



Ad Hoc And Sensor Networks

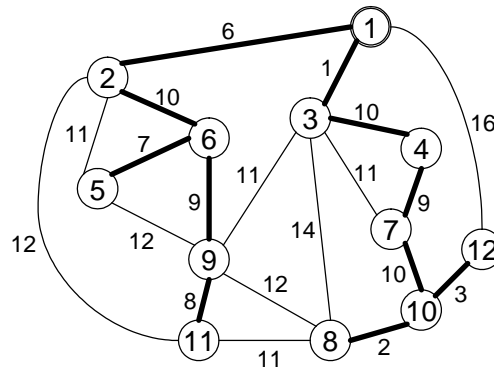
Sample Solution to Exercise 5

Assigned: October 25, 2010

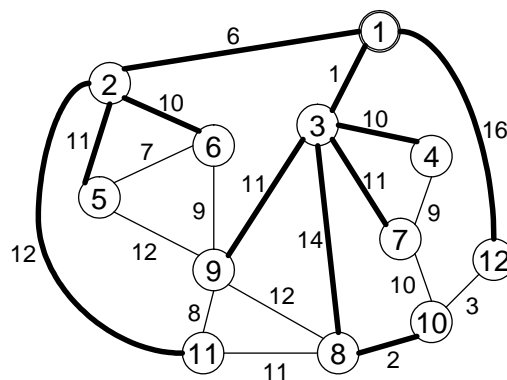
Due: November 1, 2010

1 Data Gathering Topologies

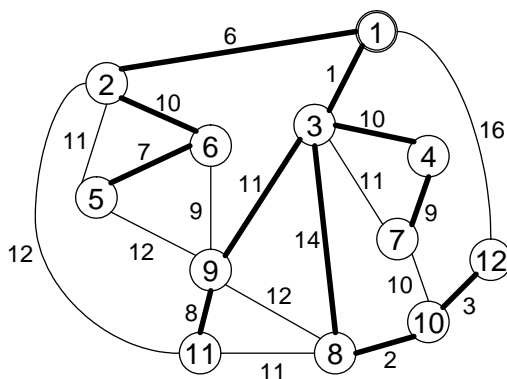
a) The Minimum Spanning Tree (MST) of the given graph is depicted below.



b) The Shortest Path Tree (SPT) rooted at node 1 looks as follows:

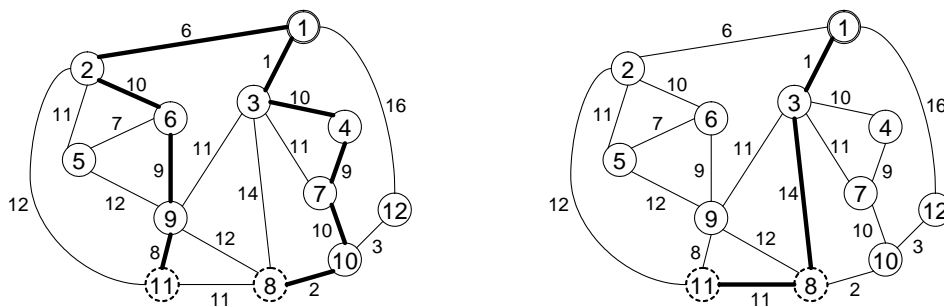


- c) Here we need the preordering of the MST. With node 1 as root it is (1,2,6,5,9,11,3,4,7,10,8,12). Then, the Shallow Light Tree (SLT) with $\alpha = 2$ is resulting in the following topology:

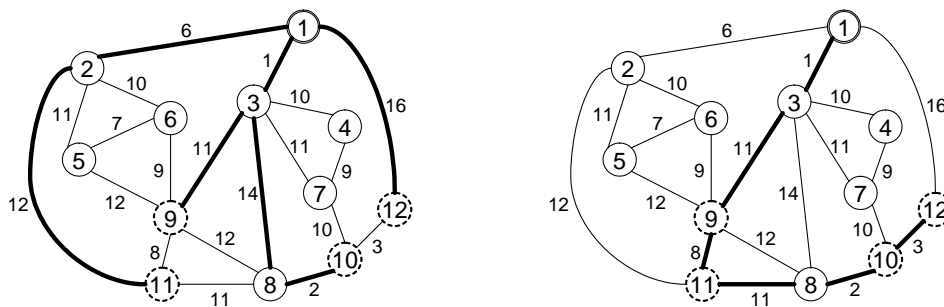


2 Universal Spanning Tree

- a) It can be seen that for the two nodes 8 and 11 the MST produces a cost of 65 (see left figure below). In comparison, the tree depicted on the right side only sums up to a cost of 26 for the same subset of nodes. Thus the stretch for the MST on this graph is at least $65/26 = 2.5$.



- b) For the SPT we consider the set 9,10,11,12. The SPT results in costs 62 as all bold edges are used to route data from the four nodes back to the sink at node 1. However if we look at the tree shown below in the right graph the same information could be gathered using only a cost of 36. This leads to a stretch of at least $62/36 = 1.72$ for the SPT.



c) The SLT for the given graph is shown in 1.c). For the set 5,9,7,10 the induced subgraph is shown in the left figure below. Its cost amounts to 70. In contrast the tree depicted on the right side only produces a cost of 48. Therefore, the stretch of the SLT in this example is at least $70/48 = 1.45$.

