

Adventures in Iterations

Vikrant Patil

Fun With Iterations

- Doing something repetatively
- Simple operations like shuffling of a deck
- Series calculations
- Pressing cos key on calculator repetatively
- Doing some tricks with digits of a number
- Doing some gemetric changes in a figure

Riffle Shuffle

deck	part1	part2		out-shuffle	in-shuffle
A1	A1			A1	B1
A2		B1		B1	A1
A3	A2			A2	B2
A4		B2	====>	B2	A2
B1	A3			A3	B3
B2		B3		B3	A3
B3	A4			A4	B4
B4		B4		B4	A4

Four Number Game

- Lets begin with $a = 10$, $b=25$, $c=15$, $d=5$
- Iteratively do following operation
 - $a \Rightarrow |a-b| = |10-25| = 10$
 - $b \Rightarrow |b-c| = |25-15| = 10$
 - $c \Rightarrow |c-d| = |15-5| = 10$
 - $d \Rightarrow |d-a| = |5-10| = 5$
- Obeserve what happens to a,b,c,d

Sum Of Squares(SSQ)

- Begin with a number $a = 1234$
- Find sum of squares of its digits ($1 + 4 + 9 + 16 = 30$)
- Let this SSQ be new value of a
- Repeat above procedure observe what happens to a

Kaprekar Iteration

Rearrange digits of a four digit number to form max and min number.

Difference of max and min becomes new number

a	max	min	new a
3927	9732	2379	7353
7353	7533	3357	6174
6174	7641	1467	6174

Iterations in Python

- Lists – indexing, slicing
- Iteration Protocol – next()
- for loops
- List comprehensions
- Iteration patterns

Lets riffle-shuffle!

```
def riffle_shuffle(deck):  
    n = len(deck)  
    part1 = deck[:n//2]  
    part2 = deck[n//2:]  
  
    s = []  
    for x,y in zip(part1, part2):  
        s.extend([x,y])  
  
    if n%2==1: # in case we have odd number of items in deck!  
        s.append(part2[-1]) #last item from second list  
  
    return s
```


out/in

0 Python Conference 2018

1 Peyrtehnocne C2o0n1f8

2 Pee y rCt2eoh0nno1cfn8

3 Poehe0 nyn or1Cctf2ne8

4 Poore1hCec0t fn2ynne 8

5 Pto ofrne21yhnCneec 08

6 Python Conference 2018

7 Peyrtehnocne C2o0n1f8

8 Pee y rCt2eoh0nno1cfn8

9 Poehe0 nyn or1Cctf2ne8

10 Poore1hCec0t fn2ynne 8

1 ePryetnhcoen 2C0o1n8f

2 ne P r2yCe0ton1hnc8ofe

3 tnoen 1Ph nrc28yoCfee0

4 rtcn2o8eyno C1fPehe 0n

5 rCt1cfnP2eoh8ee y0nno

6 o hr8Cete1 cyf0nnPn2oe

7 coy fh0rn8nCPent2eo1e

8 CcPoeyn tf2he0or1ne8 n

9 hCec0Poore1ynne 8t fn2

10 yhnCneec 08Pto ofrne21

11 Python Conference 2018

12 ePryetnhcoen 2C0o1n8f

Four Number Game

```
def four_number_game(a,b,c,d, n= 10):  
    for i in range(n):  
        a, b, c, d = abs(a-b), abs(b-c), abs(c-d), abs(d-a)  
        print(a,b,c,d)  
    return a, b, c, d
```

```
four_number_game(19, 49, 73, 7)
```

30 24 66 12

6 42 54 18

36 12 36 12

24 24 24 24

0 0 0 0

0 0 0 0

SSQ

```
def SSQ(n):  
    digits = [int(s) for s in str(n)]  
    return sum([d*d for d in digits])  
  
a = 42  
for i in range(20):  
    a = SSQ(a)  
    print(a, end=", ")
```

20, 4, 16, 37, 58, 89, 145, 42, 20, 4, 16, 37, 58, 89, 145, 42, 20, 4, 16, 37,

Functions, First Class Objects

```
def repeat(func, n, arg, end="\n"):  
    for i in range(n):  
        arg = func(arg)  
        print(arg, end=end)  
    return arg
```

```
SSQi = lambda a : repeat(SSQ, 50, 17, end=",")
```

