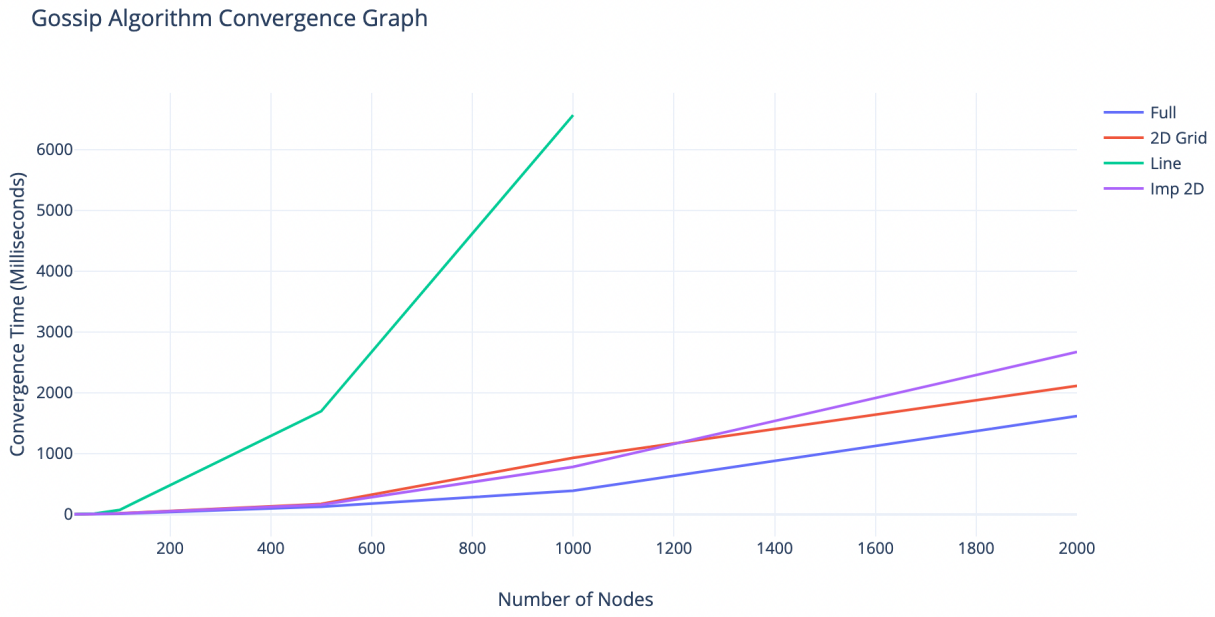
Project 2 Report

Group Members:
Joseph S Rayan, (UFID: 61022245), josephsrayan@ufl.edu
Sai Krishna Anugu, (UFID: 42266064), saikrishnaanugu@ufl.edu

Observation on Gossip Algorithm Convergence

Num of Nodes	Full Topology (ms)	Line Topology (ms)	2D Grid (ms)	Imperfect 2D (ms)
10	0	1	0	1
50	4	12	5	6
100	8	72	16	15
500	125	1696	170	157
1000	387	6567	930	780
2000	1616	132703	2112	2670



1) Line Topology: Convergence time for grows in an exponential manner as the number of nodes increases.
    a. This is to be expected as this topology has the least number of neighbors to spread the gossip and thus the amount of time it takes to spread to all the neighbors is much longer

