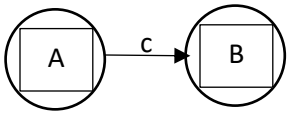
CSCI 4041, Fall 2018, Written Assignment 11

1. With the textbooks approach to the Floyd-Warshall algorithm that uses subscripts, the equation is $d_{ij}^{(k)} = \min(d_{ik}^{(k-1)}, d_{ij}^{(k-1)} + d_{ij}^{(k-1)})$. This, however, can be changed to D[i,j] = min(D[i,j], D[i,k] + D[k,j]) since no entries for when i = k or j = k will change when on the kth iteration. Because of this, we are able to change the values for D[i, j] without having to worry about using them for later calculations. Thus, we can discard the matrix $d_{ij}^{(k-1)}$ and simply use the same matrix D, meaning that the total space required is $O(n^2)$.

2. Consider the following graph (where c is any constant value):



   In this example, the vertex A is not reachable since there is only one edge in the graph, and it is directed towards B. When Bellman-Ford is run on vertex B as the source in Johnson's Algorithm, the distance value for B is initialized to 0 while the distance value for A is initialized to ∞. However, the distance value for A will remain ∞ since there is no path from B to A. This means that when we try to reweight W[A, B] we get W[A, B] = c + ∞ - 0 = ∞. Because of this, the distance value for B will be ∞ after running Dijkstra's on vertex A, meaning the when fixing the reweight later on in Johnson's, we get the equation Dist[A, B] = ∞ + 0 - ∞ = ∞ - ∞ = NaN. Thus, the professor's version of the JOHNSON algorithm will give incorrect answers.

3. h(k) = k mod 11

   Index 0: 77
   Index 1:
   Index 2: 90
   Index 3: 3 -> 25
   Index 4: 37
   Index 5: 38 -> 16
   Index 6:
   Index 7: 40
   Index 8:
   Index 9: 42 -> 31
   Index 10: 43