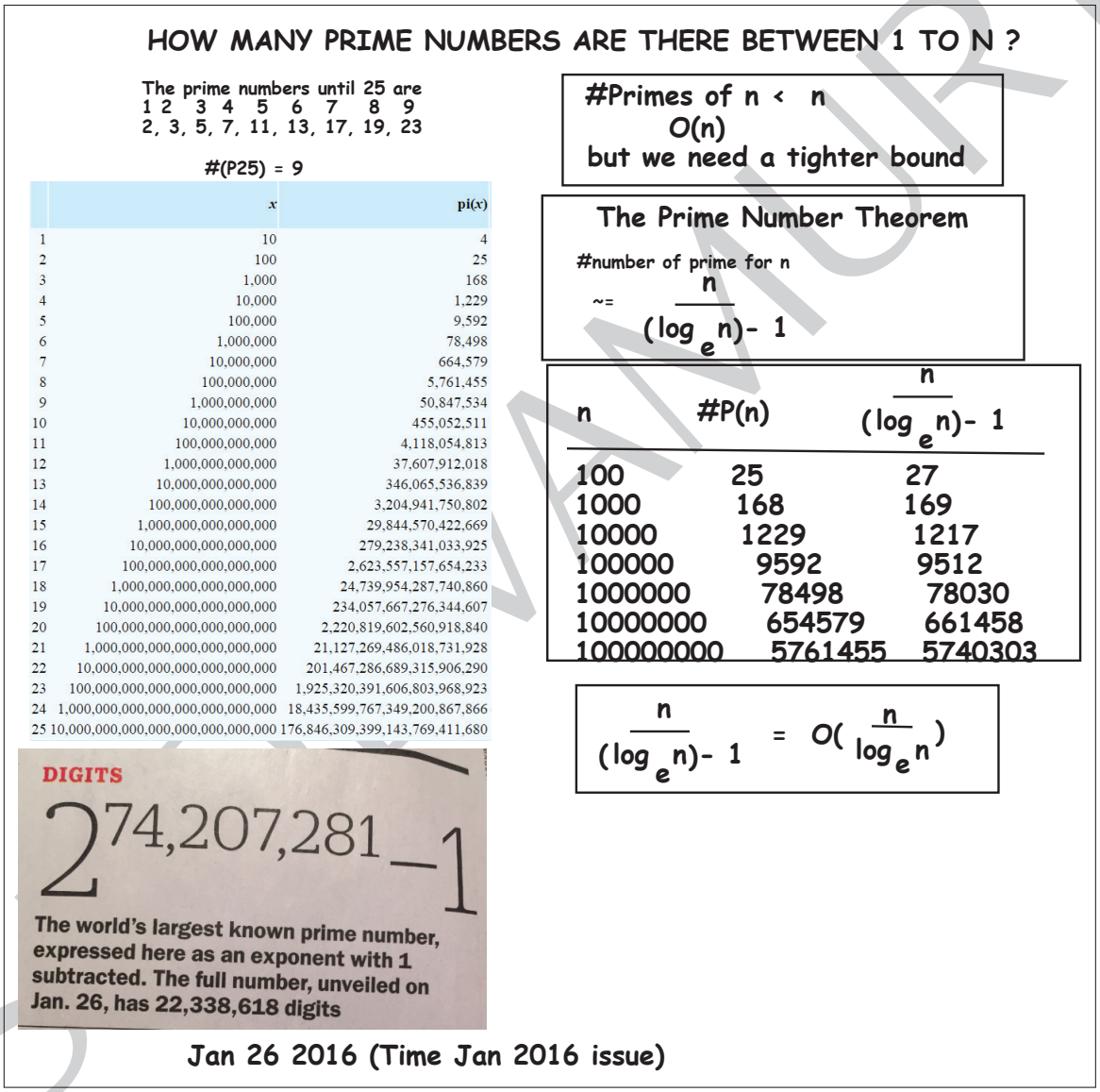

	x	pi(x)
1	10	4
2	100	25
3	1,000	168
4	10,000	1,229
5	100,000	9,592
6	1,000,000	78,498
7	10,000,000	664,579
8	100,000,000	5,761,455
9	1,000,000,000	50,847,534
10	10,000,000,000	455,052,511
11	100,000,000,000	4,118,054,813
12	1,000,000,000,000	37,607,912,018
13	10,000,000,000,000	346,065,536,839
14	100,000,000,000,000	3,204,941,750,802
15	1,000,000,000,000,000	29,844,570,422,669
16	10,000,000,000,000,000	279,238,341,033,925
17	100,000,000,000,000,000	2,623,557,157,654,233
18	1,000,000,000,000,000,000	24,739,954,287,740,860
19	10,000,000,000,000,000,000	234,057,667,276,344,607
20	100,000,000,000,000,000,000	2,220,819,602,560,918,840
21	1,000,000,000,000,000,000,000	21,127,269,486,018,731,928
22	10,000,000,000,000,000,000,000	201,467,286,689,315,906,290
23	100,000,000,000,000,000,000,000	1,925,320,391,606,803,968,923
24	1,000,000,000,000,000,000,000,000	18,435,599,767,349,200,867,866
25	10,000,000,000,000,000,000,000,000	176,846,309,399,143,769,411,680

