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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

```

1  Iteraton # 1 -----> 100 % 990 == 100
2
3  Iteraton # 2 -----> 990 % 100 == 90
4
5  Iteraton # 3 -----> 100 % 90 == 10
6
7  Iteraton # 4 -----> 90 % 10 == 0
8
9  Number of basic operation perform 4
10 GCD = 10
11
12 Iteraton # 1 -----> 100 % 970 == 100
13
14 Iteraton # 2 -----> 970 % 100 == 70
15
16 Iteraton # 3 -----> 100 % 70 == 30
17
18 Iteraton # 4 -----> 70 % 30 == 10
19
20 Iteraton # 5 -----> 30 % 10 == 0
21
22 Number of basic operation perform 5
23 GCD = 10

```

```
25 Iteraton # 1 -----> 100 % 950 == 100
26
27 Iteraton # 2 -----> 950 % 100 == 50
28
29 Iteraton # 3 -----> 100 % 50 == 0
30
31 Number of basic operation perform 3
32 GCD = 50
33
34 Iteraton # 1 -----> 100 % 930 == 100
35
36 Iteraton # 2 -----> 930 % 100 == 30
37
38 Iteraton # 3 -----> 100 % 30 == 10
39
40 Iteraton # 4 -----> 30 % 10 == 0
41
42 Number of basic operation perform 4
43 GCD = 10
44
45 Iteraton # 1 -----> 100 % 910 == 100
46
47 Iteraton # 2 -----> 910 % 100 == 10
48
49 Iteraton # 3 -----> 100 % 10 == 0
50
51 Number of basic operation perform 3
52 GCD = 10
```

```
54 Iteraton # 1 -----> 100 % 890 == 100
55
56 Iteraton # 2 -----> 890 % 100 == 90
57
58 Iteraton # 3 -----> 100 % 90 == 10
59
60 Iteraton # 4 -----> 90 % 10 == 0
61
62 Number of basic operation perform 4
63 GCD = 10
64
65 Iteraton # 1 -----> 100 % 870 == 100
66
67 Iteraton # 2 -----> 870 % 100 == 70
68
69 Iteraton # 3 -----> 100 % 70 == 30
70
71 Iteraton # 4 -----> 70 % 30 == 10
72
73 Iteraton # 5 -----> 30 % 10 == 0
74
75 Number of basic operation perform 5
76 GCD = 10
```

```
78   Iteraton # 1 -----> 100 % 850 == 100
79
80   Iteraton # 2 -----> 850 % 100 == 50
81
82   Iteraton # 3 -----> 100 % 50 == 0
83
84   Number of basic operation perform 3
85   GCD = 50
86
87   Iteraton # 1 -----> 100 % 830 == 100
88
89   Iteraton # 2 -----> 830 % 100 == 30
90
91   Iteraton # 3 -----> 100 % 30 == 10
92
93   Iteraton # 4 -----> 30 % 10 == 0
94
95   Number of basic operation perform 4
96   GCD = 10
97
98   Iteraton # 1 -----> 100 % 810 == 100
99
100  Iteraton # 2 -----> 810 % 100 == 10
101
102  Iteraton # 3 -----> 100 % 10 == 0
103
104  Number of basic operation perform 3
105  GCD = 10
```

```
107 | Iteraton # 1 -----> 100 % 790 == 100
108 |
109 | Iteraton # 2 -----> 790 % 100 == 90
110 |
111 | Iteraton # 3 -----> 100 % 90 == 10
112 |
113 | Iteraton # 4 -----> 90 % 10 == 0
114 |
115 |   Number of basic operation perform 4
116 |   GCD = 10
117 |
118 | Iteraton # 1 -----> 100 % 770 == 100
119 |
120 | Iteraton # 2 -----> 770 % 100 == 70
121 |
122 | Iteraton # 3 -----> 100 % 70 == 30
123 |
124 | Iteraton # 4 -----> 70 % 30 == 10
125 |
126 | Iteraton # 5 -----> 30 % 10 == 0
127 |
128 |   Number of basic operation perform 5
129 |   GCD = 10
130 |
```

```
131 | Iteraton # 1 -----> 100 % 750 == 100
132 |
133 | Iteraton # 2 -----> 750 % 100 == 50
134 |
135 | Iteraton # 3 -----> 100 % 50 == 0
136 |
137 |   Number of basic operation perform 3
138 |   GCD = 50
