INIAD CS Essentials

1-1: Let’s Get Introduced to Python

Python is a Programming Language

1. What is programming?

Means of making the computer process information the way you want, for example, for doing number crunching, string manipulation, displaying graphics, playing sound, etc.

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Roles of computers and programming

- Our society depends on computers on a day-to-day basis
  - Numerous consumer electronics
    - Smartphones and PCs.
    - Home electronics (Air conditioners, microwave, TV, etc.)
  - Various public services
    - Economic activity (e-commerce), Political activities (e-government), etc.
    - Weather forecast, traffic signals, electronic displays at stations, etc.

- Programming = making such activities
  - Using the computer is just like eating served food
  - Programming is like cooking your own food

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Programming is very important

- A computer is a tool for labor saving
  - Programming can automate various things
    - For example, by programming a mechanized farm, it is cheaper, more efficient, and more delicious and nutritious crops are achieved without manpower.
  - In modern society, programming is important not only for computer experts, but also for people from other industries

Strawberry Farm Using ICT technology(* 1)

Farmnote 2.0 Management of the Ranch by(* 2)

Source
(* 1) Https://www.tohoku-epco.co.jp/fukyu/report/contents/f45_ichigo/index.html
(* 2) https://farmnote.jp/press-release/20150413.html

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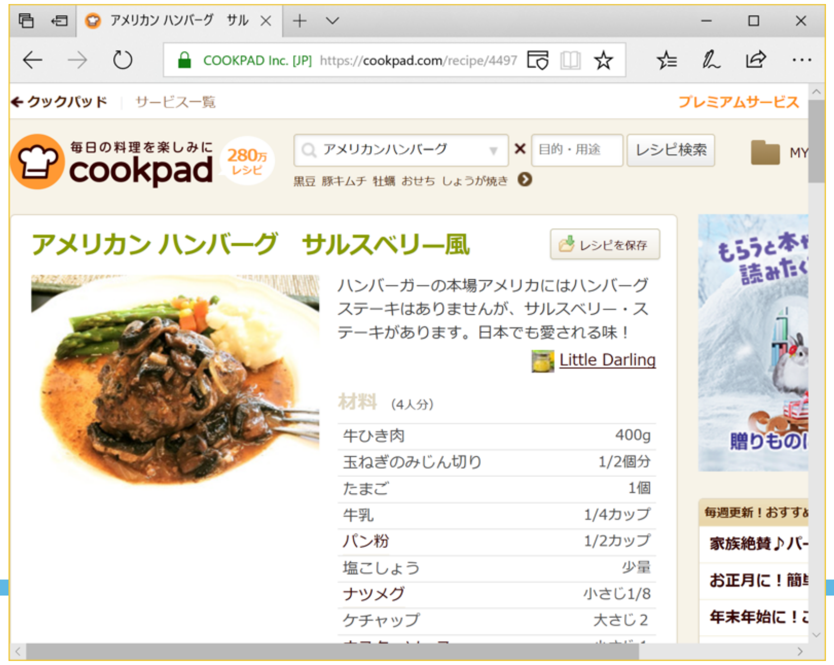
Program = Recipe to Computers

- Programming = Teaching computer how to do any task
- Like a recipe for a cook who does not know hot to cook
  - Depending on the recipe you will get hamburger, sushi, and so on

- You can get whatever you want by changing the recipe
  - This universality is the essential feature of computers (more precisely referred to as **von Neumann Computer**」)
  - Program (Software) = Recipe for the computer



