

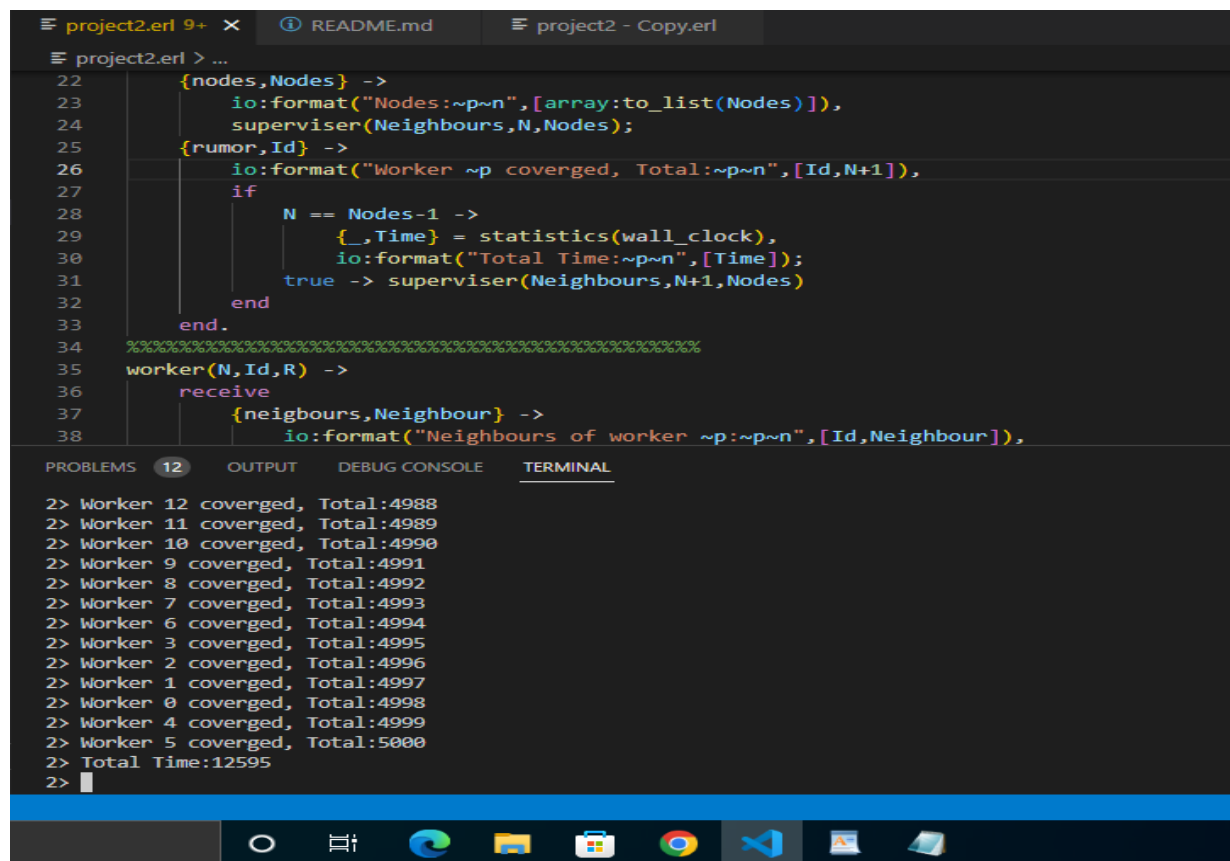
# COP 5615: Project 2 Report

## Project Members:

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We considered 10000 nodes for Gossip Algorithm, 1000 nodes for Pushsum Algorithm, and attached a sample output for the both algorithms and graphs for all the topologies.

