Maad Saifuddin

Cs162017

5B

CS 302: Design and Analysis of Algorithms

. Submit your code and output snapshot for Euclid Algorithm.

In [30]:
```
def gcd(num1,num2):
    gcd=1
    i=1
    if num1 == 0 or num2 == 0:
        print(gcd)
    rem=num1%num2
    print('Iteraton # ',i,'------>',num1,'%',num2,'==',rem)
    str1=' Iteraton # '+str(i)+' ------> '+str(num1)+' % '+str(num2)+' == '+str(rem)+'\n'
    with open('file','a') as f:
        f.write(str1)
        f.write('\n')
        while rem != 0:
            i=i+1
            num1=num2
            num2=rem
            rem=num1%num2
            str1='Iteraton # '+str(i)+' ------> '+str(num1)+' % '+str(num2)+' == '+str(rem)+'\n'
            f.write(str1)
            f.write('\n')
        gcd=num2
        print('Number of basic operation perform',i)
        print(' GCD = ',gcd)
        str2=' Number of basic operation perform '+str(i)+'\n'
        str3=' GCD = '+str(gcd)+'\n'
        f.write(str2)
        f.write(str3)
        f.write('\n')
        f.close()
        return i
```

```
count=0
sum1=0
for i in range(100,1000,10):
    for j in range(990,500,-20):
            count=count+1
            a=gcd(i,j)
            sum1=sum1+a
```

Output

```
 Iteraton # 1 ------> 100 % 990 == 100

Iteraton # 2 ------> 990 % 100 == 90

Iteraton # 3 ------> 100 % 90 == 10

Iteraton # 4 ------> 90 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 100 % 970 == 100

Iteraton # 2 ------> 970 % 100 == 70

Iteraton # 3 ------> 100 % 70 == 30

Iteraton # 4 ------> 70 % 30 == 10

Iteraton # 5 ------> 30 % 10 == 0

 Number of basic operation perform 5
 GCD = 10
```

```
 Iteraton # 1 ------> 100 % 950 == 100

Iteraton # 2 ------> 950 % 100 == 50

Iteraton # 3 ------> 100 % 50 == 0

 Number of basic operation perform 3
 GCD = 50

 Iteraton # 1 ------> 100 % 930 == 100

Iteraton # 2 ------> 930 % 100 == 30

Iteraton # 3 ------> 100 % 30 == 10

Iteraton # 4 ------> 30 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 100 % 910 == 100

Iteraton # 2 ------> 910 % 100 == 10

Iteraton # 3 ------> 100 % 10 == 0

 Number of basic operation perform 3
 GCD = 10
```

```
 Iteraton # 1 ------> 100 % 890 == 100

Iteraton # 2 ------> 890 % 100 == 90

Iteraton # 3 ------> 100 % 90 == 10

Iteraton # 4 ------> 90 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 100 % 870 == 100

Iteraton # 2 ------> 870 % 100 == 70

Iteraton # 3 ------> 100 % 70 == 30

Iteraton # 4 ------> 70 % 30 == 10

Iteraton # 5 ------> 30 % 10 == 0

 Number of basic operation perform 5
 GCD = 10
```

```
 Iteraton # 1 ------> 100 % 850 == 100

Iteraton # 2 ------> 850 % 100 == 50

Iteraton # 3 ------> 100 % 50 == 0

 Number of basic operation perform 3
 GCD = 50

 Iteraton # 1 ------> 100 % 830 == 100

Iteraton # 2 ------> 830 % 100 == 30

Iteraton # 3 ------> 100 % 30 == 10

Iteraton # 4 ------> 30 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 100 % 810 == 100

Iteraton # 2 ------> 810 % 100 == 10

Iteraton # 3 ------> 100 % 10 == 0

 Number of basic operation perform 3
 GCD = 10
```

```
 Iteraton # 1 ------> 100 % 790 == 100

Iteraton # 2 ------> 790 % 100 == 90

Iteraton # 3 ------> 100 % 90 == 10

Iteraton # 4 ------> 90 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 100 % 770 == 100

Iteraton # 2 ------> 770 % 100 == 70

Iteraton # 3 ------> 100 % 70 == 30

Iteraton # 4 ------> 70 % 30 == 10

Iteraton # 5 ------> 30 % 10 == 0

 Number of basic operation perform 5
 GCD = 10
```

```
 Iteraton # 1 ------> 100 % 750 == 100

Iteraton # 2 ------> 750 % 100 == 50

Iteraton # 3 ------> 100 % 50 == 0

 Number of basic operation perform 3
 GCD = 50

 Iteraton # 1 ------> 100 % 730 == 100

Iteraton # 2 ------> 730 % 100 == 30

Iteraton # 3 ------> 100 % 30 == 10

Iteraton # 4 ------> 30 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 100 % 710 == 100

Iteraton # 2 ------> 710 % 100 == 10

Iteraton # 3 ------> 100 % 10 == 0

 Number of basic operation perform 3
 GCD = 10
```

```
 Iteraton # 1 ------> 100 % 690 == 100

Iteraton # 2 ------> 690 % 100 == 90

Iteraton # 3 ------> 100 % 90 == 10

Iteraton # 4 ------> 90 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 100 % 670 == 100

Iteraton # 2 ------> 670 % 100 == 70

Iteraton # 3 ------> 100 % 70 == 30

Iteraton # 4 ------> 70 % 30 == 10

Iteraton # 5 ------> 30 % 10 == 0

 Number of basic operation perform 5
 GCD = 10