139 |
140 |   Iteraton # 1 -----> 100 % 730 == 100
141 |
142 |   Iteraton # 2 -----> 730 % 100 == 30
143 |
144 |   Iteraton # 3 -----> 100 % 30 == 10
145 |
146 |   Iteraton # 4 -----> 30 % 10 == 0
147 |
148 |   Number of basic operation perform 4
149 |   GCD = 10
150 |
151 |   Iteraton # 1 -----> 100 % 710 == 100
152 |
153 |   Iteraton # 2 -----> 710 % 100 == 10
154 |
155 |   Iteraton # 3 -----> 100 % 10 == 0
156 |
157 |   Number of basic operation perform 3
158 |   GCD = 10
```

```
160 Iteraton # 1 -----> 100 % 690 == 100
161
162 Iteraton # 2 -----> 690 % 100 == 90
163
164 Iteraton # 3 -----> 100 % 90 == 10
165
166 Iteraton # 4 -----> 90 % 10 == 0
167
168 Number of basic operation perform 4
169 GCD = 10
170
171 Iteraton # 1 -----> 100 % 670 == 100
172
173 Iteraton # 2 -----> 670 % 100 == 70
174
175 Iteraton # 3 -----> 100 % 70 == 30
176
177 Iteraton # 4 -----> 70 % 30 == 10
178
179 Iteraton # 5 -----> 30 % 10 == 0
180
181 Number of basic operation perform 5
182 GCD = 10
183
```



```
184   Iteraton # 1 -----> 100 % 650 == 100
185
186   Iteraton # 2 -----> 650 % 100 == 50
187
188   Iteraton # 3 -----> 100 % 50 == 0
189
190   Number of basic operation perform 3
191   GCD = 50
192
193   Iteraton # 1 -----> 100 % 630 == 100
194
195   Iteraton # 2 -----> 630 % 100 == 30
196
197   Iteraton # 3 -----> 100 % 30 == 10
198
199   Iteraton # 4 -----> 30 % 10 == 0
200
201   Number of basic operation perform 4
202   GCD = 10
203
204   Iteraton # 1 -----> 100 % 610 == 100
205
206   Iteraton # 2 -----> 610 % 100 == 10
207
208   Iteraton # 3 -----> 100 % 10 == 0
209
210   Number of basic operation perform 3
211   GCD = 10
```

```

---
213 Iteraton # 1 -----> 100 % 590 == 100
214
215 Iteraton # 2 -----> 590 % 100 == 90
216
217 Iteraton # 3 -----> 100 % 90 == 10
218
219 Iteraton # 4 -----> 90 % 10 == 0
220
221 Number of basic operation perform 4
222 GCD = 10
223
224 Iteraton # 1 -----> 100 % 570 == 100
225
226 Iteraton # 2 -----> 570 % 100 == 70
227
228 Iteraton # 3 -----> 100 % 70 == 30
229
230 Iteraton # 4 -----> 70 % 30 == 10
231
232 Iteraton # 5 -----> 30 % 10 == 0
233
234 Number of basic operation perform 5
235 GCD = 10
236

```

```
237 Iteraton # 1 -----> 100 % 550 == 100
238
239 Iteraton # 2 -----> 550 % 100 == 50
240
241 Iteraton # 3 -----> 100 % 50 == 0
242
243 Number of basic operation perform 3
244 GCD = 50
245
246 Iteraton # 1 -----> 100 % 530 == 100
247
248 Iteraton # 2 -----> 530 % 100 == 30
249
250 Iteraton # 3 -----> 100 % 30 == 10
251
252 Iteraton # 4 -----> 30 % 10 == 0
253
254 Number of basic operation perform 4
255 GCD = 10
256
257 Iteraton # 1 -----> 100 % 510 == 100
258
259 Iteraton # 2 -----> 510 % 100 == 10
260
261 Iteraton # 3 -----> 100 % 10 == 0
262
263 Number of basic operation perform 3
264 GCD = 10
265
```

```
266   Iteraton # 1 -----> 110 % 990 == 110
267
268   Iteraton # 2 -----> 990 % 110 == 0
269
270   Number of basic operation perform 2
271   GCD = 110
272
273   Iteraton # 1 -----> 110 % 970 == 110
274
275   Iteraton # 2 -----> 970 % 110 == 90
276
