Homework 4 Report

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In homework 4, we want to apply the FordFulkerson to find maximum flow of undirected graph. The basic concept of the program is very easy, we just consider the undirected graph as directed graph with both directions. So the algorithm for the modified Fordfulkerson is same as the FordFulkerson for directed graph besides the updateresidual part. In the updateResidual part, we have to update residual of edges of both edges.

**public** MaxFlow getMaximumFlow(Graph graph, **int** source, **int** target)

{

MaxFlow mf = **new** MaxFlow(graph);

List<Edge> path;

**double** min;

**while** ((path = getPathDF(graph, mf, **new** ArrayList<Edge>(), **new** HashSet<Integer>(), source, target)) != **null**)

{

min = getMin(mf, path);

List<Edge> allEdges = graph.getAllEdges();

**for** (Edge Edge1: allEdges){

**for**(Edge Edge2 : path){

**if**(Edge1.getSource() == Edge2.getTarget() && Edge2.getSource() == Edge1.getTarget())

mf.updateResidual(Edge1, -min);

}

}

mf.updateResidual(path, min);

}

**return** mf;

}

The getMaximumFlow method start with finding a path from source to target. I use the getPathDF method, which using the depth first search to find a path. Then we calculate the minimum capacity of the edges in this path in order to update the residual. The update part in the only part I change in the FordFulkerson algorithm. I first get all the edges in the graph and use an for loop to traverse all the edges and search for the edge with opposite direction to the edges in the path. For the opposite direction edge we have to update with negative residual. After that, we update the residual for the edges in the path.

The reason why we have to update with negative residual for the opposite direction edges is as following.

If the capacity of edge from 3<->4 is 2 and if our path go through 1-3-4-5 and there is a flow 2 go through 1-3-4-5. We find another path from 6-4-3-2 and flow is 1, if we do not take negative residual, then there will be no flow go through 6-4-3-2. However the max flow in this case will be 1 flow through 1-3-2-1 flow through 1-3-4-5, 1 flow from 6-4-6 and 1 flow from 6-4-3-2. So in order to get the maximum capacity, we need to use negative residual to offset the opposite direction flow.