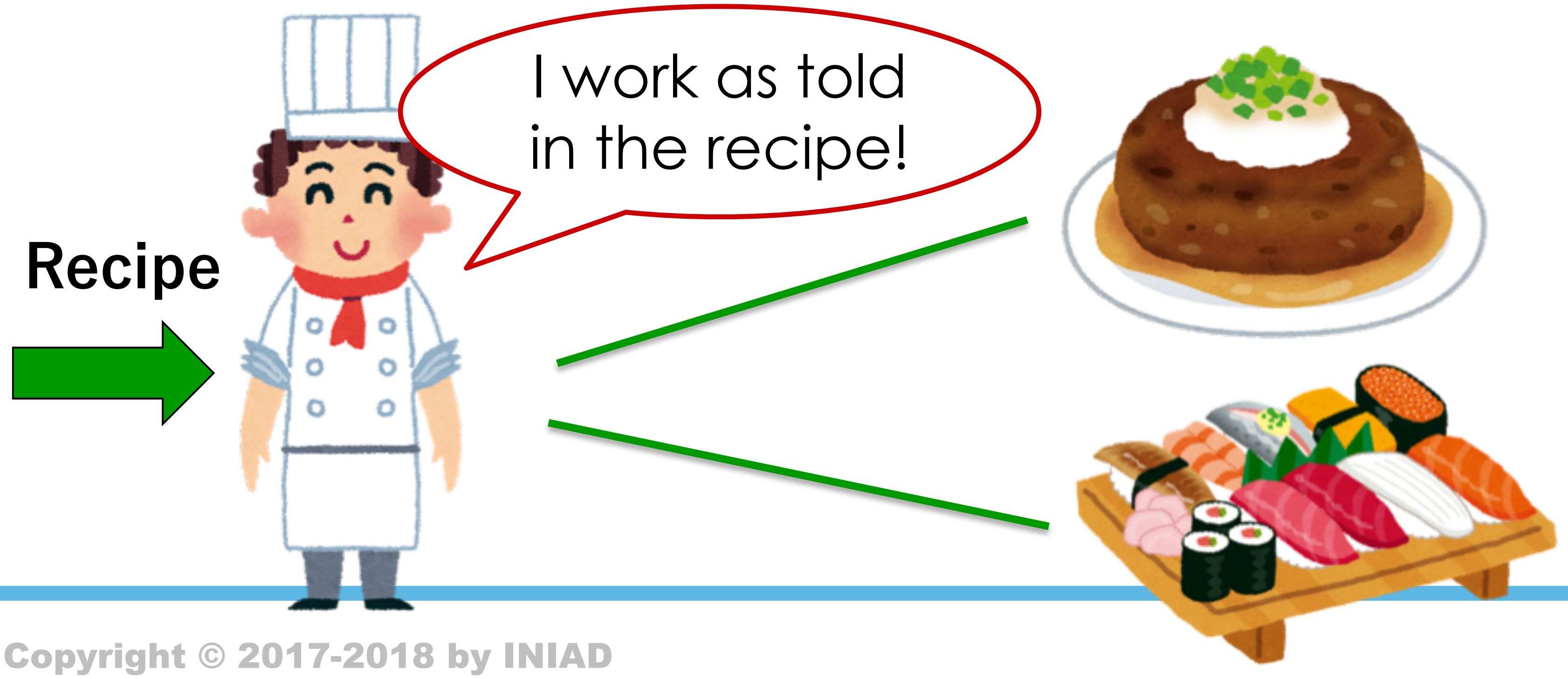
アメリカン ハンバーグ　サルスベリー風

ハンバーガーの本場アメリカにはハンバーグステーキはありませんが、サルスベリー・ステーキがあります。日本でも愛される味！

Little Darling

材料 (4人分)

牛ひき肉	400g
玉ねぎのみじん切り	1/2個分
たまご	1個
牛乳	1/4カップ
パン粉	1/2カップ
塩こしょう	少量
ナツメグ	小さじ1/8
ケチャップ	大さじ2



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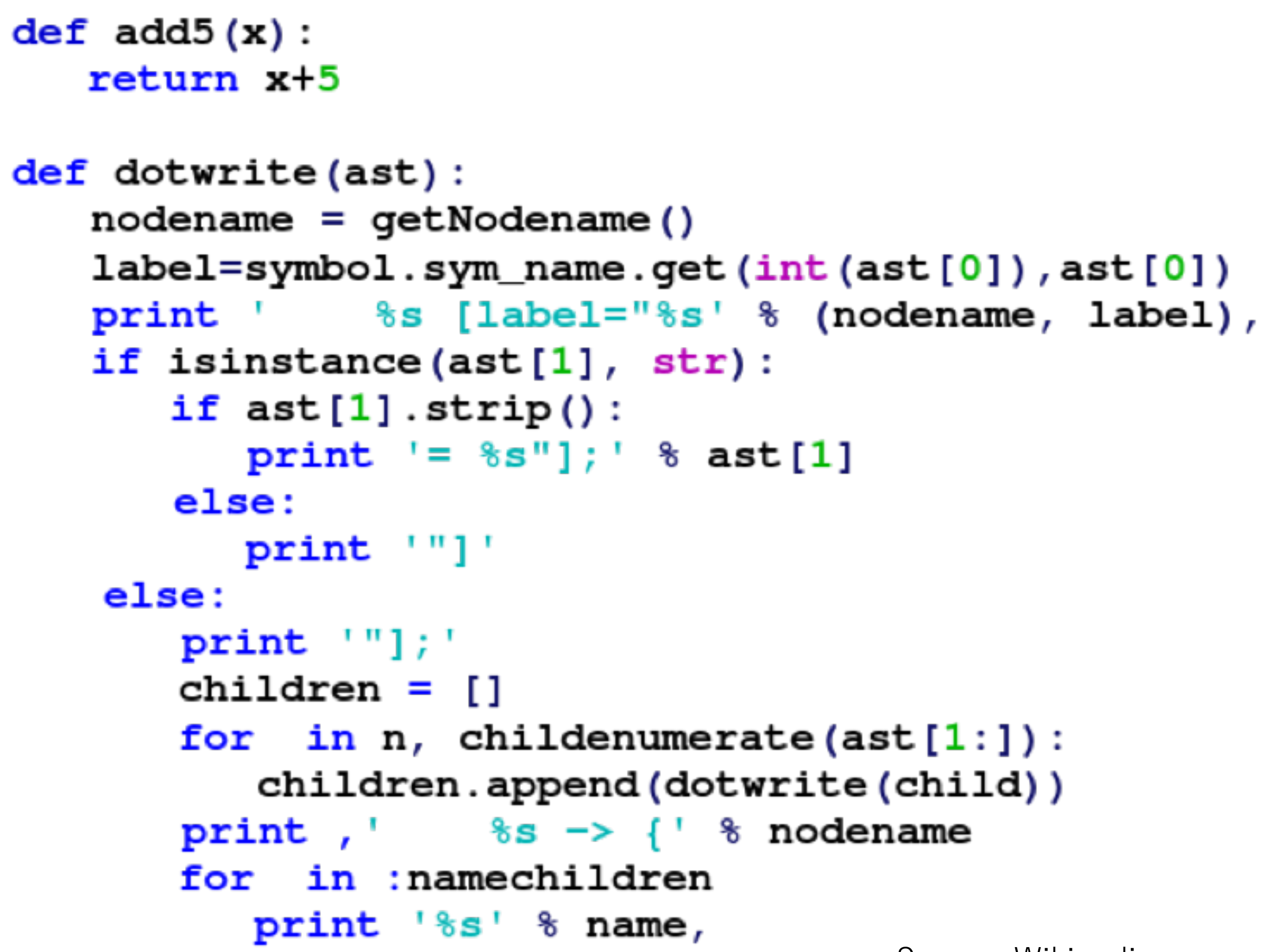
Programming language “Python”

- Python programming language is easy to learn with high level versatility and clean grammar. Used in cutting-edge technologies like AI. Definitely worth learning!
- Study Python and make the computer work as you want



```
def add5(x):
    return x+5

def dotwrite(ast):
    nodename = getNodename()
    label=symbol.sym_name.get(int(ast[0]),ast[0])
    print '      %s [label="%s' % (nodename, label),
    if isinstance(ast[1], str):
        if ast[1].strip():
            print '= %s"];' % ast[1]
        else:
            print '"]'
     else:
         print '"];'
         children = []
         for  in n, childenumerate(ast[1:]):
             children.append(dotwrite(child))
         print ,'      %s -> {' % nodename
         for  in :namechildren
             print '%s' % name,
```