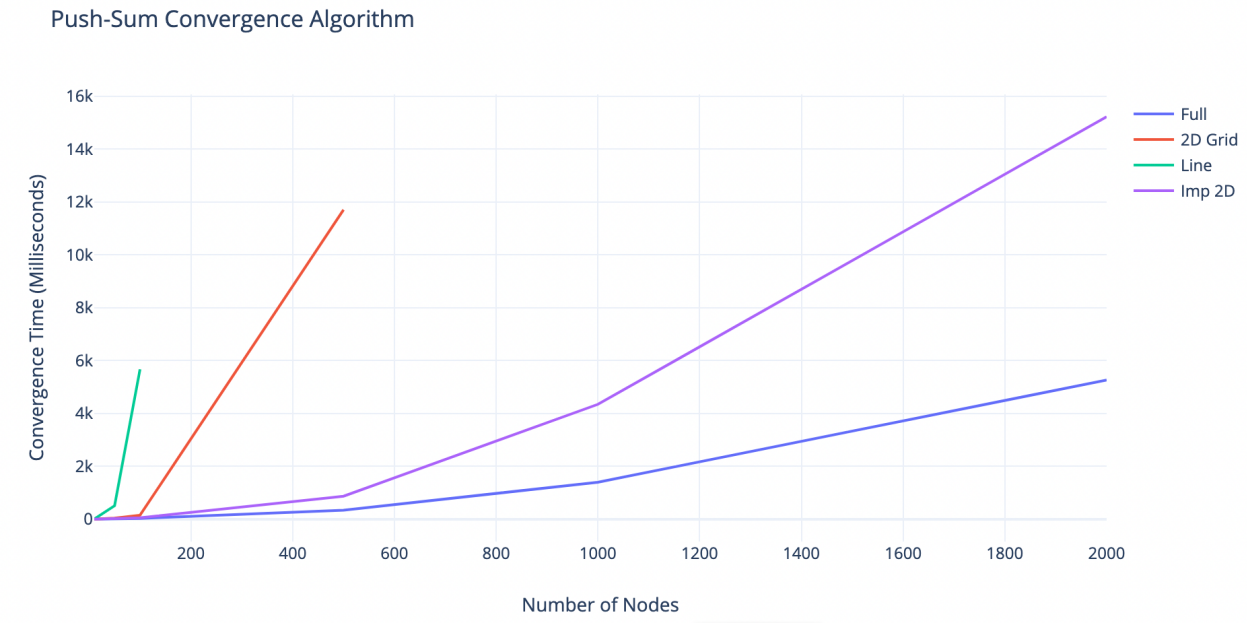
2) Full Topology: has the lowest convergence time among all 4 topologies

a. Again, this is also to be expected as the neighbors for this topology are basically everyone else and thus the options for spreading the gossip are bound only by the number of nodes there are

3) 2D-Grid and Imperfect 2D: The convergence times for both topologies are relatively close.
   a. This is due to the number of neighbors that each node can spread the rumor to are around the same ballpark of neighbors.

Observation on Push-Sum Algorithm Convergence

Num of Nodes	Full Topology (ms)	Line Topology (ms)	2D Grid (ms)	Imperfect 2D (ms)
10	2	8	2	2
50	12	511	42	22
100	31	5670	150	54
500	340	784671	1170	870
1000	1399	-	105293	4345
2000	5265	-	-	15221



1) Line Topology: Convergence time grows at a much faster rate as the number of nodes increases.

a. Like Gossip Algorithm, this topology has the longest convergence time compared to the others

2) Full Topology: has the lowest convergence time among all 4 topologies
    a. Like Gossip Algorithm, this topology has the shortest convergence time compared to the rest

3) 2D-Grid and Imperfect 2D: The convergence times for both topologies are further apart
    a. For the push-sum algorithm, it can be observed that Imperfect 2D topology has a lower convergence time in general as the number of neighbors available will increase faster due to the randomized nature of the topology where there there is a possibility of choosing a random node other than the immediate neighbor. This causes the gossip to spread at a much higher rate due the parallelism of the actors.

Comparisons between both Algorithms

1) In general, it can be observed that the normal gossip algorithm has a lower convergence time across all topologies as compared the push-sum algorithm.
    a. Some possible reasons as why are due to the nature of convergence for the push-sum algorithm.

The normal algorithm only requires that the gossip is received by a neighbor a certain number of times, whereas the push-sum algorithm requires that the change of sum estimate ratio for each fall below the threshold of 10^(-10).

Maximum Node Values Checked

	Maximum Node Value	Gossip (ms)	Maximum Node Value	Push-Sum (ms)
Full	10000	57910	4000	22699
Line	2100	177365	500	784671
2D	10000	91196	1000	105293
Imperfect 2D	10000	146014	4000	68528

Appendix

```
40> maingossip:start(10000,"full").

start time is {12937523,6852}true

convergence time is 57910 milliseconds
```

```
2> maingossip:start(10000, "2dgrid").

Num of Nodes rounded off to 10000
start time is {26715,8625}true

convergence time is 91196 milliseconds
```

```
40> maingossip:start(10000,"full").

start time is {12937523,6852}true

convergence time is 57910 milliseconds
```

```
5> mainpushsum:start(4000, "full").

start time is {1154197,485384}<0.26298.0>

convergence time is 22699 milliseconds
```

```
4> maingossip:start(2100, "line").

start time is {491448,96045}true

convergence time is 177365 milliseconds
```

```
3> maingossip:start(10000, "imp2d").

Num of Nodes rounded off to 10000
start time is {249389,131478}true

convergence time is 146014 milliseconds
```

```
3> maingossip:start(10000, "imp2d").

Num of Nodes rounded off to 10000
start time is {249389,131478}true

convergence time is 146014 milliseconds
```