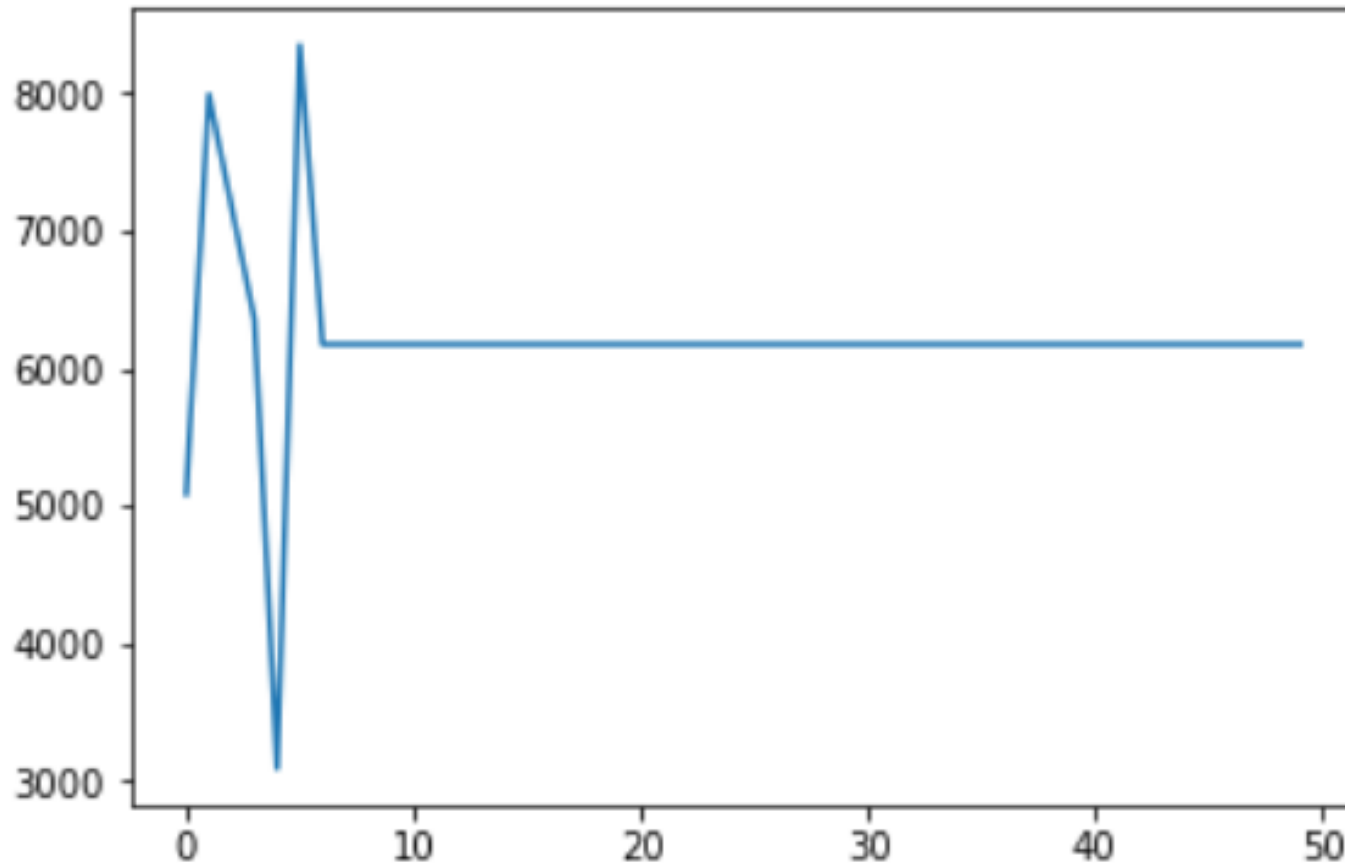
Sequences

```
def SSQi_(n):  
    while True:  
        n = SSQ(n)  
        yield n  
  
def take(seq, n):  
    """  
    takes first n elements from a sequence  
    """  
    return [next(seq) for i in range(n)]
```

