

An evil-genius guide to computer programming

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```
data = getjson("http://country.io/names.json")
country=data["TN"]

data = getjson("http://country.io/capital.json")
capital = data["TN"]

data = getjson("https://worldtimeapi.org/api/timezone/Africa/Tunis")
time= data['datetime']

print("My country is "+country)
print("The capital of "+country+ " is "+capital)
print("The time now in "+capital+ " is "+time [11:19])
```

```
data = getjson("http://country.io/names.json")
country=data["TN"]

data = getjson("http://country.io/capital.json")
capital = data["TN"]

data = getjson("https://worldtimeapi.org/api/timezone/Africa/Tunis")
time= data['datetime']

print("My country is "+country)
print("The capital of "+country+ " is "+capital)
print("The time now in "+capital+ " is "+time [11:19])
```

```
from urllib.request import urlopen

def getjson(url):
    return json.loads(urlopen(url).read().decode("utf-8"))

data = getjson("https://api.weather.gc.ca/collections/ltce-temperature?f=json&lang=en-CA")
print(data['description'])
```

Week 2

Get Smarter by Programming

Numbers

- 15 digits (64-bit, binary64)
- `1.000000000000000e30` to `9.999999999999999e30`

Non-ASCII URL

é U+00E9

C3 A9

```
import json
from urllib.request import urlopen

def getjson(url):
    return json.loads(urlopen(url).read().decode("utf-8"))

data = getjson("https://api.agify.io/?name=éric")
print(data)
print(data["age"])
```



```
import json
from urllib.request import urlopen

def getjson(url):
    return json.loads(urlopen(url).read().decode("utf-8"))

data = getjson("https://api.agify.io/?name=%C3%A9ric")
print(data)
print(data["age"])
```

What a computer is to me is it's the most remarkable tool that we've ever come up with, and it's the equivalent of a bicycle for our minds." ~ Steve Jobs

Branches

```
if 1 == 2 :  
    print ("equal")  
else:  
    print ("not equal")
```

Compare and jump

```
if condition :  
    jump new adress  
continue
```

Loops

```
w = 0
while 2 * w + 3 < 100:
    w = 3 * w + 1
```

```
for i in range(10):
    print(w)
```

Loops are just branches

```
beginning  
something  
something  
if condition : go elsewhere  
go to beginning
```

Advanced arithmetic

```
x // y  
x % y  
x>>6  
x<<3
```

Two's complement

```
0b00011  
0b00010  
0b00001  
0b00000
```


Two's complement

```
0b00011  
0b00010  
0b00001  
0b00000  
-----  
0b11111  
0b11110  
0b11101
```

Two's complement

$2^{63}-1$

...

1

0

$2^{64}-1$

$2^{63}-2$

....

2^{63}

shift right

```
-16>>2
```

```
>>> 10//3
3
>>> 10%3
1
>>> 10>>1
5
>>> 10<<2
40
```

```
>>> (-1)%3  
2
```

```
> (-1)%3  
-1
```

Random numbers

Pseudo !!!

really hard to do well.

D. H. Lehmer (1951)

```
seed = 1234

def random():
    global seed
    seed = seed * 0xda942042e4dd58b5
    value = seed >> 64
    value = seed % 2**64
    return value

for i in range(10):
    print(random())
```

```
for i in range(10):  
    print(random()%3)
```



```
>>> counts = [0,0,0]
>>> for i in range(2**16):
...     counts[i%3] += 1
...
>>> print(counts)
[21846, 21845, 21845]
```

```
>>> counts = [0, 0, 0]
>>> for i in range(3000):
...     counts[random()%3] += 1
...
>>> counts
[958, 998, 1044]
```

Towers of Hanoi

--

----- --

----- -- -----

```
state = [[5,2,1], [], []]
while True:
    start = random.choice([0,1,2])
    if len(state[start]) == 0:
        continue
    end = random.choice([0,1,2])
    startvalue = minimum(state[start])
    endvalue = minimum(state[end])
    if endvalue != 0 and startvalue > endvalue:
        continue
    state[start].remove(startvalue)
    state[end].append(startvalue)
    steps = steps + 1
    if len(state[2]) == 3:
        break
```

Solve puzzling probability problems



```
import random

times = 1000000
hit = 0
for x in range(times):
    treasure = random.choice([1,2,3])
    mychoice = random.choice([1,2,3])
    if mychoice == treasure:
        hit += 1

print(hit / times)
# 0.333
```

```
import random

times = 1000000
hit = 0
for x in range(times):
    treasure = random.choice([1,2,3])
    mychoice = random.choice([1,2,3])
    if mychoice == treasure:
        hit += 1

print(hit / times)
# 0.667
```

Solve Peg solitaire

https://en.wikipedia.org/wiki/Peg_solitaire


```
peg = [[2,2,1,1,1,2,2],  
        [2,2,1,1,1,2,2],  
        [1,1,1,1,1,1,1],  
        [1,1,1,0,1,1,1],  
        [1,1,1,1,1,1,1],  
        [2,2,1,1,1,2,2]]
```

```

def find_playables(peg):
    playables = []
    for r in range(len(peg)):
        for c in range(len(peg[0])):
            if peg[r][c] == 1:
                # search neighbor
                if (r > 1 and peg[r-1][c] == 1 and peg[r-2][c] == 0):
                    playables.append((r,c),(r-2,c))
                if (c > 1 and peg[r][c-1] == 1 and peg[r][c-2] == 0):
                    playables.append((r,c),(r,c-2))
                if (r+2 < len(peg) and peg[r+1][c] == 1 and peg[r+2][c] == 0):
                    playables.append((r,c),(r+2,c))
                if (c+2 < len(peg[0]) and peg[r][c+1] == 1 and peg[r][c+2] == 0):
                    playables.append((r,c),(r,c+2))
    return playables

```

```
def tryme():  
    game = []  
    peg = [[2,2,1,1,1,2,2],  
           [2,2,1,1,1,2,2],  
           [1,1,1,1,1,1,1],  
           [1,1,1,0,1,1,1],  
           [1,1,1,1,1,1,1],  
           [2,2,1,1,1,2,2]]  
    count = 0  
    for r in range(len(peg)):  
        for c in range(len(peg[0])):  
            if peg[r][c] == 1:  
                count += 1
```

```
while count > 1:
    playables = find_playables(peg)
    if len(playables) == 0 :
        return False, game
    source, dest = random.choice(playables)
    game.append((source, dest))
    peg[source[0]][source[1]] = 0
    peg[(source[0]+dest[0])//2][(source[1]+dest[1])//2] = 0
    peg[dest[0]][dest[1]] = 1
    count -= 1
return True, game
```

```
count = 0
result, g = tryme()
while(not result):
    count += 1
    if(count % 1000 ==0):print(count)
    result, g = tryme()

# [((3, 1), (3, 3)), ((5, 2), (3, 2)), ((2, 2), (4, 2)),...
```

```
from z3 import *

s = Solver()
a = BitVec('seed', 128)
s.add(LShR(a*0xda942042e4dd58b5, 64) == 0x01020304050607)
if(s.check() == z3.sat):
    m = s.model()
    print(m[a])
```

<https://replit.com/@lemire/QuietSaltyNetwork#main.py>

Homework

Solve a simple mathematical puzzle using z3:

<https://ericpony.github.io/z3py-tutorial/guide-examples.htm>