Source: Wikipedia

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2. Let’s interact with Python

Before writing “actual” programs, we will learn how to use Python for simple interactions with computers

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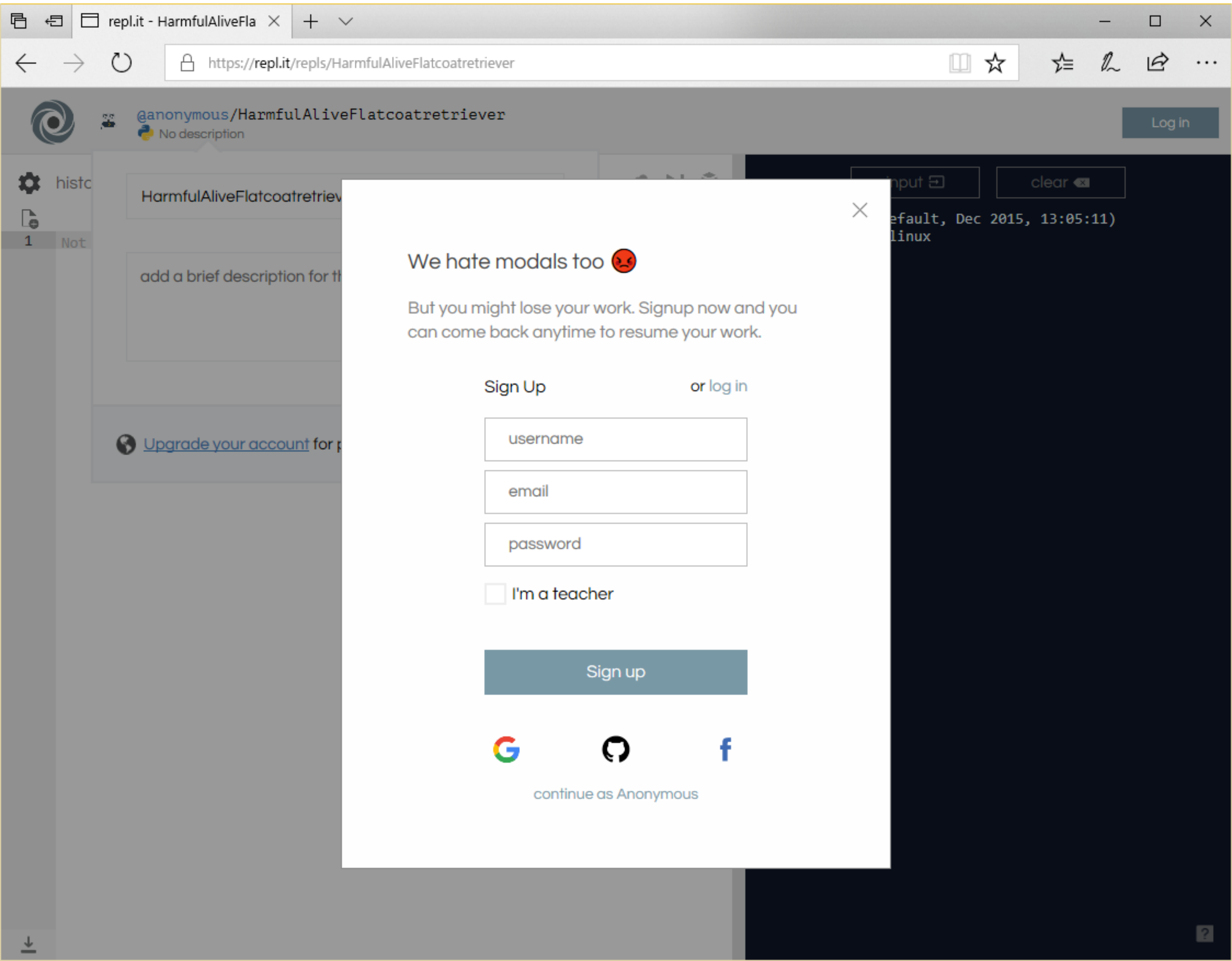
Let's run Python in your browser

- Let's open https://repl.it/languages/python3
  - Click the above link to open Python in a browser
- The following screen should come out



repl.it - HarmfulAliveFla
https://repl.it/repls/HarmfulAliveFlatcoatretriever
@anonymous/HarmfulAliveFlatcoatretriever
No description
Log in
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add a brief description for th
Upgrade your account for p
input
clear

```
efault, Dec 2015, 13:05:11)
linux
```

We hate modals too 😡

But you might lose your work. Signup now and you can come back anytime to resume your work.

Sign Up
or log in
username
email
password
□ I'm a teacher
Sign up
continue as Anonymous