## Sample code run screenshot:



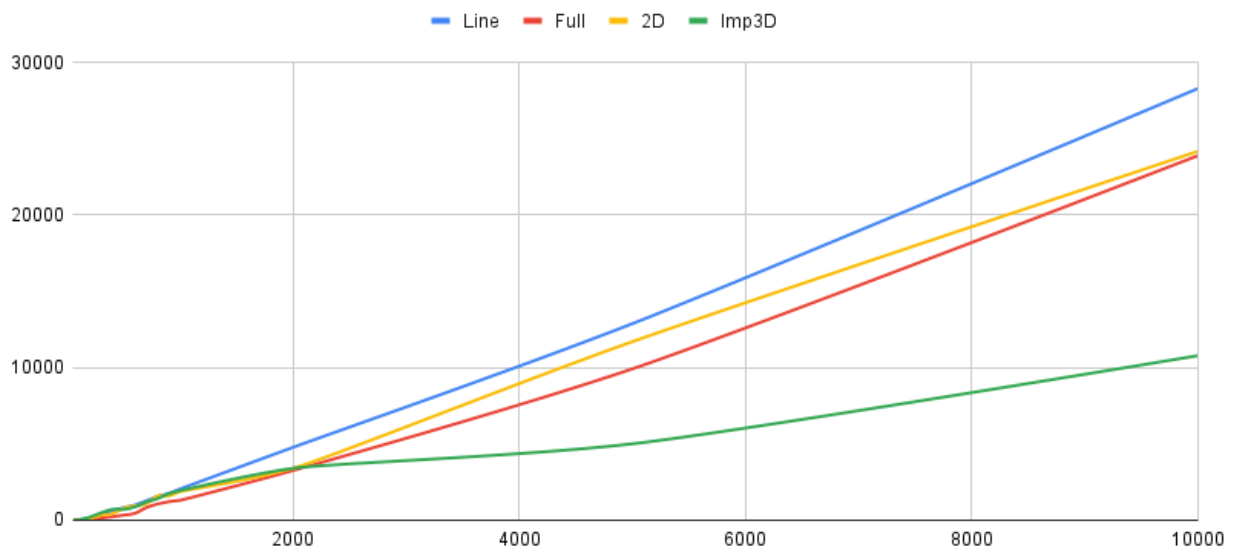
```
project2.eri 9+ x  README.md  project2 - Copy.eri
project2.eri > ...
22 {nodes,Nodes} ->
23   io:format("Nodes:~p~n",[array:to_list(Nodes)]),
24   supervisor(Neighbours,N,Nodes);
25 {rumor,Id} ->
26   io:format("Worker ~p covered, Total:~p~n",[Id,N+1]),
27   if
28     N == Nodes-1 ->
29       {_,Time} = statistics(wall_clock),
30       io:format("Total Time:~p~n",[Time]);
31     true -> supervisor(Neighbours,N+1,Nodes)
32   end
33 end.
34 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
35 worker(N,Id,R) ->
36   receive
37     {neighbours,Neighbour} ->
38       io:format("Neighbours of worker ~p:~p~n",[Id,Neighbour]),
39       R(N,Id,R,Neighbour);
40   end.

PROBLEMS 12  OUTPUT  DEBUG CONSOLE  TERMINAL
2> Worker 12 covered, Total:4988
2> Worker 11 covered, Total:4989
2> Worker 10 covered, Total:4990
2> Worker 9 covered, Total:4991
2> Worker 8 covered, Total:4992
2> Worker 7 covered, Total:4993
2> Worker 6 covered, Total:4994
2> Worker 3 covered, Total:4995
2> Worker 2 covered, Total:4996
2> Worker 1 covered, Total:4997
2> Worker 0 covered, Total:4998
2> Worker 4 covered, Total:4999
2> Worker 5 covered, Total:5000
2> Total Time:12595
2>
```