277   Iteraton # 3 -----> 110 % 90 == 20
278
279   Iteraton # 4 -----> 90 % 20 == 10
280
281   Iteraton # 5 -----> 20 % 10 == 0
282
283   Number of basic operation perform 5
284   GCD = 10
```

```
286   Iteraton # 1 -----> 110 % 950 == 110
287
288   Iteraton # 2 -----> 950 % 110 == 70
289
290   Iteraton # 3 -----> 110 % 70 == 40
291
292   Iteraton # 4 -----> 70 % 40 == 30
293
294   Iteraton # 5 -----> 40 % 30 == 10
295
296   Iteraton # 6 -----> 30 % 10 == 0
297
298   Number of basic operation perform 6
299   GCD = 10
300
301   Iteraton # 1 -----> 110 % 930 == 110
302
303   Iteraton # 2 -----> 930 % 110 == 50
304
305   Iteraton # 3 -----> 110 % 50 == 10
306
307   Iteraton # 4 -----> 50 % 10 == 0
308
309   Number of basic operation perform 4
310   GCD = 10
```

```
312 Iteraton # 1 -----> 110 % 910 == 110
313
314 Iteraton # 2 -----> 910 % 110 == 30
315
316 Iteraton # 3 -----> 110 % 30 == 20
317
318 Iteraton # 4 -----> 30 % 20 == 10
319
320 Iteraton # 5 -----> 20 % 10 == 0
321
322 Number of basic operation perform 5
323 GCD = 10
324
325 Iteraton # 1 -----> 110 % 890 == 110
326
327 Iteraton # 2 -----> 890 % 110 == 10
328
329 Iteraton # 3 -----> 110 % 10 == 0
330
331 Number of basic operation perform 3
332 GCD = 10
```

```
334   Iteraton # 1 -----> 110 % 870 == 110
335
336   Iteraton # 2 -----> 870 % 110 == 100
337
338   Iteraton # 3 -----> 110 % 100 == 10
339
340   Iteraton # 4 -----> 100 % 10 == 0
341
342   Number of basic operation perform 4
343   GCD = 10
344
345   Iteraton # 1 -----> 110 % 850 == 110
346
347   Iteraton # 2 -----> 850 % 110 == 80
348
349   Iteraton # 3 -----> 110 % 80 == 30
350
351   Iteraton # 4 -----> 80 % 30 == 20
352
353   Iteraton # 5 -----> 30 % 20 == 10
354
355   Iteraton # 6 -----> 20 % 10 == 0
356
357   Number of basic operation perform 6
358   GCD = 10
359
```

```
360 Iteraton # 1 -----> 110 % 830 == 110
361
362 Iteraton # 2 -----> 830 % 110 == 60
363
364 Iteraton # 3 -----> 110 % 60 == 50
365
366 Iteraton # 4 -----> 60 % 50 == 10
367
368 Iteraton # 5 -----> 50 % 10 == 0
369
370 Number of basic operation perform 5
371 GCD = 10
372
373 Iteraton # 1 -----> 110 % 810 == 110
374
375 Iteraton # 2 -----> 810 % 110 == 40
376
377 Iteraton # 3 -----> 110 % 40 == 30
378
379 Iteraton # 4 -----> 40 % 30 == 10
380
381 Iteraton # 5 -----> 30 % 10 == 0
382
383 Number of basic operation perform 5
384 GCD = 10
385
```



```
386 Iteraton # 1 -----> 110 % 790 == 110
387
388 Iteraton # 2 -----> 790 % 110 == 20
389
390 Iteraton # 3 -----> 110 % 20 == 10
391
392 Iteraton # 4 -----> 20 % 10 == 0
393
394 Number of basic operation perform 4
395 GCD = 10
396
397 Iteraton # 1 -----> 110 % 770 == 110
398
399 Iteraton # 2 -----> 770 % 110 == 0
400
401 Number of basic operation perform 2
402 GCD = 110
403
```

```
404 Iteraton # 1 -----> 110 % 750 == 110
405
406 Iteraton # 2 -----> 750 % 110 == 90
407
408 Iteraton # 3 -----> 110 % 90 == 20
409
410 Iteraton # 4 -----> 90 % 20 == 10
411
412 Iteraton # 5 -----> 20 % 10 == 0
413
414 Number of basic operation perform 5
415 GCD = 10
416
417 Iteraton # 1 -----> 110 % 730 == 110
