Output and total time of problem requests

% java PercolationStats 200 100

```
mean:                           = 0.5932544999999998
stddev:                         = 0.010132043864827467
95% confidence interval = 0.5912686194024936, 0.595240380597506
The total time is:  0.411
```

% java PercolationStats 200 100

```
mean:                           = 0.591239
stddev:                         = 0.009900568369563639
95% confidence interval = 0.5892984885995655, 0.5931795114004345
The total time is:  0.391
```

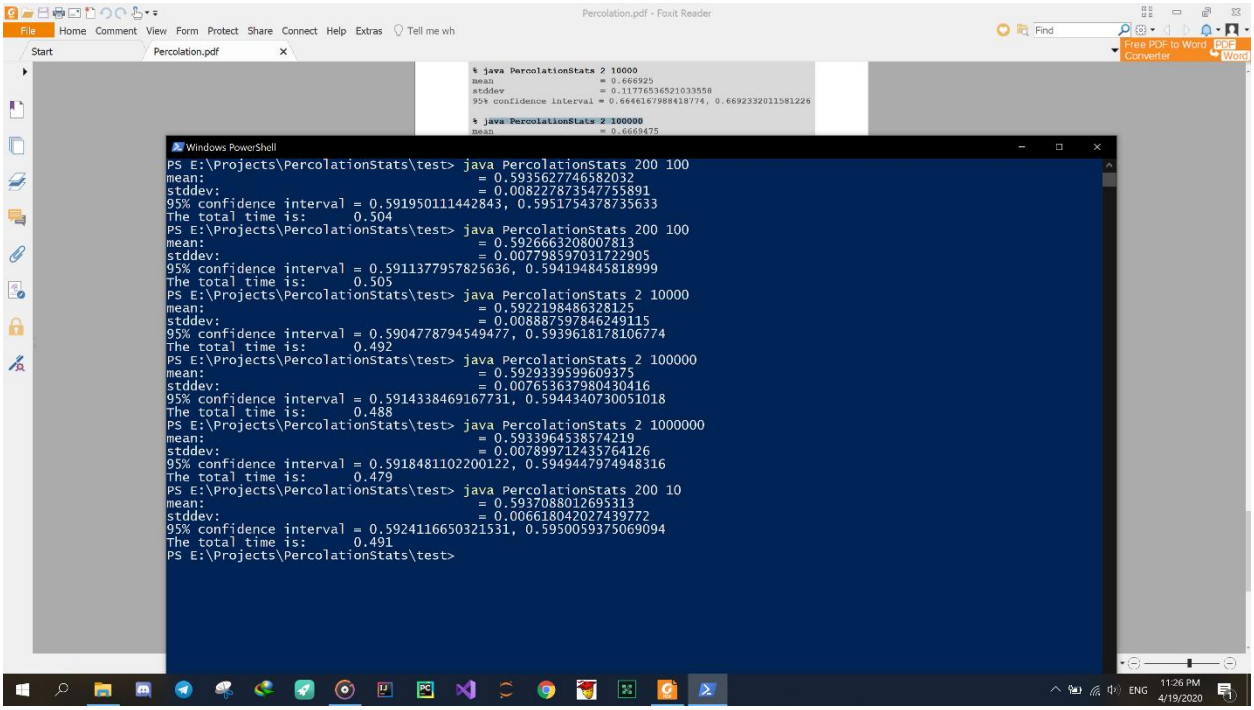
% java PercolationStats 2 10000

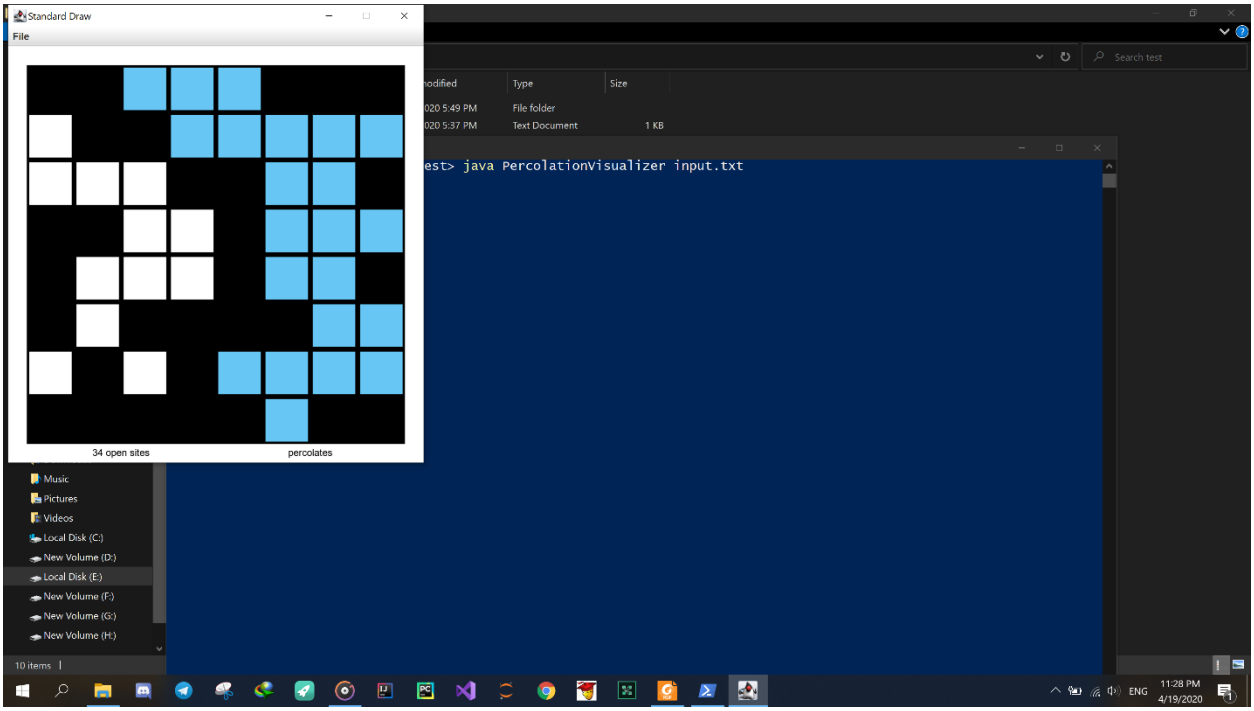
```
mean:                           = 0.6665
stddev:                         = 0.11791581918487896
95% confidence interval = 0.6641888499439763, 0.6688111500560237
The total time is:  0.058
```

% java PercolationStats 2 100000

```
mean:                           = 0.6670625
stddev:                         = 0.11771102179742576
95% confidence interval = 0.6663329195282123, 0.6677920804717877
The total time is:  0.14
```

Screenshots of compiling project:





Runtime analysis

% java PercolationStats 1 100

```
mean:                           = 1.0
stddev:                         = 0.0
95% confidence interval = 1.0, 1.0
The total time is:  0.037
```

% java PercolationStats 2 100

```
mean:                           = 0.6675
stddev:                         = 0.11814539065631512
95% confidence interval = 0.6443435034313623, 0.6906564965686377
The total time is:  0.042
```

% java PercolationStats 4 100

```
mean:                           = 0.600625
stddev:                         = 0.10948362210897576
95% confidence interval = 0.5791662100666407, 0.6220837899333592
The total time is:  0.042
```

% java PercolationStats 8 100

```
mean:                           = 0.59515625
stddev:                         = 0.08847465712976679
95% confidence interval = 0.5778152172025658, 0.6124972827974343
The total time is:  0.044
```

% java PercolationStats 16 100

```
mean:                           = 0.5917578125
stddev:                         = 0.05516312996747516
95% confidence interval = 0.5809458390263749, 0.6025697859736252
The total time is:  0.054
```