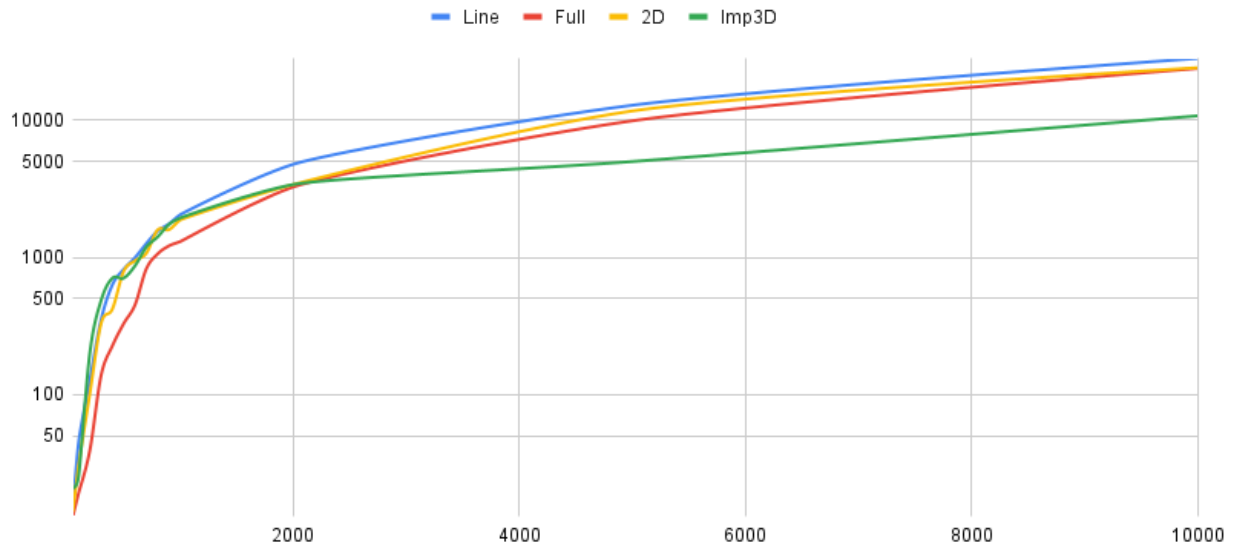
## Time Comparisons: Gossip Algorithm (Intel I5)

| Nodes | Line - Times(ms) | Full -Times(ms) | 2D - Times(ms) | Imp3D - Times(ms) |
|-------|------------------|-----------------|----------------|-------------------|
| 50    | 15               | 13              | 14             | 21                |
| 100   | 44               | 19              | 30             | 25                |
| 200   | 127              | 39              | 101            | 200               |
| 300   | 352              | 138             | 330            | 486               |
| 400   | 633              | 227             | 421            | 708               |
| 500   | 820              | 330             | 794            | 707               |
| 600   | 997              | 451             | 946            | 869               |
| 700   | 1264             | 827             | 1073           | 1192              |
| 800   | 1560             | 1062            | 1589           | 1412              |
| 900   | 1757             | 1216            | 1595           | 1741              |
| 1000  | 2051             | 1306            | 1876           | 1941              |
| 2000  | 4782             | 3265            | 3404           | 3404              |
| 5000  | 12884            | 9921            | 11702          | 5007              |
| 10000 | 28288            | 23888           | 24172          | 10783             |