Figure 2.18: Computing numbers of prime numbers

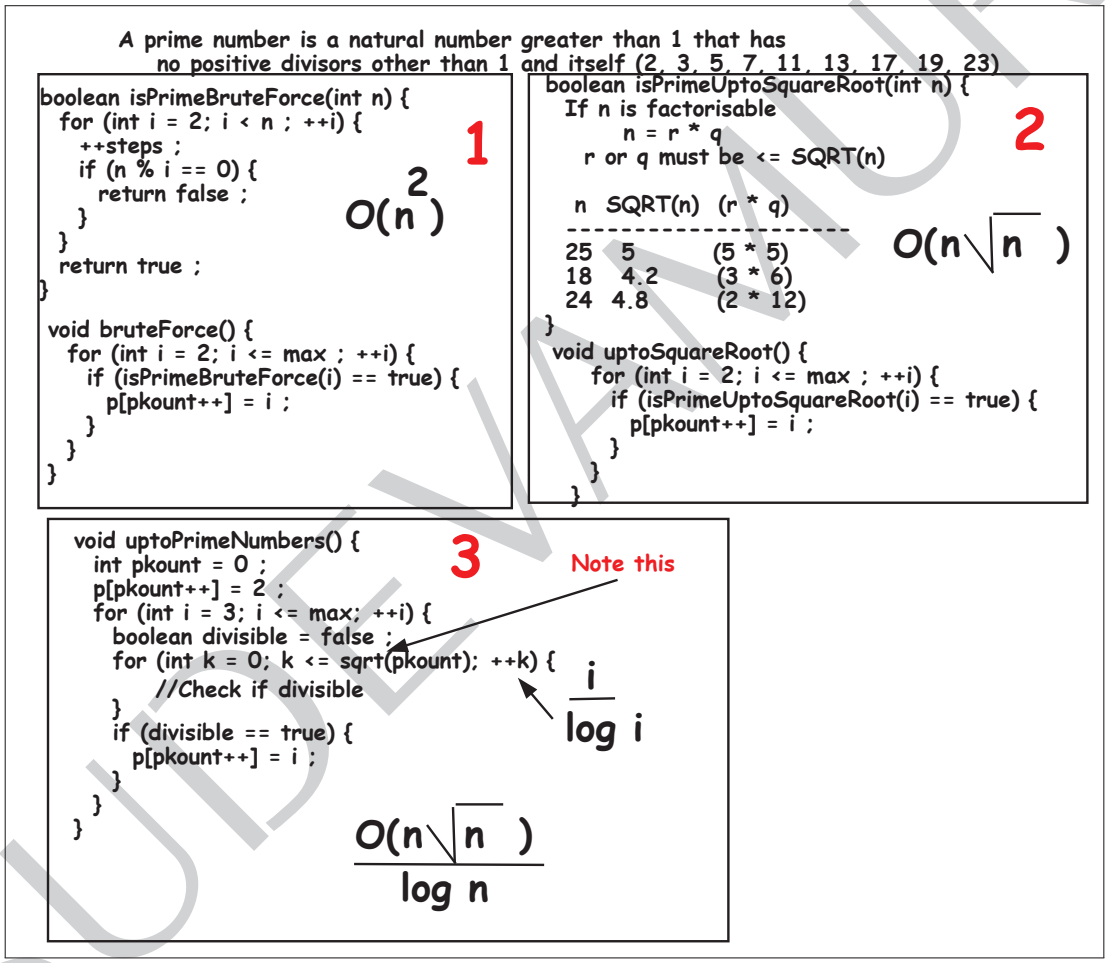

Figure 2.19: Three algorithms for generating prime numbers

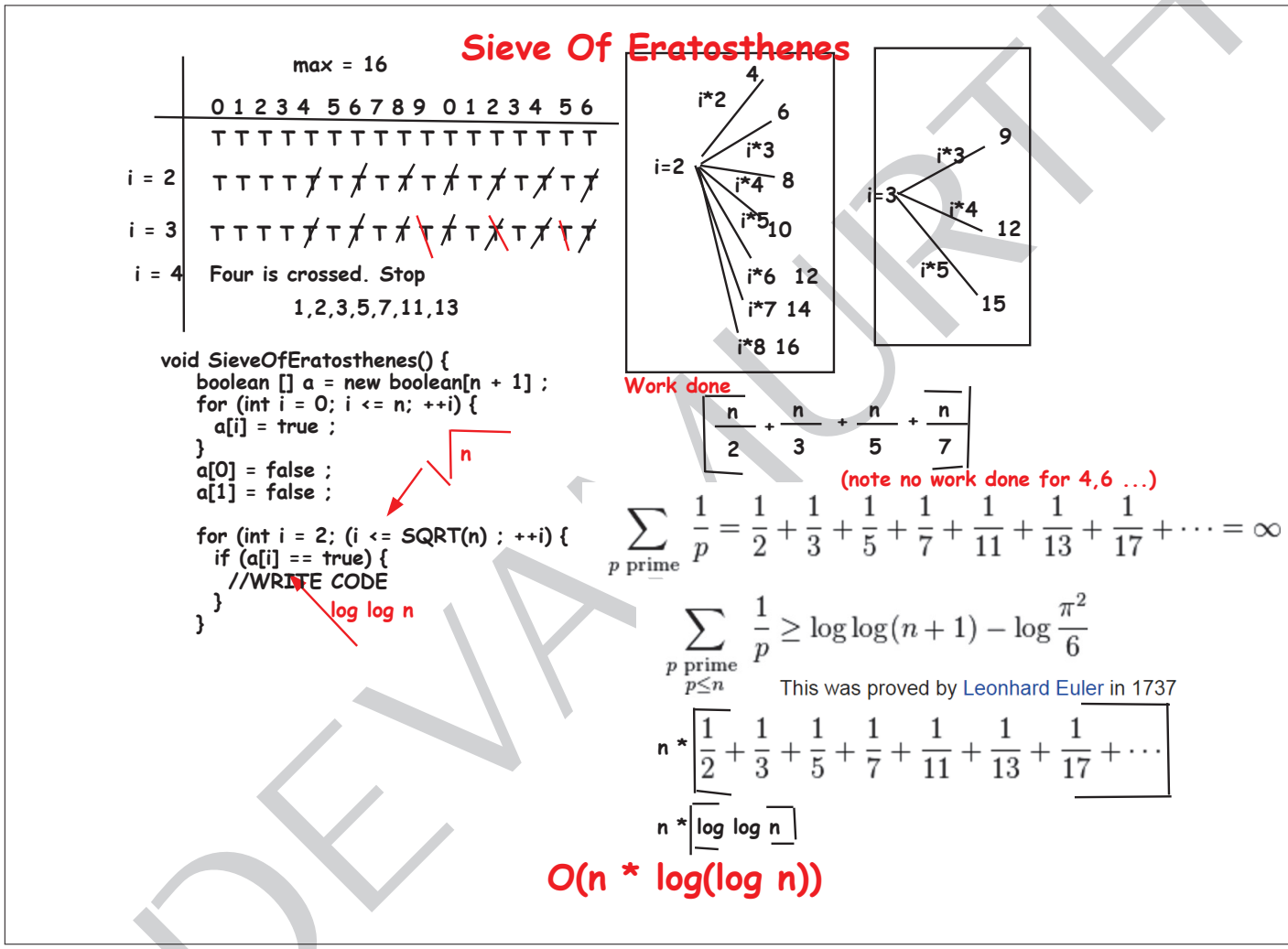

Figure 2.20: Sieve of Eratosthenes algorithm

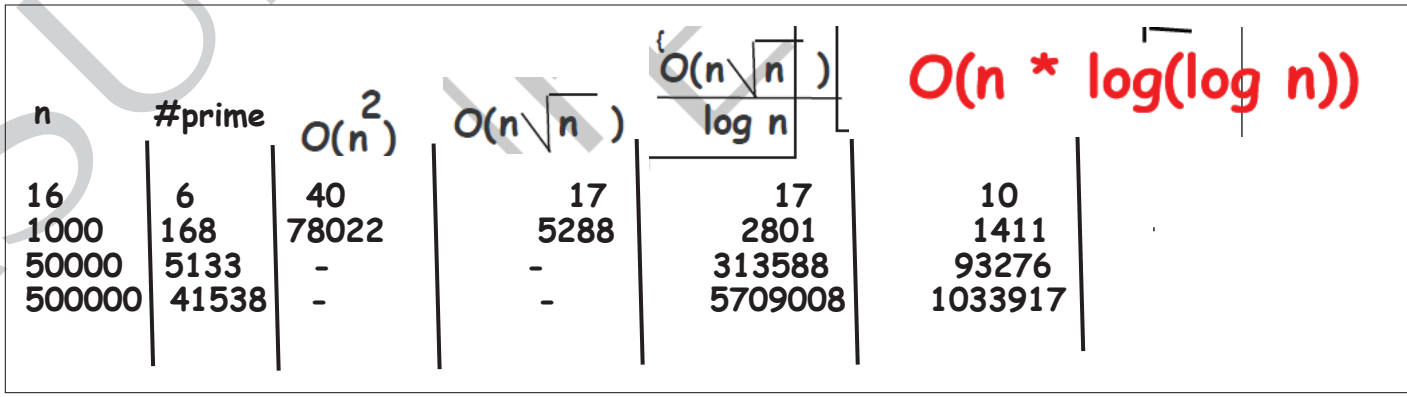

Figure 2.21: Number of steps with all the four methods

2.9.1 Expected output

```
Testing Prime.py Starts
------------- 100 -------------------------
--------------- n*SquareRoot(n)  Method-----------------------
100  has  25  Prime. Took 187  steps to compute
Total CPU time in sec = 0.0
--------------- uptoprime  Method-----------------------
100  has  25  Prime. Took 132  steps to compute
Total CPU time in sec = 0.0
--------------- n*log(n)  Method-----------------------
100  has  25  Prime. Took 306  steps to compute
Total CPU time in sec = 0.0
------------- 1000 -------------------------
--------------- n*SquareRoot(n)  Method-----------------------
1000  has  168  Prime. Took 4789  steps to compute
Total CPU time in sec = 0.0
--------------- uptoprime  Method-----------------------
1000  has  168  Prime. Took 2302  steps to compute
Total CPU time in sec = 0.0