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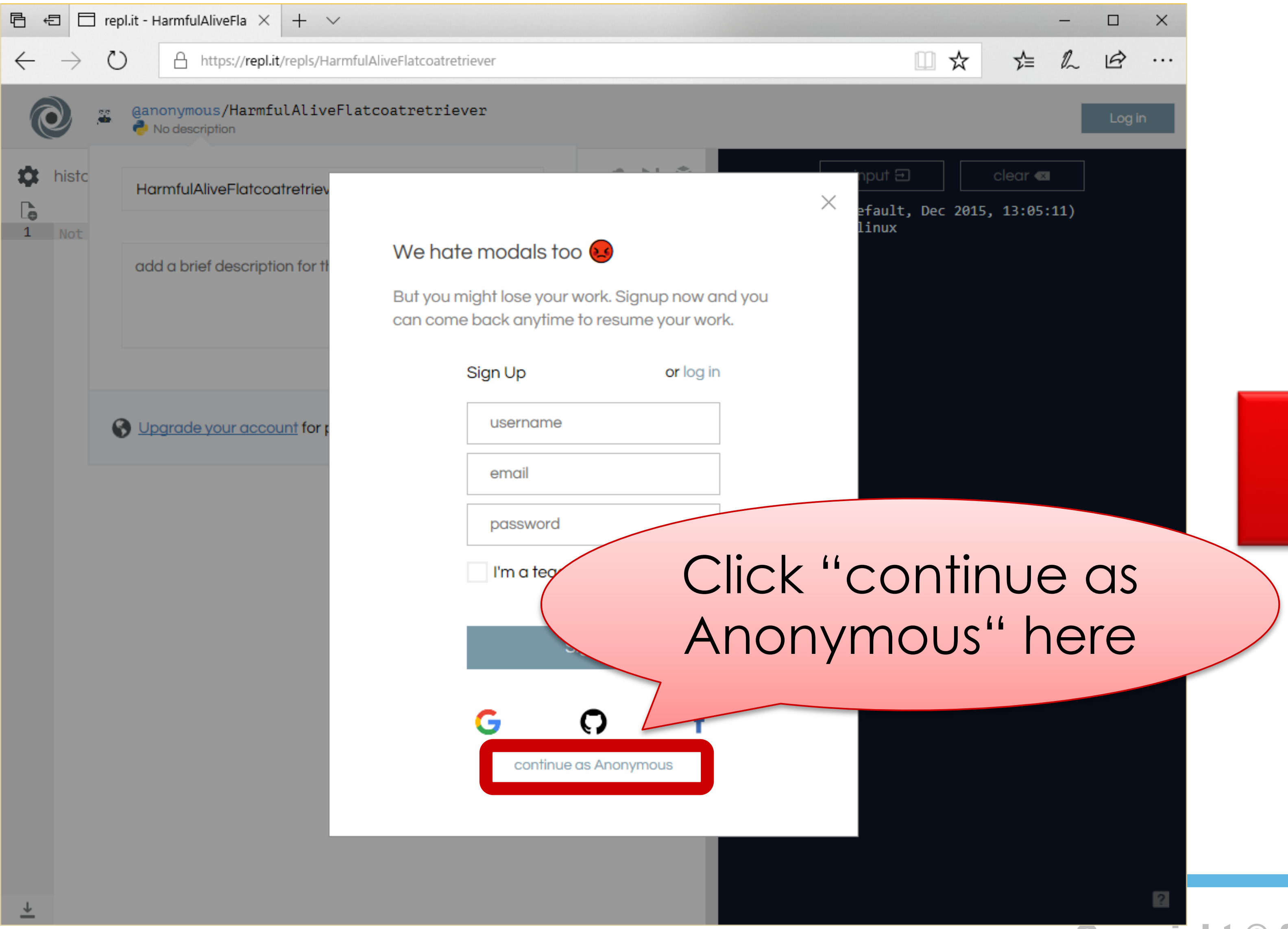
Closing the dialog box (which came to the front)

- Click “continue as Anonymous”
- Then you can close the “dialog box” that has come out to the front



We hate modals too 😡

But you might lose your work. Signup now and you can come back anytime to resume your work.