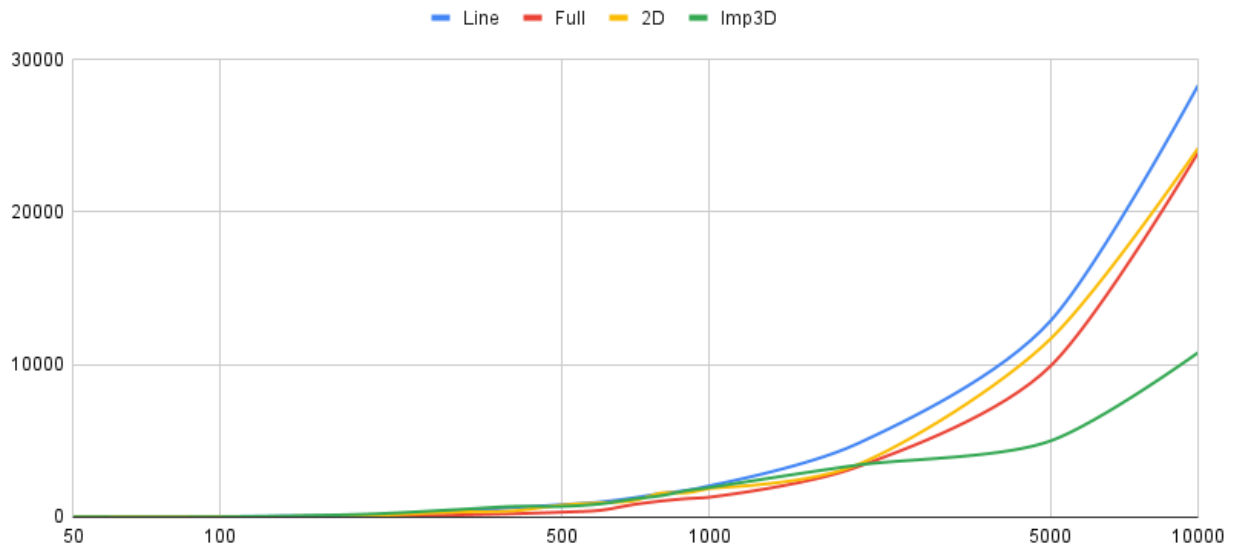
## Gossip Algorithm Graph: (Time (ms) - Linear vs Nodes - Linear)



## Gossip Algorithm Graph: (Time (ms) - Log vs Nodes - Linear)



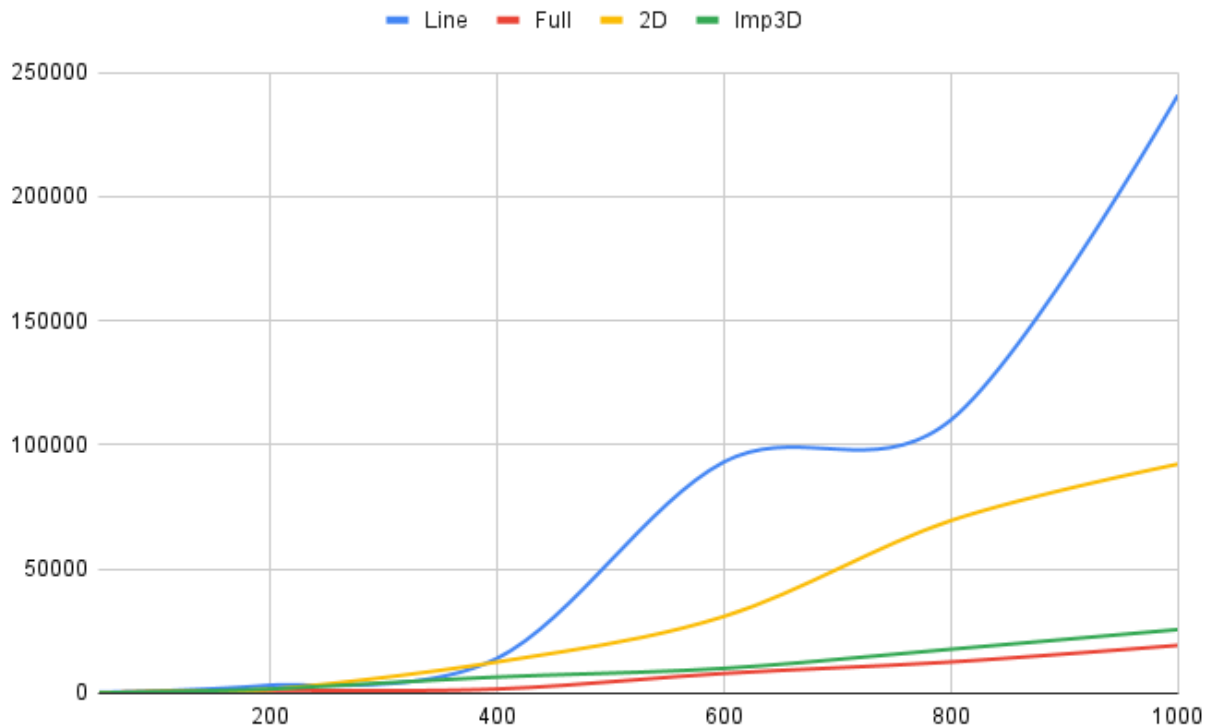
## Gossip Algorithm Graph: (Time (ms) - Linear vs Nodes - Log)



