Report for Project 3 Full

1. For the “small" data set, i.e., the subregion in the Beaufort Sea, for each correlation threshold

thresh {0:95; 0:925; 0:9}, plot the degree distribution (see below / code output for the histogram)

1. Do you think the degree distribution is consistent with that of a small-world graph? Why or why not?

It is consistent for all the thresholds because clearly it has maximum number of short-range connections and lesser numbers of long-range connections. All the histogram depicts this by their characteristic long tail.

1. Identify any super nodes, i.e., vertices with significantly higher vertex degree than the average, and where they occur. Describe your determination of super node.

I decided for the super nodes: if they were connected to more than

For 0.95: degree > 40 🡪 2 super nodes

For 0.925: degree > 100 🡪 6 super nodes

For 0.9: degree > 65 🡪 8 super nodes.

2. For the “small" data set, i.e., the subregion in the Beaufort Sea, for each correlation threshold r\_thresh {0:95; 0:925; 0:9}, compute the number of connected components in Gr and their size (i.e., number of vertices).

(a) For a small-world graph, how do you think the component structure should look?

The components should be clustered heavily, i.e least number of components, maximum connections. So, multiple high-density clusters will form components and that is what it will look like for a small world graph. When the component are printed the above is observed which leads us to conclude that the graphs are small world graphs. The above applies to the Random Graph and the Graph corresponding to the R threshold value.

(b) Do your results support your hypothesis?

Yeah, they do spectacularly. Clusters match the high degree of association. From the Data, for all thresholds : L(G\_r) > L(G\_random) and Y(G\_r) >>> Y(G\_random) and that proves the graphs are small world graphs. One more way to prove then other than the component analysis.

======================================= DATA Analysis ===============================

-----------------------0.95-----------------------

Random graph information for r = 0.95

Characteristic Path Length for Random graph = 3.38749

Clustering Coefficient for Random Graph = 0.00339566

Graph information for r = 0.95

Clustering coefficient for r = 0.95 = **0.42981**

Floyd Warshall shortest path analysis running...

Characteristic Path length = 19.4677

-----------------------0.925-----------------------

Random graph information for r = 0.925

Characteristic Path Length for Random graph = 2.73872

Clustering Coefficient for Random Graph = 0.00596911

Graph information for r = 0.925

Clustering coefficient for r = 0.925 = **0.518585**

Floyd Warshall shortest path analysis running...

Characteristic Path length = 15.9023

-----------------------0.9-----------------------

Random graph information for r = 0.9

Characteristic Path Length for Random graph = 2.40408

Clustering Coefficient for Random Graph = 0.00899415

Graph information for r = 0.9

Clustering coefficient for r = 0.9 = **0.562444**

Floyd Warshall shortest path analysis running...

Characteristic Path length = 12.6393

**Conclusions**

From the Data, for all thresholds : L(G\_r) > L(G\_random) and Y(G\_r) >>> Y(G\_random) and that proves the graphs are small world graphs. One more way to prove then other than the component analysis.

**Component Analysis r = 0.95**

Component 1 : 2888

Component 2 : 1

Component 3 : 1

Component 4 : 1

Component 5 : 3

Component 6 : 3

Component 7 : 1

Component 8 : 1

Component 9 : 1

Component 10 : 1

Component 11 : 1

Component 12 : 2

Component 13 : 1

Component 14 : 1

Component 15 : 1

Component 16 : 2

Component 17 : 1

Component 18 : 1

Component 19 : 1

Component 20 : 1

Component 21 : 1

Component 22 : 1

Component 23 : 88

Component 24 : 1

Component 25 : 1

Component 26 : 1

Component 27 : 6

Component 28 : 2

Component 29 : 2

Component 30 : 1

Component 31 : 1

Component 32 : 2

Component 33 : 1

Component 34 : 1

Component 35 : 1

Component 36 : 1

Component 37 : 1

Component 38 : 1

Component 39 : 1

Component 40 : 1

Component 41 : 1

Component 42 : 1

Component 43 : 1

Component 44 : 4

Component 45 : 4

Component 46 : 3

Component 47 : 1

Component 48 : 7

Component 49 : 2

Component 50 : 1

Component 51 : 1

Component 52 : 4

Component 53 : 1

Component 54 : 1

Component 55 : 2

Component 56 : 1

Component 57 : 1

Component 58 : 3

Component 59 : 1

Component 60 : 3

Component 61 : 1

Component 62 : 30

Component 63 : 1

Component 64 : 1

Component 65 : 1

Component 66 : 1

Component 67 : 3

Component 68 : 2

Component 69 : 2

Component 70 : 1

Component 71 : 1

Component 72 : 1

Component 73 : 3

Component 74 : 1

Component 75 : 1

Component 76 : 1

Component 77 : 1

Component 78 : 1

Component 79 : 4

Component 80 : 1

Component 81 : 1

Component 82 : 1

Component 83 : 1

Component 84 : 1

Component 85 : 1

Component 86 : 1

Component 87 : 1

Component 88 : 1

Component 89 : 1

Component 90 : 2

Component 91 : 3

Component 92 : 1

Component 93 : 1

Component 94 : 1

Component 95 : 1

Component 96 : 1

Component 97 : 2

Component 98 : 1

Component 99 : 5

Component 100 : 2

Component 101 : 1

Component 102 : 1

Component 103 : 1

Component 104 : 2

Component 105 : 1

Component 106 : 2

Component 107 : 1

Component 108 : 1

Component 109 : 1

Component 110 : 2

Component 111 : 1

Component 112 : 1

Component 113 : 1

Component 114 : 1

Component 115 : 2

Component 116 : 1

Component 117 : 2

Component 118 : 1

Component 119 : 1

Component 120 : 1

Component 121 : 1

Component 122 : 2

**Component Analysis r = 0.925**

Component 1 : 3123

Component 2 : 1

Component 3 : 1

Component 4 : 1

Component 5 : 2

Component 6 : 3

Component 7 : 1

Component 8 : 4

Component 9 : 2

Component 10 : 1

Component 11 : 1

Component 12 : 1

Component 13 : 2

Component 14 : 1

Component 15 : 1

Component 16 : 1

Component 17 : 1

Component 18 : 4

Component 19 : 1

Component 20 : 1

Component 21 : 1

Component 22 : 1

Component 23 : 1

Component 24 : 1

Component 25 : 1

Component 26 : 1

Component 27 : 1

Component 28 : 1

Component 29 : 1

Component 30 : 1

Component 31 : 1

Component 32 : 3

Component 33 : 4

Component 34 : 2

Component 35 : 1

Component 36 : 1

Component 37 : 3

Component 38 : 1

Component 39 : 1

Component 40 : 1

Component 41 : 1

Component 42 : 3

Component 43 : 1

Component Analysis r = 0.9

Component 1 : 3151

Component 2 : 1

Component 3 : 2

Component 4 : 3

Component 5 : 2

Component 6 : 2

Component 7 : 3

Component 8 : 1

Component 9 : 1

Component 10 : 1

Component 11 : 1

Component 12 : 1

Component 13 : 1

Component 14 : 1

Component 15 : 6

Component 16 : 1

Component 17 : 1

Component 18 : 1

Component 19 : 1

Component 20 : 1

Component 21 : 1

Component 22 : 3