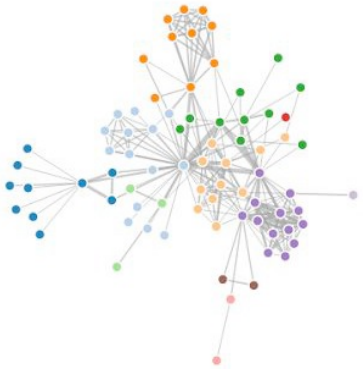
CS 519 Scientific Visualization
Machine Problem 3: Due November 29, 2017 at 11:55pm

Force Directed Graph Layout

You will implement the force-directed graph layout algorithm of Fruchterman and Reingold. The original paper can be found here.



Implementation Requirements:

1. You will use an HTML5 canvas and JavaScript to implement the algorithm.
   Your code should consist of the following files:
   GraphForceLayout.html
   You may base your code off of the code available on GitHub at
   https://github.com/shaffer1/UIllinois_SciVis/blob/master/MP3/GraphForceLayout.html

   You can grab a copy of *GraphForceLayout.html* from the repo to serve as starter code.

2. The node positions in the graph are generated iteratively by calculating attractive and repulsive forces. For the vertex n_i the forces are:

$$F_a(n_i, n_j) = \frac{\|p_j - p_i\|^2}{k}(p_j - p_i)$$

$$F_r(n_i, n_j) = \frac{-k^2}{\|p_j - p_i\|}(p_j - p_i)$$

   - k is a constant typically set to $k = C\sqrt{(A/N)}$
     - *A* is the area of the canvas
     - *N* is the number of nodes
     - C is a constant you pick to make things work well…try C=1 to begin
   - F_a is the attractive force calculated along graph edges
   - F_r is the repulsive force calculated between all pairs of nodes
   - n_i and n_j are nodes in the graph
   - p_i and p_j are the positions in space of n_i and n_j

3. You may need to cap the maximum movement of a node per iteration as some constant *t* and the decrease that by some fraction Δt at each iteration

4. You should animate the layout computation using the techniques described here: https://developer.mozilla.org/en-US/docs/Web/API/Canvas_API/Tutorial/Basic_animations

Data

For the graph, use a randomly positioned cycle graph. You can generate an ***n*** node random cycle with the following JavaScript:

```
function random_cycle(n,lim_x,lim_y)
{
    var edges=[];
    for(var i=0;i<n;i++)
        {
            edge = {"target":(i+1) % n, "source":i}
            edges.push(edge)
        }
    var nodes=[]
        for(var i=0;i<n;i++)
        {
            var rand_x = Math.random()*lim_x;
            var rand_y = Math.random()*lim_y;
            node = {"x": rand_x, "y": rand_y}
            nodes.push(node)
        }
    var g = {"nodes":nodes,"edges":edges};
    return g;
}
```

In addition, you should include a test of one other graph of your choice. The user interface on the webpage should allow someone to choose which test to run.

Submission

Submit using Compass. Upload the following:

GraphForceLayout.html