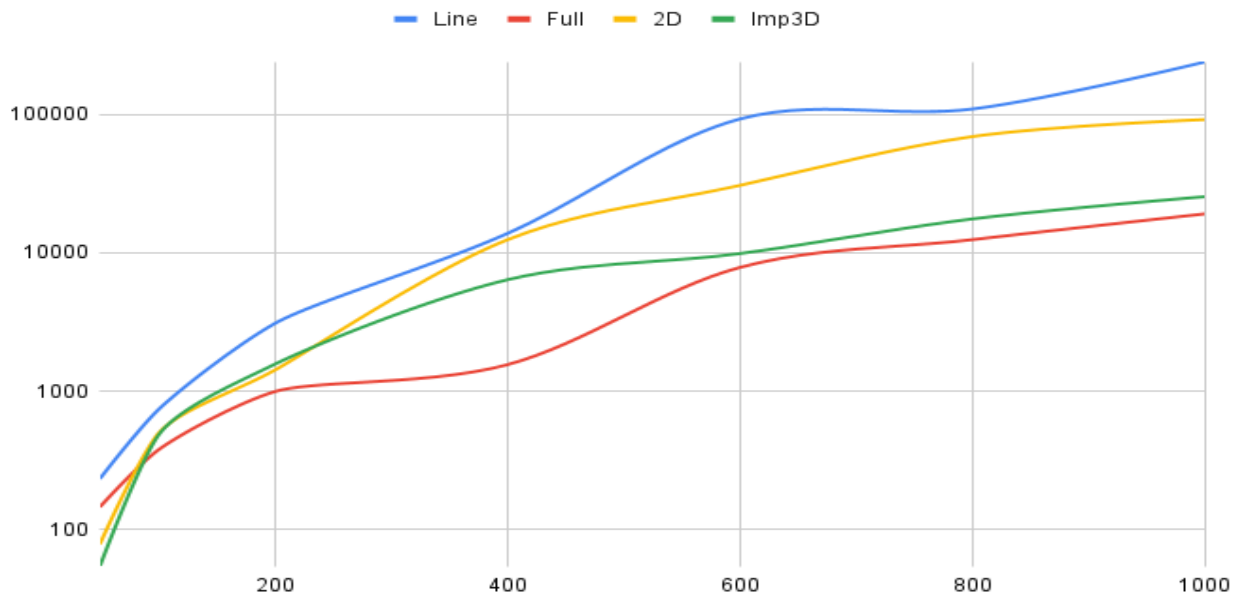
### Push Sum time data for all topologies (Macbook M1 Chip)

| Nodes | Line - Times(ms) | Full -Times(ms) | 2D - Times(ms) | Imp3d- Times (ms) |
|-------|------------------|-----------------|----------------|-------------------|
| 50    | 232              | 145             | 175            | 153               |
| 100   | 730              | 374             | 491            | 475               |
| 200   | 3072             | 990             | 1412           | 1312              |
| 400   | 13776            | 1550            | 12411          | 6385              |
| 600   | 92995            | 7838            | 30754          | 9888              |
| 800   | 109927           | 12466           | 69423          | 17606             |
| 1000  | 240903           | 19165           | 92196          | 25519             |