```

```
 Iteraton # 1 ------> 100 % 650 == 100

Iteraton # 2 ------> 650 % 100 == 50

Iteraton # 3 ------> 100 % 50 == 0

 Number of basic operation perform 3
 GCD = 50

 Iteraton # 1 ------> 100 % 630 == 100

Iteraton # 2 ------> 630 % 100 == 30

Iteraton # 3 ------> 100 % 30 == 10

Iteraton # 4 ------> 30 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 100 % 610 == 100

Iteraton # 2 ------> 610 % 100 == 10

Iteraton # 3 ------> 100 % 10 == 0

 Number of basic operation perform 3
 GCD = 10
```

```
 Iteraton # 1 ------> 100 % 590 == 100

Iteraton # 2 ------> 590 % 100 == 90

Iteraton # 3 ------> 100 % 90 == 10

Iteraton # 4 ------> 90 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 100 % 570 == 100

Iteraton # 2 ------> 570 % 100 == 70

Iteraton # 3 ------> 100 % 70 == 30

Iteraton # 4 ------> 70 % 30 == 10

Iteraton # 5 ------> 30 % 10 == 0

 Number of basic operation perform 5
 GCD = 10
```

```
 Iteraton # 1 ------> 100 % 550 == 100

Iteraton # 2 ------> 550 % 100 == 50

Iteraton # 3 ------> 100 % 50 == 0

 Number of basic operation perform 3
 GCD = 50

 Iteraton # 1 ------> 100 % 530 == 100

Iteraton # 2 ------> 530 % 100 == 30

Iteraton # 3 ------> 100 % 30 == 10

Iteraton # 4 ------> 30 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 100 % 510 == 100

Iteraton # 2 ------> 510 % 100 == 10

Iteraton # 3 ------> 100 % 10 == 0

 Number of basic operation perform 3
 GCD = 10

