**Shortest Path, Review Problems:**

We can use Dijkstra's Algorithm if all arc lengths are nonnegative. Dijkstra's Algorithm is a *label setting* algorithm. Whereas, if there were negative costs, then we may have to use a *label correcting* algorithm.

Dijkstra's Algorithm:  
Step 0: Set node 1's permanent label to 0.  
Step 1: Set each node that is connected to node 1 by a single arc with a temporary label equal to c1j (where j is the node being labeled). Set a temporary label for all other nodes as ∞ (remember, node 1's permanent label is 0).  
Step 2: Make the smallest temporary label permanent. If there is a tie, then pick one node to make permanent (leaving the rest that are tied as temporary). Call the new node that was just made permanent, node i.  
Step 3: For each node j that has a temporary label and is connected to node i by a single arc, replace node j's temporary label with .  
Step 4: Repeat Steps 2 through 3 until all nodes have permanent labels.

Result: The permanent labels are the shortest paths from node 1 to all other nodes.

Shortest Path Problem (**Example 1**):



Instances where Dijkstra's Algorithm will fail.

Problem 1: Problem 2:





**Example 2**:

Use Dijkstra's Algorithm to find the **Shortest Path** from Node 1 to **all** other Nodes. Clearly indicate the temporary and permanent labels, and the shortest path tree (i.e., the squiggly lines). Show work.