Sign Up or log in

username

email

password

continue as Anonymous

Click “continue as Anonymous“ here

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https://repl.it/repls/HarmfulAliveFlatcoatretriever
@anonymous/HarmfulAliveFlatcoatretriever
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Log in
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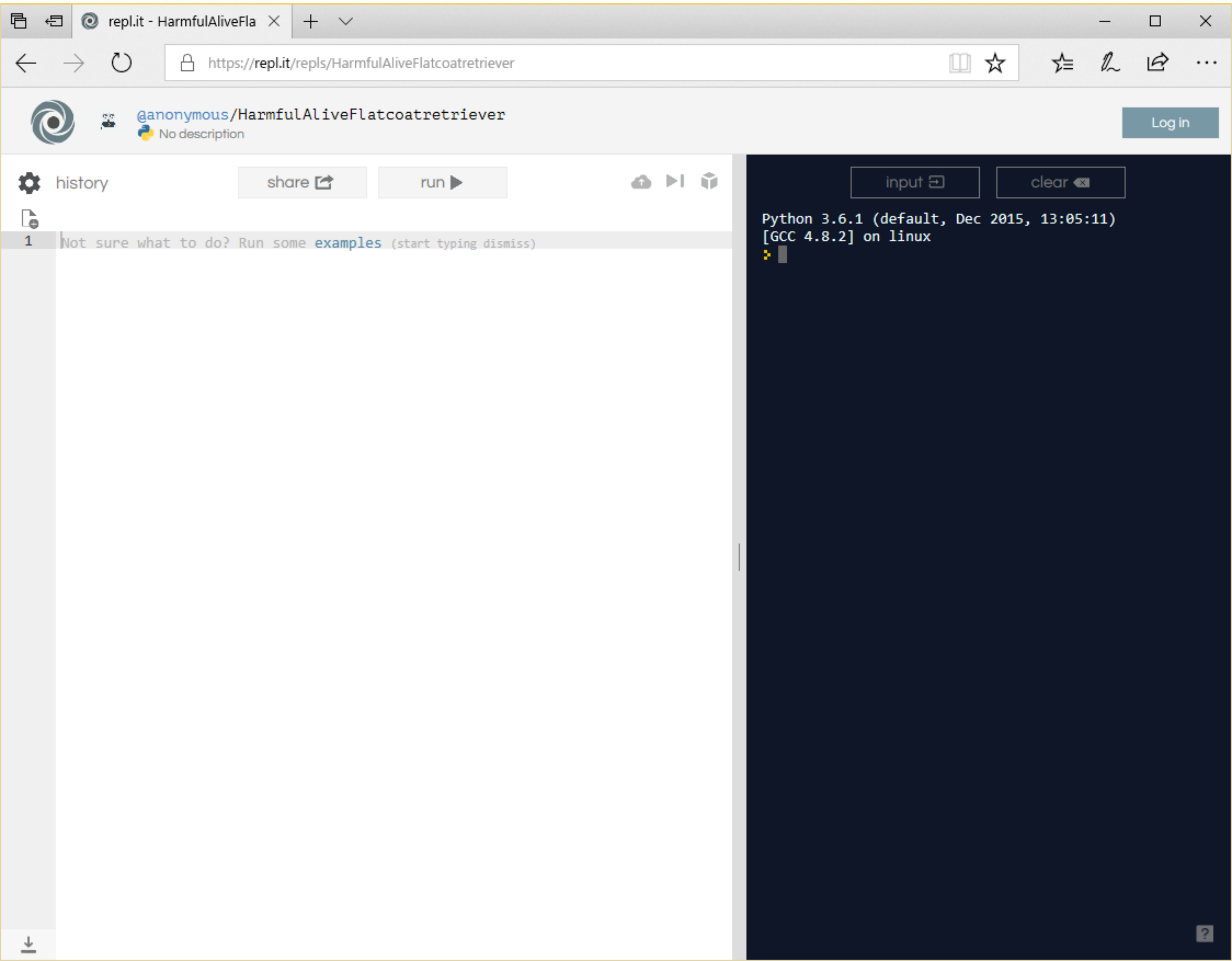
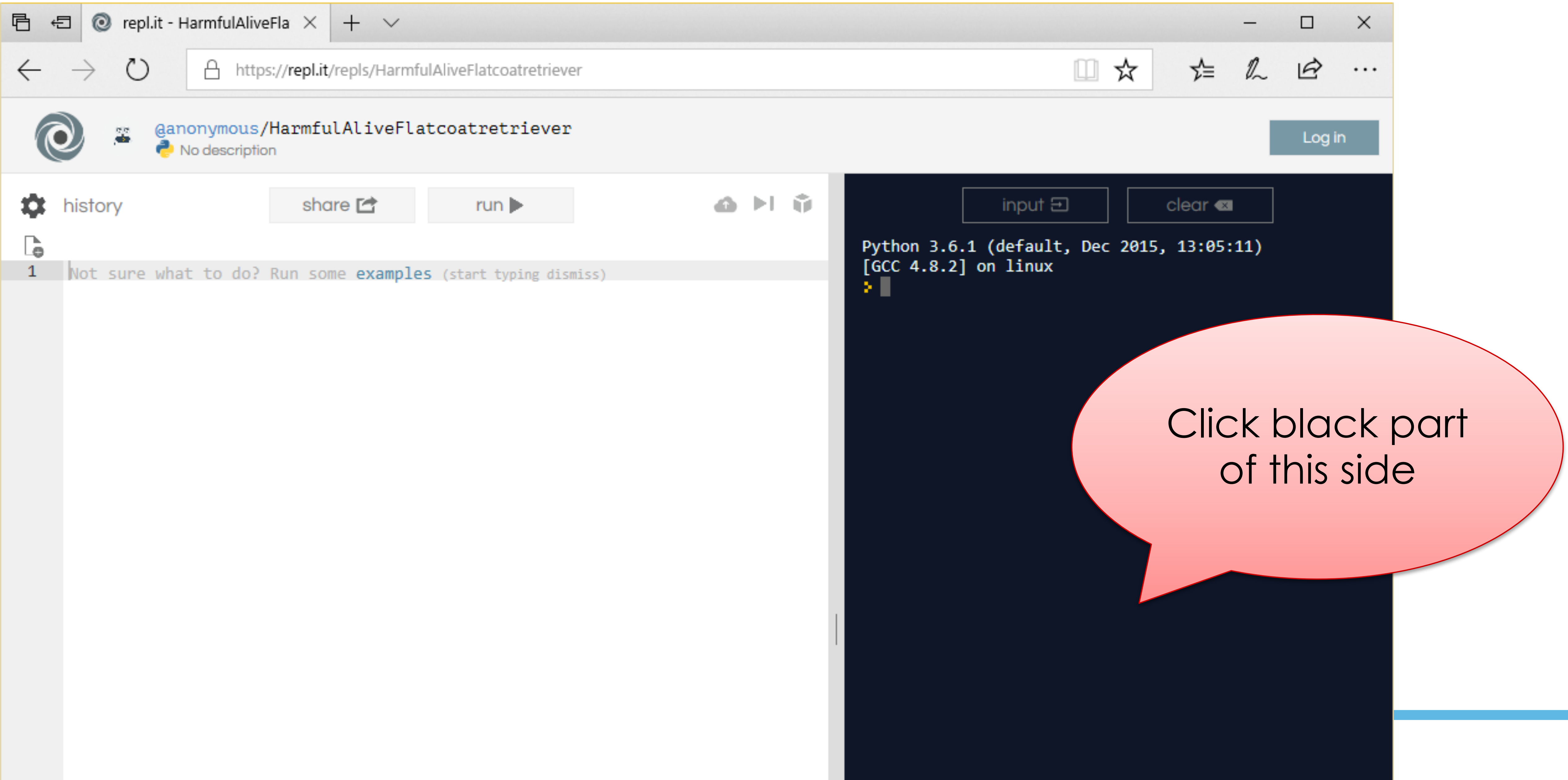


```
Python 3.6.1 (default, Dec 2015, 13:05:11)
[GCC 4.8.2] on linux
>
```

repl.it - HarmfulAliveFla
https://repl.it/repls/HarmfulAliveFlatcoatretriever
@anonymous/HarmfulAliveFlatcoatretriever
No description
Log in
history
share
run
input
clear
Not sure what to do? Run some examples (start typing dismiss)

