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Copy/Paste from running PercolationStats with these grid sizes:

grid sizes of 100, 200, 400, 800, 1600, and 3200

and using 20 trials

PercolationDFSFast

simulation data for 20 trials

grid	mean	stddev	total time
100	0.593	0.014	0.234
200	0.591	0.010	0.292
400	0.590	0.006	1.942
800	0.594	0.004	10.773

There is a stackoverflow error for grid values more than 800.

PercolationBF

simulation data for 20 trials

grid	mean	stddev	total time
100	0.593	0.014	0.240
200	0.591	0.010	0.270
400	0.590	0.006	1.552
800	0.594	0.004	6.627
1600	0.592	0.002	51.046
3200	0.593	0.001	290.038

PercolationUF with QuickUWPC

simulation data for 20 trials

grid	mean	stddev	total time
100	0.593	0.014	0.286

200	0.591	0.010	0.435
400	0.590	0.006	1.574
800	0.594	0.004	5.155
1600	0.592	0.002	23.996
3200	0.593	0.001	181.974

Answer these questions for PercolateUF with a QuickUWPC union-find object

How does doubling the grid size affect running time (keeping # trials fixed)

Based on the data, we see that doubling the grid affects the running time by a margin between 4 and 5. We suspect that if the grid size is N, the run time is O(N^2 log N). Thus depending on the initial grid size, the runtime is affected differently on doubling grid size, as log (2N)/ log (N) depends on N. However for the values of grid size here, it is roughly around 1.1 and 1.2. This also agrees with the fact that union find algorithm takes place in logarithmic time O(N). Since number of squares needed to percolate is O(N^2), where N is grid size, total runtime is O(N^2 log N), agreeing with experimental data.

How does doubling the number of trials affect running time.

For 10 trials, we get:

simulation data for 10 trials

grid	mean	stddev	total time
100	0.593	0.019	0.112
200	0.596	0.006	0.179
400	0.592	0.006	0.597
800	0.592	0.003	3.002
1600	0.594	0.002	12.974
3200	0.593	0.001	57.771

For 40 trials, we get:

simulation data for 40 trials

grid	mean	stddev	total time
100	0.594	0.015	0.487
200	0.591	0.009	0.951
400	0.591	0.005	4.547
800	0.593	0.004	14.580

1600 0.593 0.002 77.712

Based on the data for 10, 20 and 40 trials,

The running time approximately doubles with doubling the number of trials. If the number of trials is N, running time is O(N).

Estimate the largest grid size you can run in 24 hours with 20 trials. Explain your reasoning.

24 hrs = 86400 seconds

24 seconds was the rough time for grid size = 1600.

86400/24 = 3600

Therefore, if grid size is 1600k,

3600 = k^2 * log (k)/log 1600

k^2 * log (k) = 11534.8319,

Log (k) is roughly 1.3 (base 10 taken)

k=82(roughly)

Therefore, the largest grid size is about **132000.**

Answer) 132000