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159.201 Algorithms & Data Structures
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Tutorial 6

1. Draw the directed graph where:

V={A,B,C,D,E} and

E={(A,B,15), (A,C,7), (A,D,1), (A,E,2),

(B,A,1), (B,C,2),(B,D,3),(B,E,4),

(C,A,5),(C,B,1),(C,D,7),(C,E,8),

(D,A,9),(D,B,10),(D,C,11),(D,E,12),

(E,A,4),(E,B,3),(E,C,2),(E,D,1)}

2. Draw the adjacency matrix for the graph above. Consider the matrix to be implemented as a 2D static array, and that the elements in V have a correspondence on the index of the array (e.g., index 0 is for A, index 1 for B etc).

3. Draw the adjacency list for the graph above. Consider that V can be represented by a vector, and that E can be represented by a linked-list.

There are many forms of Dijkstra algorithm. A basic algorithm is:

```
Algorithm Dijkstra (Graph, SourceNode)
//the Graph contains vertices V={A,B...} and edges E={(A,B,cost)...}
  Require: array of distances d[N], array of states s[N], node current

    d[SourceNode]=0;
    s[SourceNode]=p;
    current=SourceNode;
    for each vertex v in Graph{
      if (v != SourceNode) {
        d[v] = infinite, s[v] = t;
    }
    while there is any vertex v with state s[v]==t {
      for each neighbour v of current{
        d[v] = min (d[v], d[current] + cost(current, v);//the cost(current,v)
comes from E{}
      }
      current = v with minimum d[v] and with state s[v]==t;
      s[current] = p;
    }
```

4. Using Dijkstra's algorithm, find the shorted path from node A to all other nodes in the graph above. Draw all the steps schematically or just list the state of the variables involved.

5. Discuss the steps needed to implement Dijkstra's algorithm using the adjacency list for question 3 and question 4 results.