Move input focus to black part on the right

- Click black part on the right, to input programs from your keyboard

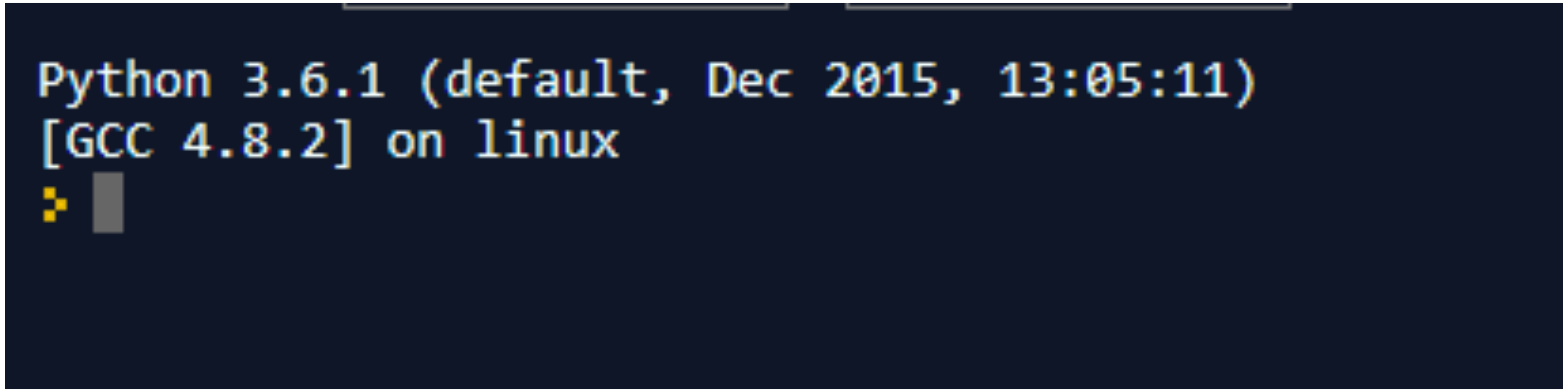

repl.it - HarmfulAliveFla
https://repl.it/repls/HarmfulAliveFlatcoatretriever
@anonymous/HarmfulAliveFlatcoatretriever
No description
Log in
history
share
run
input
clear
Not sure what to do? Run some examples (start typing dismiss)

```
Python 3.6.1 (default, Dec 2015, 13:05:11)
[GCC 4.8.2] on linux
> 
```

Click black part of this side

For a while, we only use the right side only

- You see something like below on the right side, right?



```
Python 3.6.1 (default, Dec 2015, 13:05:11)
[GCC 4.8.2] on linux
> 
```

- 「>」Indicates that the computer is waiting for your instructions
- Let’s input 「1 + 2」in the Python language
  - From here, red string indicates your input
  - You can include whitespace between numbers and plus(+) signs, but it’s not mandatory to put it here
    - If it is absolutely necessary, we denote that as 「␣」

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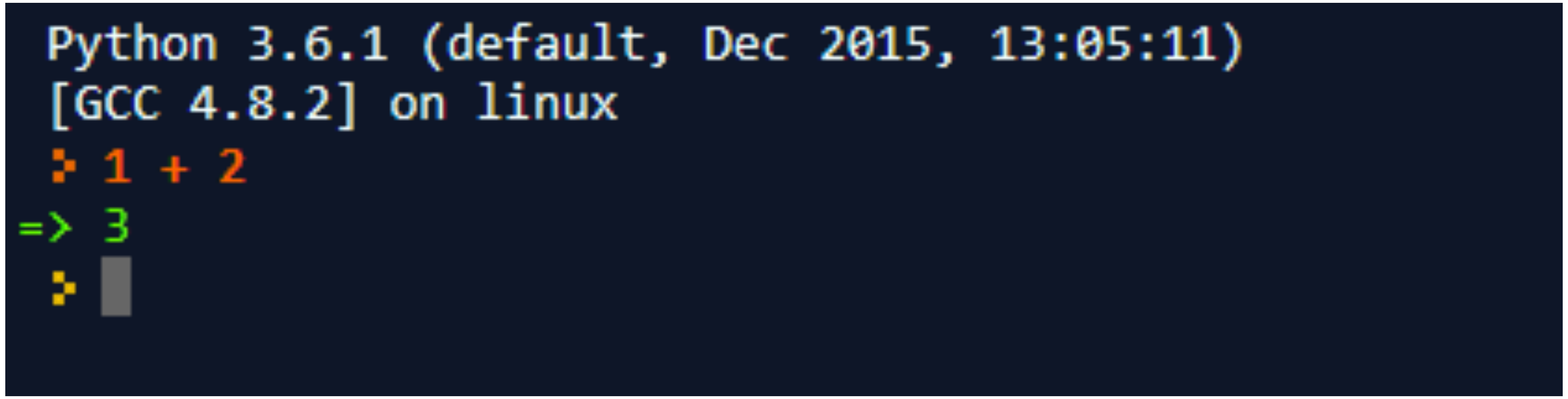
Result

- The answer from the computer is 「3」
  - You instructed to your computer「1 + 2 」
  - Then, the answer 「3」 is returned.
- Following the answer, you get new「>」
  - The computer that answered to you is waiting for the next instruction



```
 Python 3.6.1 (default, Dec 2015, 13:05:11)
 [GCC 4.8.2] on linux
 ❯ 1 + 2
=> 3
 ❯ █
```

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Try more inputs

- Continue inputting more instructions after > .
  - `> 2 + 3`
  - `> 4 + 5`
  - `> 6 - 7`
  - `> 8 + 9 + 10`
  - `> 11 + 12 - 13`
- Did you get the answer you expected?

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Operators

- 「+」 means addition, 「-」 means subtraction

  -
    ```
    > 2 + 3
    5
    ```

  -
    ```
    > 2 - 3
    -
    ```
- 「*」 (asterisk) means multiplication, and 「/」 (Slash) means division

  -
    ```
    > 2 * 3
    6
    ```

  -
    ```
    > 2 / 3
    0.6666666666666666
    ```
- Such symbols used for calculation are called **operator(s)**

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Operators

- 「//」(two slashes) means integer division, 「%」 means its remainder

  -
    ```
    > 5 //3
    1
    ```

  -
    ```
    > 5 % 3
    2
    ```
- 「()」(parentheses) can be used to change calculation order

  -
    ```
    > (1 + 2) * 3
    9
    ```

  -
    ```
    > 1 + (2 * 3)
    7
    ```
- Brackets and braces are not used; when you write a complex expression, you can nest parentheses

  -
    ```
    > 1 + ((2 + 3) * 4 - 5)
    ```

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No problems if you made mistakes

- Even if you made mistakes, you computer will tell you so
  - Even if you inputted something like below...
  -

