T.Yu Project 2

The proposal distribution used in my project is either adding or deleting one dege from the current state. The equations are defined as following:

In the case of adding an edge:

$$q(X_j|X_i) = \frac{1}{\frac{M(M-1)}{2} - E}$$

where X_i is current state and X_j is the proposed state, M is the number of nodes and E is the number of edges in current state.

In the case of deleting an edge:

$$q(X_j|X_i) = \frac{1}{E - B}$$

where X_i is current state and X_j is the proposed state, B is the number of bridges and E is the number of edges in current state.

The proposal distribution can explore the entire sample space because by incrementaly adding edges, there exist a path leading to a complete graph and by incrementaly deleting edges, there also exist a path leading to a state where all the edges left are bridges. When adding an edge, the new edges is added where there used to have no edges so that no multiple edges between two nodes. When deleting an edge, the deleting edge will not cause the graph to be disconnected. So that this proposal distribution will allow a full exploration of the sample space.

Example of using 5 node whose coordinations are $[0, 0]$, $[1, 1]$, $[1, -1]$, $[-1, -1]$, $[-1, 1]$, $r = 1$, $t = 1$ and 1000 iterations is:

- The expected number of edges connected to vertex 0 is: 3.127
- The expected number of total edges is: 4.949
- the expected maximum distance of the shortest path in a graph that connects vertex 0 to another vertex is: 7.708
- The adjacency matries of top 1% most probable graphs are:

	0	**1**	**2**	**3**	**4**
0	0	1.414	1.414	1.414	1.414
1	1.414	0	0	0	0
2	1.414	0	0	0	0
3	1.414	0	0	0	0
4	1.414	0	0	0	0

	0	**1**	**2**	**3**	**4**
0	0	1.414	1.414	1.414	1.414
1	1.414	0	0	0	0
2	1.414	0	0	2	0
3	1.414	0	2	0	0
4	1.414	0	0	0	0