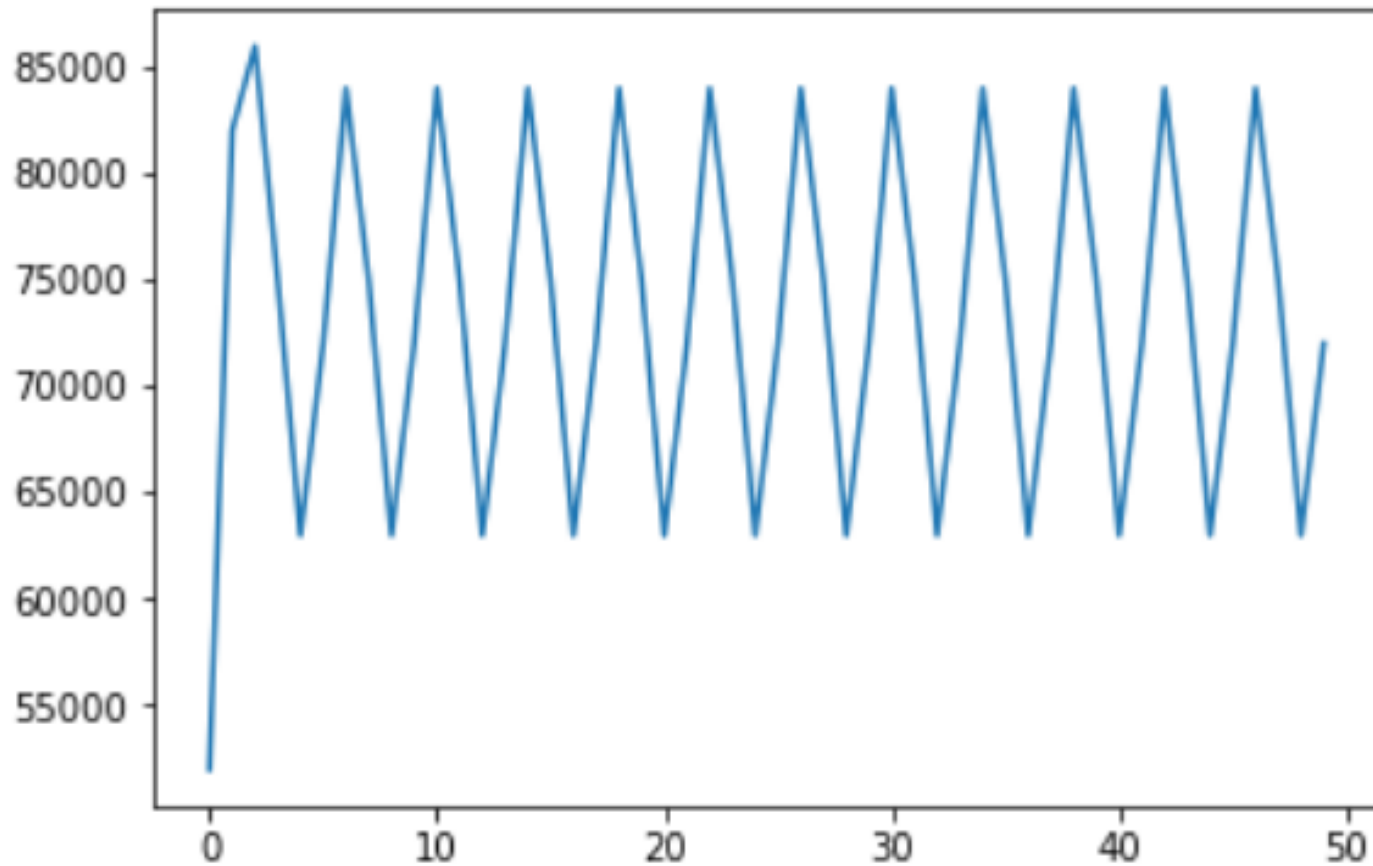
Kaprekar Iteration

```
def rearrangemax(n, digits):  
    strn = str(n).zfill(digits)  
    return int("".join(sorted(strn, reverse=True)))  
  
def rearrangemin(n, digits):  
    strn = str(n).zfill(digits)  
    return int("".join(sorted(strn)))  
  
def kaprekar(n):  
    digits = len(str(n))  
    while True:  
        min_ = rearrangemin(n, digits)  
        max_ = rearrangemax(n, digits)  
        n = max_ - min_  
        yield n
```