```
> Asdmaismdiasrasa9rtortf,;:G,; a
File "<stdin>", line 1
    Asdmaismdiasrasa9rtortf,;:G,; a
                             ^
SyntaxError: Invalid syntax
```

Not following the grammer of Python language

- The computer does not break easily!
  - In order to improve your computer skills, you should try what you think as much as possible without fearing of making mistakes
  - On computers, you can repeat the trial and error many times and modifying programs again and again

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3. Understanding Character Strings

The computer can handle both numbers and characters

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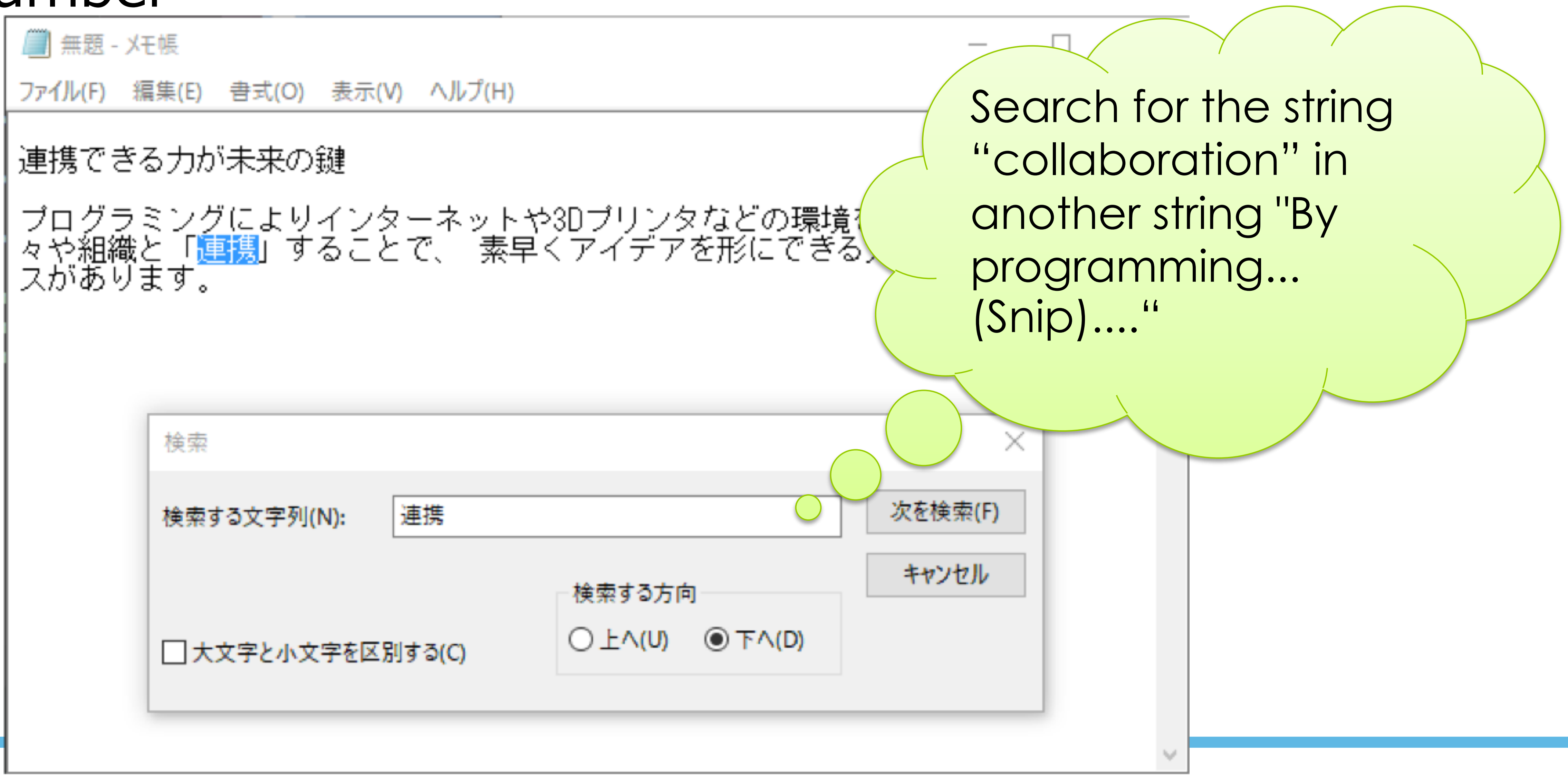
Do computers deal with numerical data only?

- We deal with not only numbers, but also images, videos, sounds, etc.
- Sequence of characters, called “string”, is one of the most important kinds of data
  - Apparently, searching for words in a sentence is not naturally achieved as a single number



連携できる力が未来の鍵

プログラミングによりインターネットや3Dプリンタなどの環境
々や組織と「連携」することで、 素早くアイデアを形にできる
スがあります。

検索する文字列(N): 連携

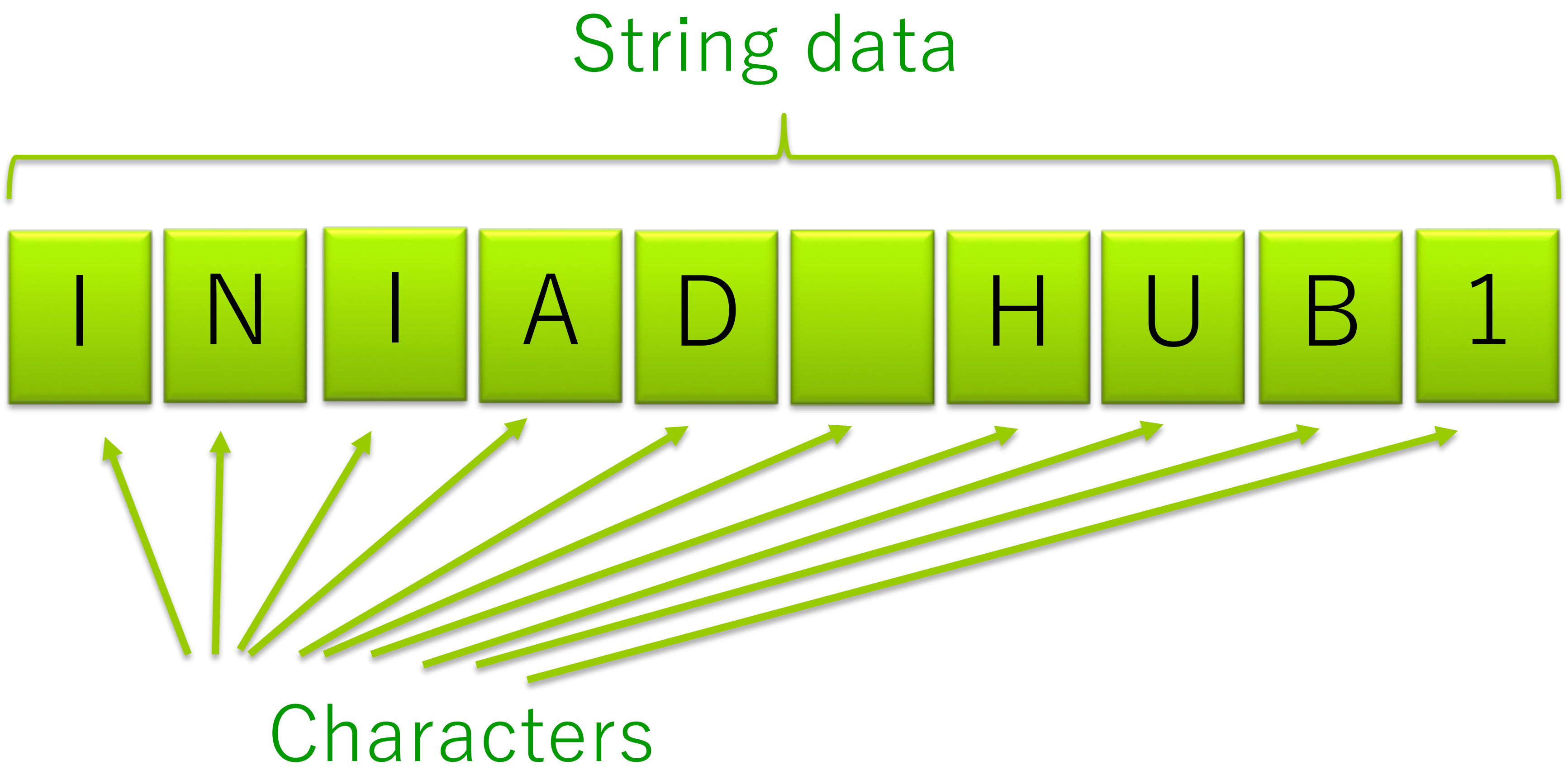
検索する方向 ○上へ(U) ●下へ(D)

□大文字と小文字を区別する(C)

Search for the string “collaboration” in another string "By programming... (Snip)....“

What is string?

- Data created by arranging letters or characters



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Let’s input a string

- To differentiate strings from other parts, strings need to be enclosed within quotes symbols (「“」 or 「’」)
  - Using 「“」 and 「’」 results in the same meaning
  - If you just type in the string, the string will be returned as it is
  - The outputted string from the computer is also enclosed with 「’」

