Quiz

CSC222 Geographic Information System

11 November 2014

1. The Cohen Sutherland algorithm categorizes line segments with respect to a rectangular drawing window. It recognizes three categories:

   - line segments that it can immediately see are wholly within the window
   - line segments that it can immediately see are wholly outside of the window
   - line segments that might or might not intersect the window—additional calculation is needed

   It does this by first labeling each endpoint of a line segment with four binary digits.

   - The first digit is 1 if the endpoint is to the left of the window and 0 if it is not to the left.
   - The second digit is 1 if the endpoint is to the right of the window and 0 if it is not to the right.
   - The third digit is 1 if the endpoint is below the window and 0 if it is not below.
   - The fourth digit is 1 if the endpoint is above the window and 0 if it is not above.

   Label the endpoints of the line segments in figure 1.

2. After labeling a line segment's endpoints, the Cohen Sutherland algorithm computes the bitwise-or and the bitwise-and of the two four bit numbers.

   The or of two bits is 1 except in the case that both bits are 0.

   The and of two bits is 0 except in the case that both bits are 1.

   Compute the results for the line segments in figure 1.

3. In figure 2 and figure 3 you see two different representations of the same graph.

   Find a graph in a book or on the Web. Shat you, given a diagrammatic representation of a graph, you can construct its adjacency matrix. Show that, given an adjacency matrix, you can draw the corresponding graph.

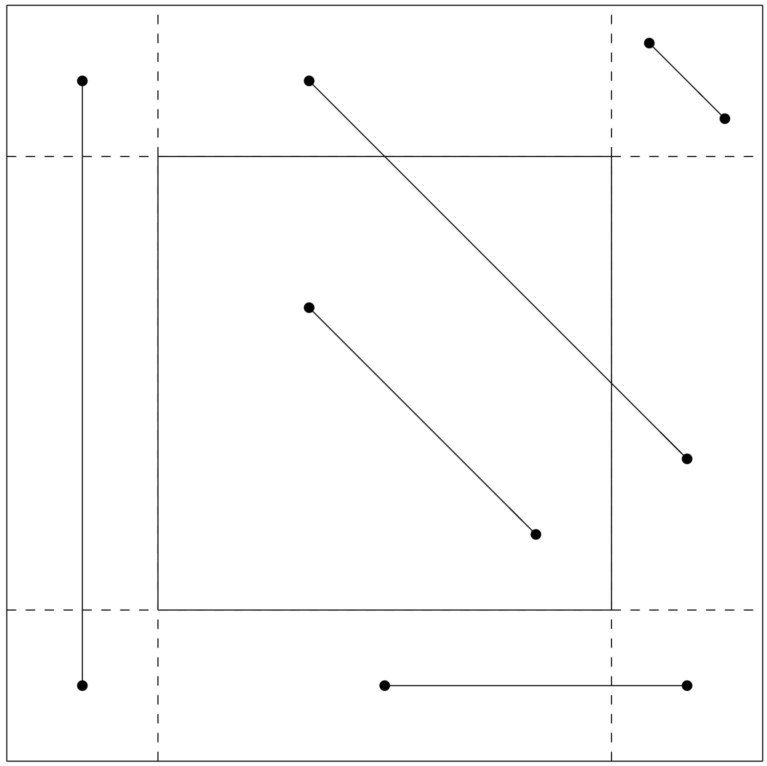

Figure 1: Cohen Sutherland algorithm.

4. In figure 4 you see the steps in the construction of a minimum spanning tree for the same graph. In figure 5 you see the result.

   Find a graph in a book or on the Web. Construct and draw a minimum spanning tree for your graph. Show your work in the same way that I have shown mine.

5. In figure 6 you see the steps for the computation of shortest paths in the same graph. In figure 7 you see the result.

   Find a graph in a book or on the Web. Compute distances from one node to all other nodes in your graph. Show your work in the same way that I have shown mine.

	A	**B**	**C**	**D**	**E**
A	–	9	8	–	–
B	9	–	5	–	1
C	8	5	–	4	3
D	–	–	4	–	7
E	–	1	3	7	–

Figure 2: Adjacency matrix.

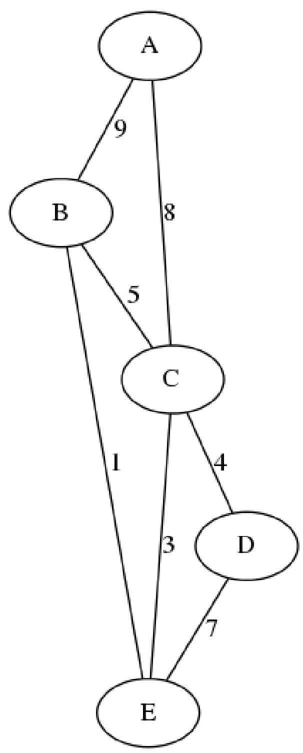

Figure 3: Graph.

Nodes in tree	**Edge**	**Length**	**Add edge to tree?**
$\emptyset$	BE	1	YES
B,E	CE	3	YES
B,C,E	CD	4	YES
B,C,D,E	BC	5	NO
B,C,D,E	DE	7	NO
B,C,D,E	AC	8	YES
A,B,C,D,E	AB	9	NO

Figure 4: Minimum spanning tree.

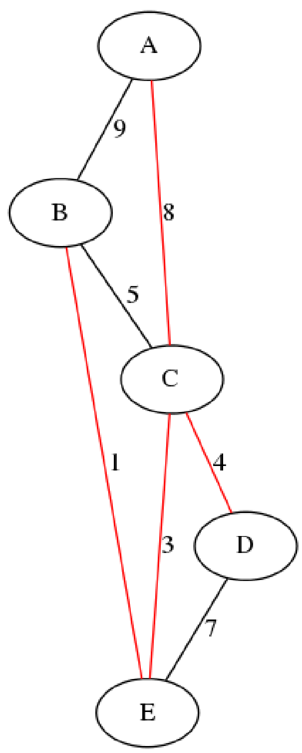

Figure 5: Minimum spanning tree.

V	**A**	**B**	**C**	**D**	**E**
$\emptyset$	**0**:$\emptyset$	∞	∞	∞	∞
A	0:$\emptyset$	9:A	**8**:A	∞	∞
AC		**9**:A		12:C	11:C
ABC				12:C	**10**:B
ABCE				**12**:C	
ABCDE					

Figure 6: Shortest path.

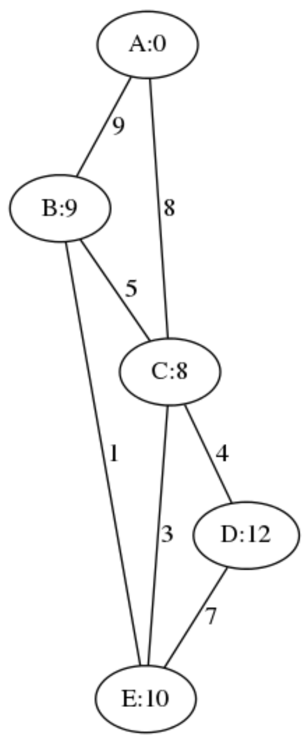

Figure 7: Shortest paths: distances from A to all other nodes.