--------------- n*log(n)  Method-----------------------
1000  has  168  Prime. Took 3413  steps to compute
Total CPU time in sec = 0.0
------------- 10000 -------------------------
--------------- n*SquareRoot(n)  Method-----------------------
10000  has  1229  Prime. Took 112528  steps to compute
Total CPU time in sec = 0.03125
--------------- uptoprime  Method-----------------------
10000  has  1229  Prime. Took 38754  steps to compute
Total CPU time in sec = 0.0
--------------- n*log(n)  Method-----------------------
10000  has  1229  Prime. Took 36983  steps to compute
Total CPU time in sec = 0.015625
------------- 100000 -------------------------
--------------- n*SquareRoot(n)  Method-----------------------
100000  has  9592  Prime. Took 2695695  steps to compute
Total CPU time in sec = 0.578125
--------------- uptoprime  Method-----------------------
100000  has  9592  Prime. Took 694437  steps to compute
Total CPU time in sec = 0.171875
--------------- n*log(n)  Method-----------------------
```



```
100000  has  9592  Prime. Took 393080  steps to compute
Total CPU time in sec = 0.078125
------------- 1000000  cannot compute using n^2 method -------------
--------------- uptoprime  Method-----------------------
1000000  has  78498  Prime. Took 13427403  steps to compute
Total CPU time in sec = 3.4375
--------------- n*log(n)  Method-----------------------
1000000  has  78498  Prime. Took 4122050  steps to compute
Total CPU time in sec = 0.890625
------------- 10000000  cannot compute using n^2 method -------------
--------------- uptoprime  Method-----------------------
10000000  has  664579  Prime. Took 281144939  steps to compute
Total CPU time in sec = 77.546875
--------------- n*log(n)  Method-----------------------
10000000  has  664579  Prime. Took 42850053  steps to compute
Total CPU time in sec = 10.296875
------------- 100000000  cannot compute using n^2 method -------------
--------------- uptoprime  Method-----------------------
100000000  has  5761455  Prime. Took 6270928471  steps to compute
Total CPU time in sec = 1950.484375
--------------- n*log(n)  Method-----------------------
100000000  has  5761455  Prime. Took 442570206  steps to compute
Total CPU time in sec = 110.625
ALL TESTS PASSED
Testing Prime.py ENDS
```

2.10 Exponential algorithms

2.10.1 Geometric series