```

```
 Iteraton # 1 ------> 110 % 990 == 110

Iteraton # 2 ------> 990 % 110 == 0

 Number of basic operation perform 2
 GCD = 110

 Iteraton # 1 ------> 110 % 970 == 110

Iteraton # 2 ------> 970 % 110 == 90

Iteraton # 3 ------> 110 % 90 == 20

Iteraton # 4 ------> 90 % 20 == 10

Iteraton # 5 ------> 20 % 10 == 0

 Number of basic operation perform 5
 GCD = 10
```

```
 Iteraton # 1 ------> 110 % 950 == 110

Iteraton # 2 ------> 950 % 110 == 70

Iteraton # 3 ------> 110 % 70 == 40

Iteraton # 4 ------> 70 % 40 == 30

Iteraton # 5 ------> 40 % 30 == 10

Iteraton # 6 ------> 30 % 10 == 0

 Number of basic operation perform 6
 GCD = 10

 Iteraton # 1 ------> 110 % 930 == 110

Iteraton # 2 ------> 930 % 110 == 50

Iteraton # 3 ------> 110 % 50 == 10

Iteraton # 4 ------> 50 % 10 == 0

 Number of basic operation perform 4
 GCD = 10
```

```
 Iteraton # 1 ------> 110 % 910 == 110

Iteraton # 2 ------> 910 % 110 == 30

Iteraton # 3 ------> 110 % 30 == 20

Iteraton # 4 ------> 30 % 20 == 10

Iteraton # 5 ------> 20 % 10 == 0

 Number of basic operation perform 5
 GCD = 10

 Iteraton # 1 ------> 110 % 890 == 110

Iteraton # 2 ------> 890 % 110 == 10

Iteraton # 3 ------> 110 % 10 == 0

 Number of basic operation perform 3
 GCD = 10
```

```
 Iteraton # 1 ------> 110 % 870 == 110

Iteraton # 2 ------> 870 % 110 == 100

Iteraton # 3 ------> 110 % 100 == 10

Iteraton # 4 ------> 100 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 110 % 850 == 110

Iteraton # 2 ------> 850 % 110 == 80

Iteraton # 3 ------> 110 % 80 == 30

Iteraton # 4 ------> 80 % 30 == 20

Iteraton # 5 ------> 30 % 20 == 10

Iteraton # 6 ------> 20 % 10 == 0

 Number of basic operation perform 6
 GCD = 10

```

```
 Iteraton # 1 ------> 110 % 830 == 110

Iteraton # 2 ------> 830 % 110 == 60

Iteraton # 3 ------> 110 % 60 == 50

Iteraton # 4 ------> 60 % 50 == 10

Iteraton # 5 ------> 50 % 10 == 0

 Number of basic operation perform 5
 GCD = 10

 Iteraton # 1 ------> 110 % 810 == 110

Iteraton # 2 ------> 810 % 110 == 40

Iteraton # 3 ------> 110 % 40 == 30

Iteraton # 4 ------> 40 % 30 == 10

Iteraton # 5 ------> 30 % 10 == 0

 Number of basic operation perform 5
 GCD = 10

```

```
 Iteraton # 1 ------> 110 % 790 == 110

Iteraton # 2 ------> 790 % 110 == 20

Iteraton # 3 ------> 110 % 20 == 10

Iteraton # 4 ------> 20 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 110 % 770 == 110

Iteraton # 2 ------> 770 % 110 == 0

 Number of basic operation perform 2
 GCD = 110

```

```
 Iteraton # 1 ------> 110 % 750 == 110

Iteraton # 2 ------> 750 % 110 == 90

Iteraton # 3 ------> 110 % 90 == 20

Iteraton # 4 ------> 90 % 20 == 10

Iteraton # 5 ------> 20 % 10 == 0

 Number of basic operation perform 5
 GCD = 10

 Iteraton # 1 ------> 110 % 730 == 110

Iteraton # 2 ------> 730 % 110 == 70

Iteraton # 3 ------> 110 % 70 == 40

Iteraton # 4 ------> 70 % 40 == 30

Iteraton # 5 ------> 40 % 30 == 10

Iteraton # 6 ------> 30 % 10 == 0

 Number of basic operation perform 6
 GCD = 10
```

```
 Iteraton # 1 ------> 110 % 710 == 110

Iteraton # 2 ------> 710 % 110 == 50

Iteraton # 3 ------> 110 % 50 == 10

Iteraton # 4 ------> 50 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

 Iteraton # 1 ------> 110 % 690 == 110

Iteraton # 2 ------> 690 % 110 == 30

Iteraton # 3 ------> 110 % 30 == 20

Iteraton # 4 ------> 30 % 20 == 10

Iteraton # 5 ------> 20 % 10 == 0

 Number of basic operation perform 5
 GCD = 10
```

```
 Iteraton # 1 ------> 110 % 670 == 110

Iteraton # 2 ------> 670 % 110 == 10

Iteraton # 3 ------> 110 % 10 == 0

 Number of basic operation perform 3
 GCD = 10

 Iteraton # 1 ------> 110 % 650 == 110

Iteraton # 2 ------> 650 % 110 == 100

Iteraton # 3 ------> 110 % 100 == 10

Iteraton # 4 ------> 100 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