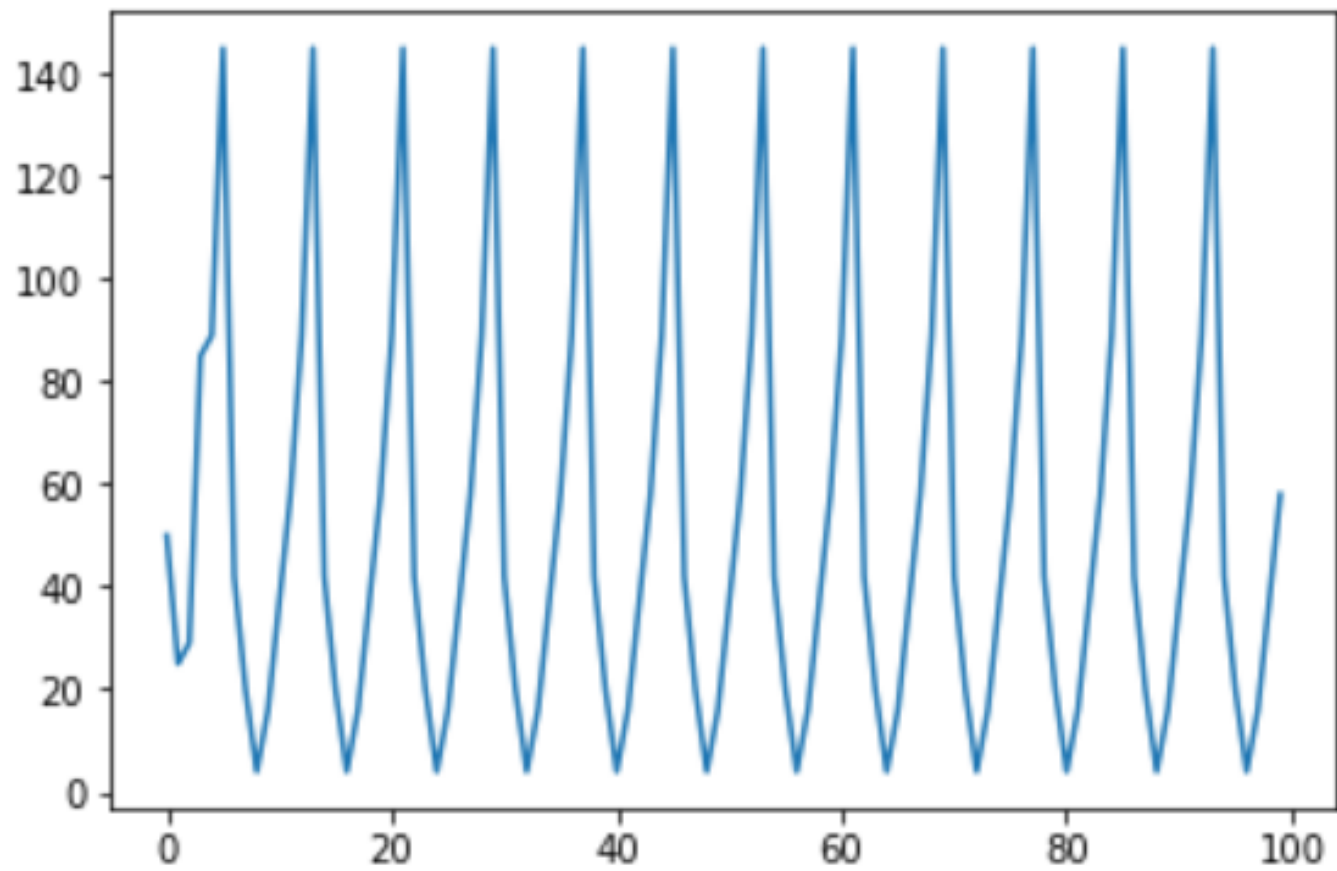
Kaprekar Iteration 4 digits



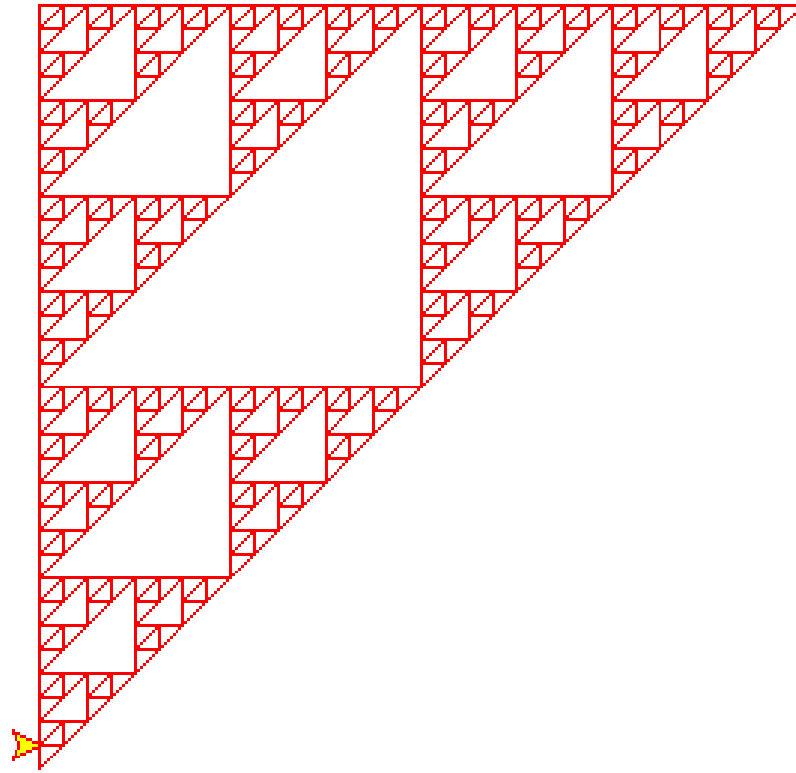
Kaprekar Iteration 5 digits



SSQ



Geometric Iterations



References

- Adventures In Iterations by Shailesh Shirali
- Jupyter notebook covering code from this talk is available at

<https://github.com/vikipedia/python-trainings/blob/master/foundation/Adventures%20In%20Iterations.ipynb>