418
419 Iteraton # 2 -----> 730 % 110 == 70
420
421 Iteraton # 3 -----> 110 % 70 == 40
422
423 Iteraton # 4 -----> 70 % 40 == 30
424
425 Iteraton # 5 -----> 40 % 30 == 10
426
427 Iteraton # 6 -----> 30 % 10 == 0
428
429 Number of basic operation perform 6
430 GCD = 10
```

```
432 Iteraton # 1 -----> 110 % 710 == 110
433
434 Iteraton # 2 -----> 710 % 110 == 50
435
436 Iteraton # 3 -----> 110 % 50 == 10
437
438 Iteraton # 4 -----> 50 % 10 == 0
439
440 Number of basic operation perform 4
441 GCD = 10
442
443 Iteraton # 1 -----> 110 % 690 == 110
444
445 Iteraton # 2 -----> 690 % 110 == 30
446
447 Iteraton # 3 -----> 110 % 30 == 20
448
449 Iteraton # 4 -----> 30 % 20 == 10
450
451 Iteraton # 5 -----> 20 % 10 == 0
452
453 Number of basic operation perform 5
454 GCD = 10
```

```

456 Iteraton # 1 -----> 110 % 670 == 110
457
458 Iteraton # 2 -----> 670 % 110 == 10
459
460 Iteraton # 3 -----> 110 % 10 == 0
461
462 Number of basic operation perform 3
463 GCD = 10
464
465 Iteraton # 1 -----> 110 % 650 == 110
466
467 Iteraton # 2 -----> 650 % 110 == 100
468
469 Iteraton # 3 -----> 110 % 100 == 10
470
471 Iteraton # 4 -----> 100 % 10 == 0
472
473 Number of basic operation perform 4
474 GCD = 10
475

```

```
476 Iteraton # 1 -----> 110 % 630 == 110
477
478 Iteraton # 2 -----> 630 % 110 == 80
479
480 Iteraton # 3 -----> 110 % 80 == 30
481
482 Iteraton # 4 -----> 80 % 30 == 20
483
484 Iteraton # 5 -----> 30 % 20 == 10
485
486 Iteraton # 6 -----> 20 % 10 == 0
487
488 Number of basic operation perform 6
489 GCD = 10
490
491 Iteraton # 1 -----> 110 % 610 == 110
492
493 Iteraton # 2 -----> 610 % 110 == 60
494
495 Iteraton # 3 -----> 110 % 60 == 50
496
497 Iteraton # 4 -----> 60 % 50 == 10
498
499 Iteraton # 5 -----> 50 % 10 == 0
500
501 Number of basic operation perform 5
502 GCD = 10
503
```

```
504   Iteraton # 1 -----> 110 % 590 == 110
505
506   Iteraton # 2 -----> 590 % 110 == 40
507
508   Iteraton # 3 -----> 110 % 40 == 30
509
510   Iteraton # 4 -----> 40 % 30 == 10
511
512   Iteraton # 5 -----> 30 % 10 == 0
513
514   Number of basic operation perform 5
515   GCD = 10
516
517   Iteraton # 1 -----> 110 % 570 == 110
518
519   Iteraton # 2 -----> 570 % 110 == 20
520
521   Iteraton # 3 -----> 110 % 20 == 10
522
523   Iteraton # 4 -----> 20 % 10 == 0
524
525   Number of basic operation perform 4
526   GCD = 10
527
```

```
528 | Iteraton # 1 -----> 110 % 550 == 110
529 |
530 | Iteraton # 2 -----> 550 % 110 == 0
531 |
532 | Number of basic operation perform 2
533 | GCD = 110
534 |
535 | Iteraton # 1 -----> 110 % 530 == 110
536 |
537 | Iteraton # 2 -----> 530 % 110 == 90
538 |
539 | Iteraton # 3 -----> 110 % 90 == 20
540 |
541 | Iteraton # 4 -----> 90 % 20 == 10
542 |
543 | Iteraton # 5 -----> 20 % 10 == 0
544 |
545 | Number of basic operation perform 5
546 | GCD = 10
547 |
548 | Iteraton # 1 -----> 110 % 510 == 110
549 |
550 | Iteraton # 2 -----> 510 % 110 == 70
551 |
552 | Iteraton # 3 -----> 110 % 70 == 40
553 |
554 | Iteraton # 4 -----> 70 % 40 == 30
```

```

548   Iteraton # 1 -----> 110 % 510 == 110