```

```
 Iteraton # 1 ------> 110 % 630 == 110

Iteraton # 2 ------> 630 % 110 == 80

Iteraton # 3 ------> 110 % 80 == 30

Iteraton # 4 ------> 80 % 30 == 20

Iteraton # 5 ------> 30 % 20 == 10

Iteraton # 6 ------> 20 % 10 == 0

 Number of basic operation perform 6
 GCD = 10

 Iteraton # 1 ------> 110 % 610 == 110

Iteraton # 2 ------> 610 % 110 == 60

Iteraton # 3 ------> 110 % 60 == 50

Iteraton # 4 ------> 60 % 50 == 10

Iteraton # 5 ------> 50 % 10 == 0

 Number of basic operation perform 5
 GCD = 10

```

```
 Iteraton # 1 ------> 110 % 590 == 110

Iteraton # 2 ------> 590 % 110 == 40

Iteraton # 3 ------> 110 % 40 == 30

Iteraton # 4 ------> 40 % 30 == 10

Iteraton # 5 ------> 30 % 10 == 0

 Number of basic operation perform 5
 GCD = 10

 Iteraton # 1 ------> 110 % 570 == 110

Iteraton # 2 ------> 570 % 110 == 20

Iteraton # 3 ------> 110 % 20 == 10

Iteraton # 4 ------> 20 % 10 == 0

 Number of basic operation perform 4
 GCD = 10

```

```
 Iteraton # 1 ------> 110 % 550 == 110

Iteraton # 2 ------> 550 % 110 == 0

 Number of basic operation perform 2
 GCD = 110

 Iteraton # 1 ------> 110 % 530 == 110

Iteraton # 2 ------> 530 % 110 == 90

Iteraton # 3 ------> 110 % 90 == 20

Iteraton # 4 ------> 90 % 20 == 10

Iteraton # 5 ------> 20 % 10 == 0

 Number of basic operation perform 5
 GCD = 10

 Iteraton # 1 ------> 110 % 510 == 110

Iteraton # 2 ------> 510 % 110 == 70

Iteraton # 3 ------> 110 % 70 == 40

Iteraton # 4 ------> 70 % 40 == 30
```

```
 Iteraton # 1 ------> 110 % 510 == 110

Iteraton # 2 ------> 510 % 110 == 70

Iteraton # 3 ------> 110 % 70 == 40

Iteraton # 4 ------> 70 % 40 == 30

Iteraton # 5 ------> 40 % 30 == 10

Iteraton # 6 ------> 30 % 10 == 0

 Number of basic operation perform 6
 GCD = 10

 Iteraton # 1 ------> 120 % 990 == 120

Iteraton # 2 ------> 990 % 120 == 30

Iteraton # 3 ------> 120 % 30 == 0

 Number of basic operation perform 3
 GCD = 30
```

```
 Iteraton # 1 ------> 120 % 970 == 120

Iteraton # 2 ------> 970 % 120 == 10

Iteraton # 3 ------> 120 % 10 == 0

 Number of basic operation perform 3
 GCD = 10

 Iteraton # 1 ------> 120 % 950 == 120

Iteraton # 2 ------> 950 % 120 == 110

Iteraton # 3 ------> 120 % 110 == 10

Iteraton # 4 ------> 110 % 10 == 0

 Number of basic operation perform 4
 GCD = 10
```

```
 Iteraton # 1 ------> 630 % 910 == 630

Iteraton # 2 ------> 910 % 630 == 280

Iteraton # 3 ------> 630 % 280 == 70

Iteraton # 4 ------> 280 % 70 == 0

 Number of basic operation perform 4
 GCD = 70
```

```
 Iteraton # 1 ------> 630 % 890 == 630

Iteraton # 2 ------> 890 % 630 == 260

Iteraton # 3 ------> 630 % 260 == 110

Iteraton # 4 ------> 260 % 110 == 40

Iteraton # 5 ------> 110 % 40 == 30

Iteraton # 6 ------> 40 % 30 == 10

Iteraton # 7 ------> 30 % 10 == 0

 Number of basic operation perform 7
 GCD = 10

 Iteraton # 1 ------> 630 % 870 == 630

Iteraton # 2 ------> 870 % 630 == 240

Iteraton # 3 ------> 630 % 240 == 150

Iteraton # 4 ------> 240 % 150 == 90

Iteraton # 5 ------> 150 % 90 == 60

Iteraton # 6 ------> 90 % 60 == 30