% java PercolationStats 32 100

```
mean:                           = 0.586201171875
stddev:                         = 0.038827232789562585
95% confidence interval = 0.5785910342482458, 0.5938113095017542
The total time is:  0.077
```

% java PercolationStats 64 100

```
mean:                           = 0.59226318359375
stddev:                         = 0.02218114837699032
95% confidence interval = 0.5879156785118599, 0.59661068867564
The total time is:  0.147
```

% java PercolationStats 128 100

```
mean:                           = 0.593360595703125
stddev:                         = 0.014485886922634118
95% confidence interval = 0.5905213618662888, 0.5961998295399613
The total time is:  0.215
```

% java PercolationStats 256 100

```
mean:                           = 0.5927090454101562
stddev:                         = 0.008122833003222073
95% confidence interval = 0.5911169701415248, 0.5943011206787877
The total time is:  0.584
```

% java PercolationStats 512 100

```
mean:                           = 0.5925073623657227
stddev:                         = 0.0050026776854162165
```

```
95% confidence interval = 0.5915268375393811, 0.5934878871920642
The total time is:  3.93
```

% java PercolationStats 1024 100

```
mean:                           = 0.5928369235992431
stddev:                         = 0.003038666333773182
95% confidence interval = 0.5922413449978235, 0.5934325022006627
The total time is:  19.23
```

% java PercolationStats 2048 100

```
mean:                           = 0.5925393152236939
stddev:                         = 0.001748037720134768
95% confidence interval = 0.5921966998305475, 0.5928819306168402
The total time is:  97.186
```

% java PercolationStats 4096 100

```
mean:                           = 0.5929054927825927
stddev:                         = 0.0012065776967578469
95% confidence interval = 0.5926690035540282, 0.5931419820111573
The total time is:  468.832
```

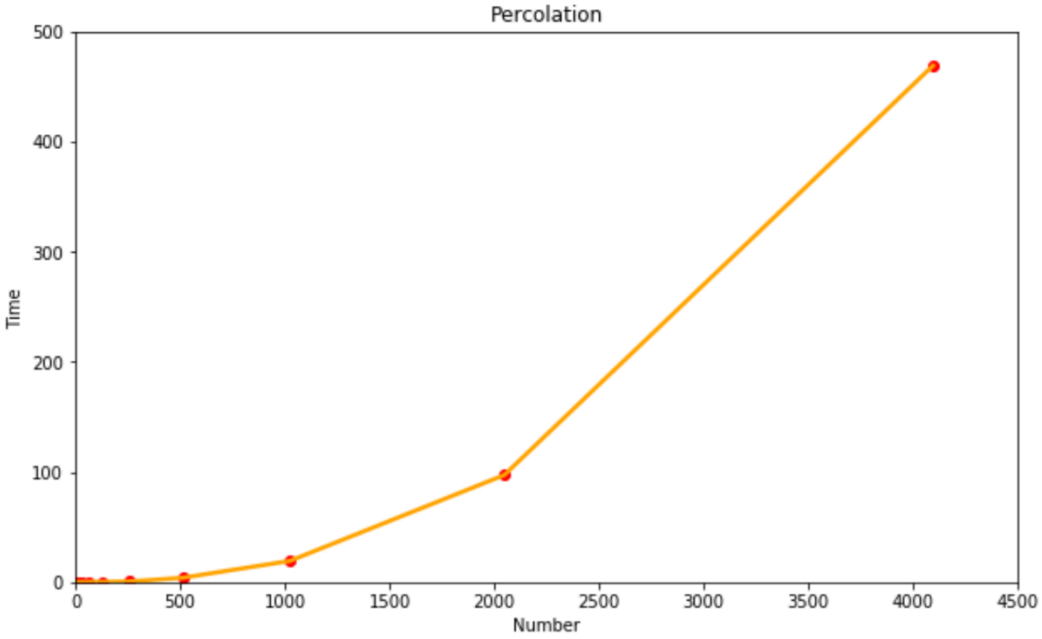
As can be seen from the above numbers, doubling the numbers (N) increases the execution time. That T(n) is analyzed through the following relationships. Of course, due to random selection, the numbers are approximate and inaccurate, but we take almost the same values calculated by Stopwatch to analyze the same algorithm.

