Triangle counting and Graph Diameter

Done by P. Sai Akhil, Mechanical Engineering, IIT Madras
under the guidance of Prof. Rupesh Nasre

Triangle Counting: (tricountdir)

A triangle is formed by three nodes *a, b, c* if the edges *ab, bc, ca* exist in the graph.

- Function: tricountdir
- Input : Edge list of a directed graph
- Output : Number of directed triangles in the graph
- Assumptions: Nodes are labelled by numbers and no parallel loops

The function, *tricountdir* takes edge list of a graph as input and gives number of triangles in the graph as output. The nodes of the graph must be labelled by numbers. Self-loops cannot form a triangle so self-loops are eliminated from the edge list. Also nodes with zero in-degree or zero out-degree cannot form any directed triangles, so edges from these nodes are also eliminated.

The edge list is converted to two adjacency lists, **adj** and **dej**. *adj(i)* gives the nodes that are adjacent to node *i* and *dej(i)* gives the nodes which has node *i* as adjacent node. Adjacency list *adj* is used to form *grouped_adj* which gives the nodes adjacent to nodes in *adj.* So, *grouped_adj(i)* gives nodes adjacent to nodes in *adj(i)*. Now for each node *i* in the graph the number of directed triangles it can form is given by the number of intersections between *grouped_adj(i)* and *dej(i)*. This is done for every node that can form a triangle and the count is maintained. In this way each triangle is counted thrice (once for each node in it), so finally number of triangles is given by dividing the count by 3.

Diameter: (dia)

The diameter of a graph is defined as the maximum of number of hops in the shortest paths between every pair of nodes in the graph.

- Function: dia
- Input : Edge list of a directed graph
- Output : Diameter of the graph (in terms of number of hops)
- Assumptions: Nodes are labelled by numbers

The function, dia takes edge list of a graph as input and considering edge weight as 1 it applies dijkstra's single source shortest path algorithm to every node and length of longest shortest path is given as output.