549
550   Iteraton # 2 -----> 510 % 110 == 70
551
552   Iteraton # 3 -----> 110 % 70 == 40
553
554   Iteraton # 4 -----> 70 % 40 == 30
555
556   Iteraton # 5 -----> 40 % 30 == 10
557
558   Iteraton # 6 -----> 30 % 10 == 0
559
560   Number of basic operation perform 6
561   GCD = 10
562
563   Iteraton # 1 -----> 120 % 990 == 120
564
565   Iteraton # 2 -----> 990 % 120 == 30
566
567   Iteraton # 3 -----> 120 % 30 == 0
568
569   Number of basic operation perform 3
570   GCD = 30
571
572   Iteraton # 1 -----> 120 % 970 == 120
573
574   Iteraton # 2 -----> 970 % 120 == 10
575
576   Iteraton # 3 -----> 120 % 10 == 0
577
578   Number of basic operation perform 3
579   GCD = 10
580
581   Iteraton # 1 -----> 120 % 950 == 120
582
583   Iteraton # 2 -----> 950 % 120 == 110
584
585   Iteraton # 3 -----> 120 % 110 == 10
586
587   Iteraton # 4 -----> 110 % 10 == 0
588
589   Number of basic operation perform 4
590   GCD = 10

```

```
L7346 | Iteraton # 1 -----> 630 % 910 == 630
L7347 |
L7348 | Iteraton # 2 -----> 910 % 630 == 280
L7349 |
L7350 | Iteraton # 3 -----> 630 % 280 == 70
L7351 |
L7352 | Iteraton # 4 -----> 280 % 70 == 0
L7353 |
L7354 | Number of basic operation perform 4
L7355 | GCD = 70
L7356 |
```



```
17357   Iteraton # 1 -----> 630 % 890 == 630
17358
17359   Iteraton # 2 -----> 890 % 630 == 260
17360
17361   Iteraton # 3 -----> 630 % 260 == 110
17362
17363   Iteraton # 4 -----> 260 % 110 == 40
17364
17365   Iteraton # 5 -----> 110 % 40 == 30
17366
17367   Iteraton # 6 -----> 40 % 30 == 10
17368
17369   Iteraton # 7 -----> 30 % 10 == 0
17370
17371   Number of basic operation perform 7
17372   GCD = 10
17373
17374   Iteraton # 1 -----> 630 % 870 == 630
17375
17376   Iteraton # 2 -----> 870 % 630 == 240
17377
17378   Iteraton # 3 -----> 630 % 240 == 150
17379
17380   Iteraton # 4 -----> 240 % 150 == 90
17381
17382   Iteraton # 5 -----> 150 % 90 == 60
17383
17384   Iteraton # 6 -----> 90 % 60 == 30
17385
```

```
17374 Iteraton # 1 -----> 630 % 870 == 630
17375
17376 Iteraton # 2 -----> 870 % 630 == 240
17377
17378 Iteraton # 3 -----> 630 % 240 == 150
17379
17380 Iteraton # 4 -----> 240 % 150 == 90
17381
17382 Iteraton # 5 -----> 150 % 90 == 60
17383
17384 Iteraton # 6 -----> 90 % 60 == 30
17385
17386 Iteraton # 7 -----> 60 % 30 == 0
17387
17388 Number of basic operation perform 7
17389 GCD = 30
17390
```

```

28405 Iteraton # 1 -----> 990 % 530 == 460
28406
28407 Iteraton # 2 -----> 530 % 460 == 70
28408
28409 Iteraton # 3 -----> 460 % 70 == 40
28410
28411 Iteraton # 4 -----> 70 % 40 == 30
28412
28413 Iteraton # 5 -----> 40 % 30 == 10
28414
28415 Iteraton # 6 -----> 30 % 10 == 0
28416
28417 Number of basic operation perform 6
28418 GCD = 10
28419
28420 Iteraton # 1 -----> 990 % 510 == 480
28421
28422 Iteraton # 2 -----> 510 % 480 == 30
28423
28424 Iteraton # 3 -----> 480 % 30 == 0
28425
28426 Number of basic operation perform 3
28427 GCD = 30
28428
28429

```

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
3295
```

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