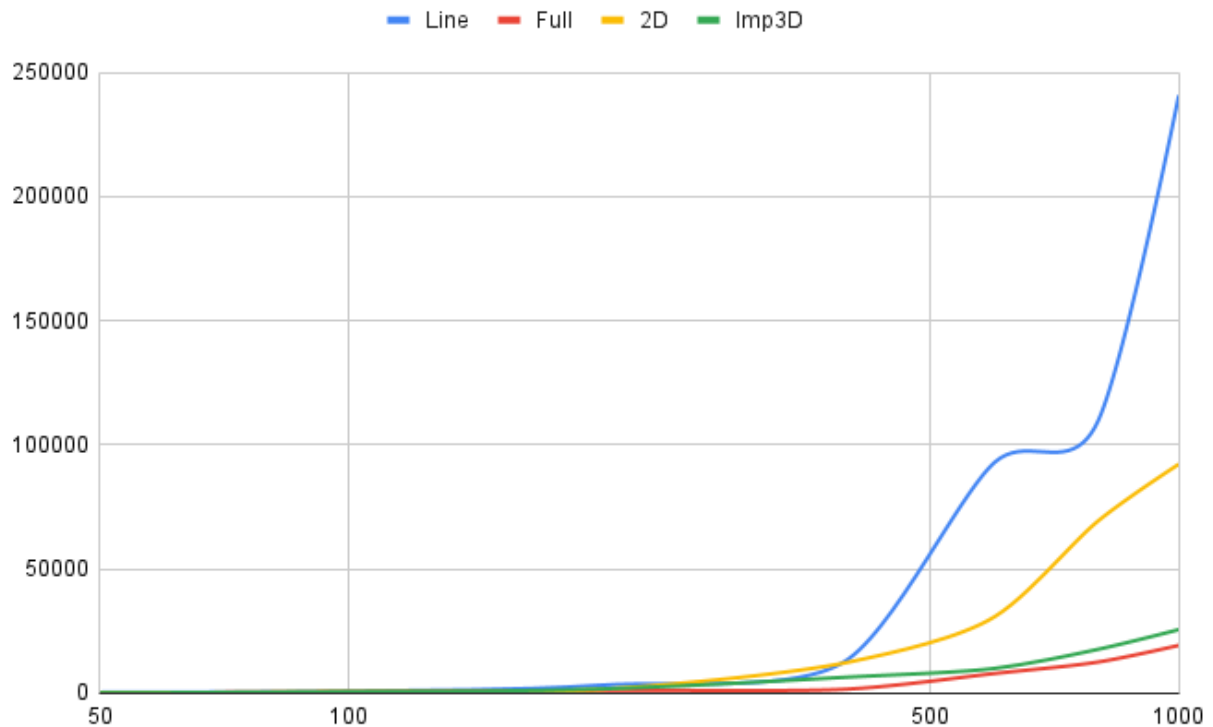
### Push Sum Graph for all topologies : Linear Scale



## **Push Sum Graph for all topologies : Time (Log Scale) vs Nodes (Linear)**



## **Push Sum Algorithm Graph: (Time (ms) - Linear vs Nodes - Log):**



## Interesting Findings:

- For both Gossip and Pushsum Algorithms we observed that the Line topology has always the worst convergence time when compared to all the remaining topologies.
- Till 2000 nodes the order observed is Line > 2D > Imperfect 3D > Full.
- After 2000 nodes we observed that the imperfect 3D converges faster when compared to full topology in Gossip algorithm. We think this might be because of the increasing distance between nodes in full topology as the number of nodes increases.
- After 2000 nodes the order of convergence time is Line > 2D > Full > Imperfect 3D.
- For Pushsum algorithm we observed the order of convergence Line > 2D > Imperfect 3D > Full
- The last some nodes (3-4%) for line topology are taking more time to converge when compared to other nodes in pushsum.