```
■ > '情報連携学部'
■ > "INIAD"
■ > '3.14159'
■ > "1 + (2 + 3)"
  '1 + (2 + 3)'
```

Note that the result is not “6”!

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Calculation of strings

- 「String + String」 results in the concatenation of strings

  -
    ```
    >>> "abc" + "123"
    'abc123'
    ```

  -
    ```
    >>> "123" + "45"
    '12345'
    ```

「Note that the result is not “6”!

- 「String * Integer」 or 「Integer * String」 results in repetition of the same string the given number of times

  -
    ```
    >>> "iniad" * 3
    'iniadiniadiniad'
    ```

  -
    ```
    >>> 5 * "iniad"
    'iniadiniadiniadiniadiniad’
    ```
- For strings, operators「-」, 「/」, 「//」, 「%」are not available

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4. Understanding data types and values

Things may look similar, but they are NOT!

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Distinguish clearly, even if they may look similar

- Understand the differences of 123 and '123’, even if they may look quite similar

  -
    ```
    > 123 + 45
    168
    ```

  -
    ```
    > '123' + '45'
    '12345'
    ```
- What is the difference?
  - 123 is a number, but '123’ is a string
  - As a result, the meaning of addition(+) is totally different

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By the way

- As strings and numbers are different, so you cannot add them together

```
> '123' + 45
...
TypeError: Can't convert 'int' object to str
implicitly
```

- This is like summing the weight and length of something; you cannot get the answer

What is a data type (or type)?

- Categories of data, like number or string, is called data type (or simply types)
- We have so far seen data from three types
  - int type : Integers (Example: 10, 123, -30)
  - float type : Floating point numbers (Example: 2.5, 16.1, -89.1)
  - str type : Strings (Example: “hello”, ‘INIAD’, “情報連携”)

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Value and type determine calculation

- Different types results in different operators available

  -
    ```
    > 123 - 45
    78
    ```

  -
    ```
    > '123' - '45'
    …
    TypeError: unsupported operand type(s) for -: 'str' and 'str'
    ```
- The same operator works differently depending on types

  -
    ```
    > 123 + 45
    ```

  -
    ```
    > '123' + '45’
    ```
- If values of wrong types are given, calculation results in an error

  -
    ```
    > '123' * 3
    '123123123'
    ```

  -
    ```
    > '123' * '3'
    TypeError: can't multiply sequence by non-int of type 'str'
    ```

Type conversion

- You can convert data to those of other types, by enclosing them using int( ), float ( ), str(   )

  -
    ```
    > int("123")
    123
    ```

  -
    ```
    > float("123.4") + 5.6
    129.0
    ```

When you want to check the type

- You can get type information of data by enclosing them using type( )

  -
    ```
    > type(12.3)
    <class 'float'>
    ```

  -
    ```
    > type("12.3")
    <class 'str'>
    ```

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