```

```
 Iteraton # 1 ------> 630 % 870 == 630

Iteraton # 2 ------> 870 % 630 == 240

Iteraton # 3 ------> 630 % 240 == 150

Iteraton # 4 ------> 240 % 150 == 90

Iteraton # 5 ------> 150 % 90 == 60

Iteraton # 6 ------> 90 % 60 == 30

Iteraton # 7 ------> 60 % 30 == 0

 Number of basic operation perform 7
 GCD = 30

```

```
 Iteraton # 1 ------> 990 % 530 == 460

Iteraton # 2 ------> 530 % 460 == 70

Iteraton # 3 ------> 460 % 70 == 40

Iteraton # 4 ------> 70 % 40 == 30

Iteraton # 5 ------> 40 % 30 == 10

Iteraton # 6 ------> 30 % 10 == 0

 Number of basic operation perform 6
 GCD = 10

 Iteraton # 1 ------> 990 % 510 == 480

Iteraton # 2 ------> 510 % 480 == 30

Iteraton # 3 ------> 480 % 30 == 0

 Number of basic operation perform 3
 GCD = 30
```

2. Identify the Input size and basic operation for Euclid Algorithm. Justify your response.

```
count=0
sum1=0
for i in range(100,1000,10):
    for j in range(990,500,-20):
            count=count+1
            a=gcd(i,j)
            sum1=sum1+a
```

Input size is number of 3 digit log of n

Basic operation if num1 % num2

3. Find and justify the following for Euclid Algorithm

a. Best Case Scenario for input of size k

```
266  Iteraton # 1 ------> 110 % 990 == 110
267
268 Iteraton # 2 ------> 990 % 110 == 0
269
270  Number of basic operation perform 2
271  GCD = 110
```

b. Worst Case Scenario for input of size k

```
3277  Iteraton # 1 ------> 210 % 970 == 210
3278
3279 Iteraton # 2 ------> 970 % 210 == 130
3280
3281 Iteraton # 3 ------> 210 % 130 == 80
3282
3283 Iteraton # 4 ------> 130 % 80 == 50
3284
3285 Iteraton # 5 ------> 80 % 50 == 30
3286
3287 Iteraton # 6 ------> 50 % 30 == 20
3288
3289 Iteraton # 7 ------> 30 % 20 == 10
3290
3291 Iteraton # 8 ------> 20 % 10 == 0
3292
3293  Number of basic operation perform 8
3294  GCD = 10
```

c. Average Case Scenario for input of size k

```
count=0
sum1=0
for i in range(100,1000,10):
    for j in range(990,500,-20):
            count=count+1
            a=gcd(i,j)
            sum1=sum1+a
```

```
In [35]: print(count)
         print(sum1)
         sum1/count

         2250
         10839

Out[35]: 4.817333333333333
```

```
 Iteraton # 1 ------> 110 % 590 == 110

Iteraton # 2 ------> 590 % 110 == 40

Iteraton # 3 ------> 110 % 40 == 30

Iteraton # 4 ------> 40 % 30 == 10

Iteraton # 5 ------> 30 % 10 == 0

 Number of basic operation perform 5
 GCD = 10
```

d. Random Case Scenario for input of size k

```
 Iteraton # 1 ------> 45 % 12 == 9

Iteraton # 2 ------> 12 % 9 == 3

Iteraton # 3 ------> 9 % 3 == 0

 Number of basic operation perform 3
 GCD = 3
```