieces of bread that costs 1€HT each

```
price_whitout_taxes = 1 euros
quantity = int(input())
taxes_rate = 20%
```

Solve the problem

```
Total_price = price_whitout_taxes x quantity x (1+taxes_rates/100)
```

Proof

```
print(Total_price)
```

printing the values of some variables

Enhance the programming language I Conditional statements

- For alternative treatments

```
if (test):
        instructions if test is True
else:
        instructions if test is False
```

- else statement is facultative

Enhance the programming language I
Conditional statements

- For alternative treatments

if (te...
        ...ue
else...
        ...lse

```
temp = int(input())
if (temp < 0)
        print("Oh it's freezing !")
else:
        print("what a nice weather !")
```

- else statement is facultative

Enhance the programming language 2 arrays/lists

- A special type of variable
- L = [5,6,8,7]
- print(L[1])
- L[2] = 10
- L.append(10)
- L.sort()
- len(L)
- Draw something

```
import matplotlib.pyplot as np
np.plot(L)
np.show()
```

Enhance the programming language 3 dictionaries

- Another special type of variable

- D = {"Name": "Bourdon","Age": 18}

- print(D.get("Name"))

- D["Age"] = 19

- NB: values can be lists (or lists of lists or lists of dictionaries,......)

Enhance the programming language 4 Loops

- « for » loop

  for i in range(1,10):
  instructions that can use i

- « while » loop

  while (test):
  instructions that must modify test

Enhance the programming language 5
Iterate on everything with a for loop

- Iterate on strings (s="Hello world")

```
for c in s:
    print(s)
```

- Iterate on lists (L=[2,5,7])

```
for e in L:
    print(e)
```

- Iterate on dicts

```
for k in D:
    print(k,D.get(k))
```

Enhance the programming language 6
Files storage

- Reading a (text) file

```
fd = open("data.txt","r")
for l in fd:
    print(l)
fd.close()
```

- Write to a (text) file

```
fd = open("data.txt","w")
for e in L:
    fd.write(str(e))
fd.close()
```

- Reading a (csv) file

```
T=list()
fd = open("data.csv","r")
for l in fd:
    T.append(l.split(";"))
fd.close()
```

Enhance the programming language 7 Functions

```
def MyFunctionName(parameters):
    instructions
    return value
```

```
def Pancakes(n):
        flour = 1.5*n/8
        backed_powder = 3.5*n/8

        …..
        pancake_batter = [flour, backed_powder,…]
        while (not smooth(pancake_batter)):
            mix(pancake_batter)
        pancakes = …….
        return pancakes
```

Now its your turn !

Terminal
« Jupyter notebook »