Experimental observation:

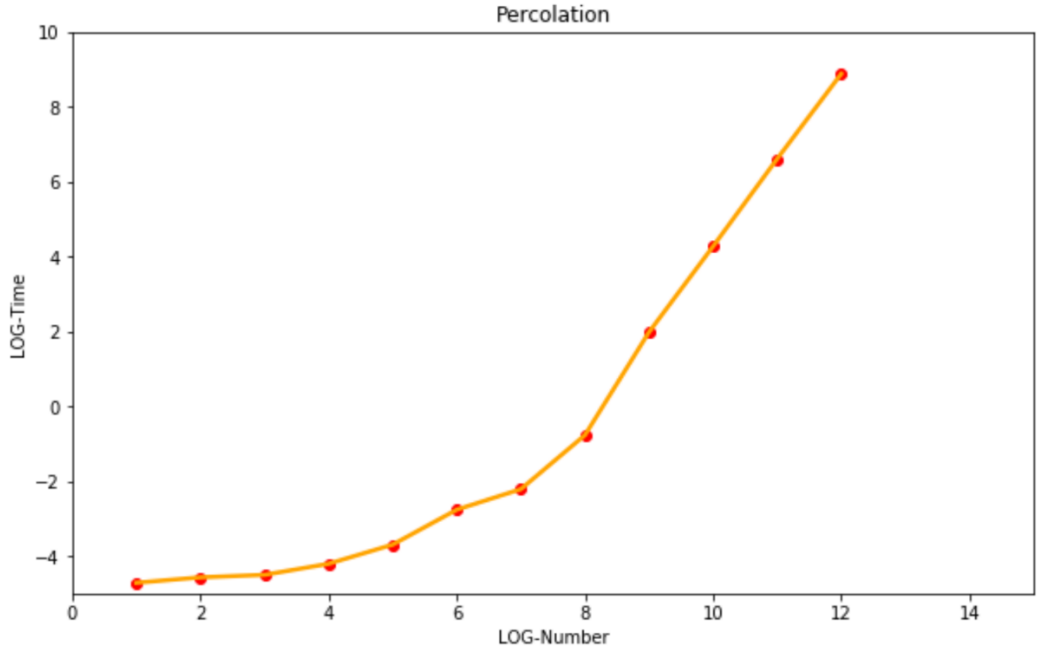
N	Time(seconds)
2	0.038
4	0.042
8	0.044
16	0.054
32	0.077
64	0.147
128	0.215
256	0.584
512	3.93
1024	19.23
2048	97.186
4096	468.832

In the figure below, we see the diagrams drawn in the Jupyter Notebook environment by matplotlib.

Standard diagram:



Log-Log chart:



Time(seconds)	N	LOG-TIME	LOG-N
0.038	2	-4.7179	1.0000
0.042	4	-4.5735	2.0000
0.044	8	-4.5064	3.0000
0.054	16	-4.2109	4.0000
0.077	32	-3.6990	5.0000
0.147	64	-2.7661	6.0000
0.215	128	-2.2176	7.0000
0.584	256	-0.7760	8.0000
3.93	512	1.9745	9.0000
19.23	1024	4.2653	10.0000
97.186	2048	6.6027	11.0000
468.832	4096	8.8729	12.0000

Due to the high error rate of low data, we use high-value data to analyze the algorithm and find the slope of the graph.

$$Lg(T(n)) = blgN + c$$

$$b = \frac{8.8729 - (-0.7760)}{12.0 - 8.0} = 2.412225$$

$$1.9745 = b * 9.0 + c, \quad c = -19.73575$$

$$T(n) = aN^b, \quad a = 2^c$$

$$T(n) = 1.46 * 10^{-6} N^{2.412}$$