Exercises of lecture
# Wireless Sensor Networks
Winter 2006/2007

Sheet 11

SECTION 1:

Topology Control: Minimum Spanning Tree, Yao-graph

1. There are two well-known algorithms for finding minimum spanning trees (MSTs), namely Prim's algorithm and Kruskal's algorithm. What is the significant difference between them in terms of the construction of MSTs?

2. Consider the following connected undirected weighted graph G(V,E) of the air distance among several cities in miles. Use Prim's algorithm to find a minimum spanning tree of G starting from the vertex called 'London'. Show each major step in a separate diagram.
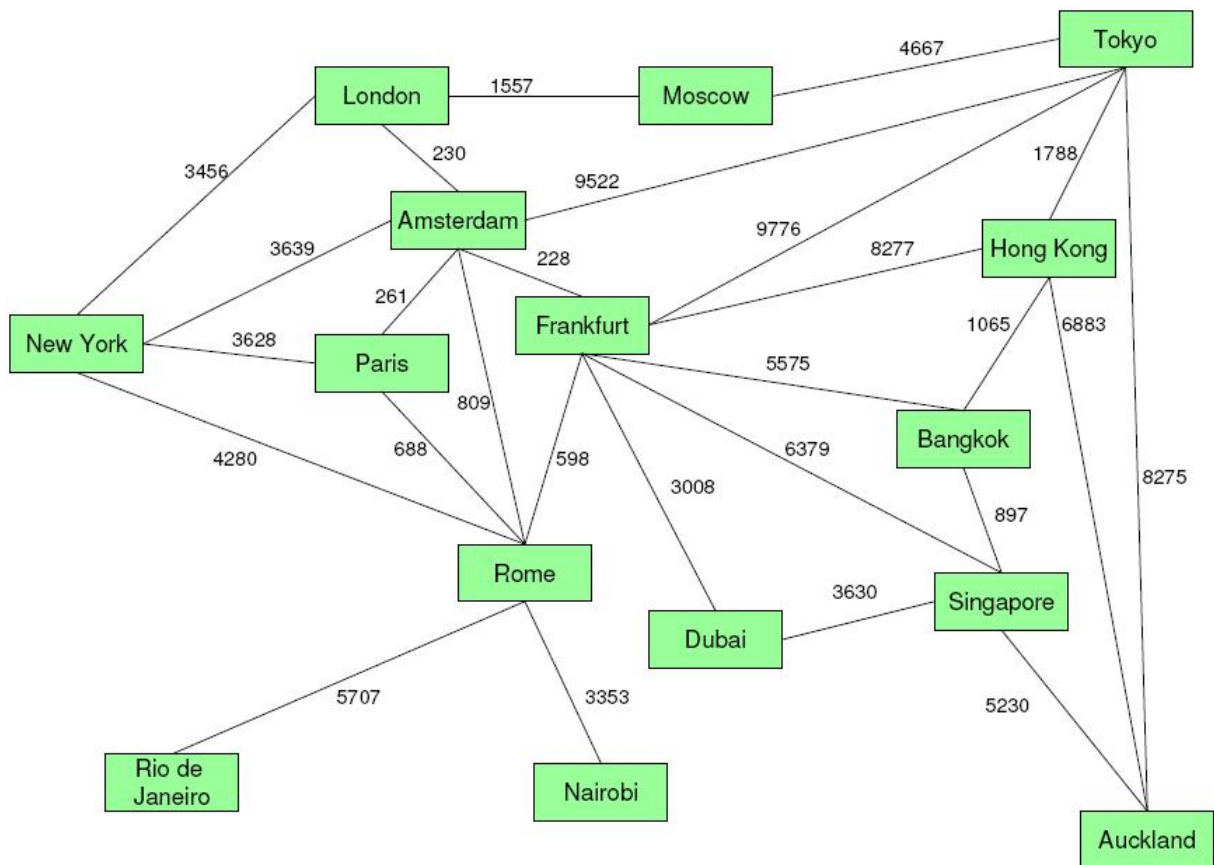
3. Draw a directed Yao graph $Y_k(V)$ centered at node u with k=6, and the ray starting on the horizontal line of the diagram below.
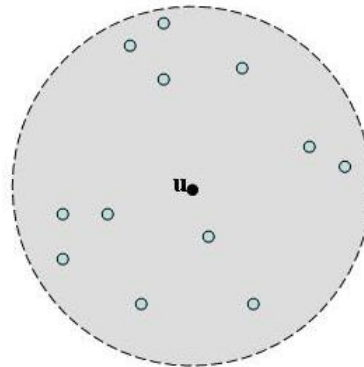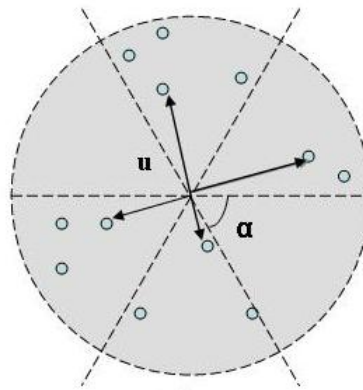

$$\vec{Y_k(V)}$$

K=6

$\alpha = 60°$

Solution:

(a) The construction of an MST by Prim's algorithm starts from a single node. Then, the tree is expanded until it covers all the nodes in the graph. There is always only one partial tree during the construction of the MST tree. The construction of an MST using Kruskal's algorithm starts from a n-tree forest. It then merges two trees in the forest into one, and repeats so until there is only one tree left in the forest.

(b) Please find the answer in the diagram below:
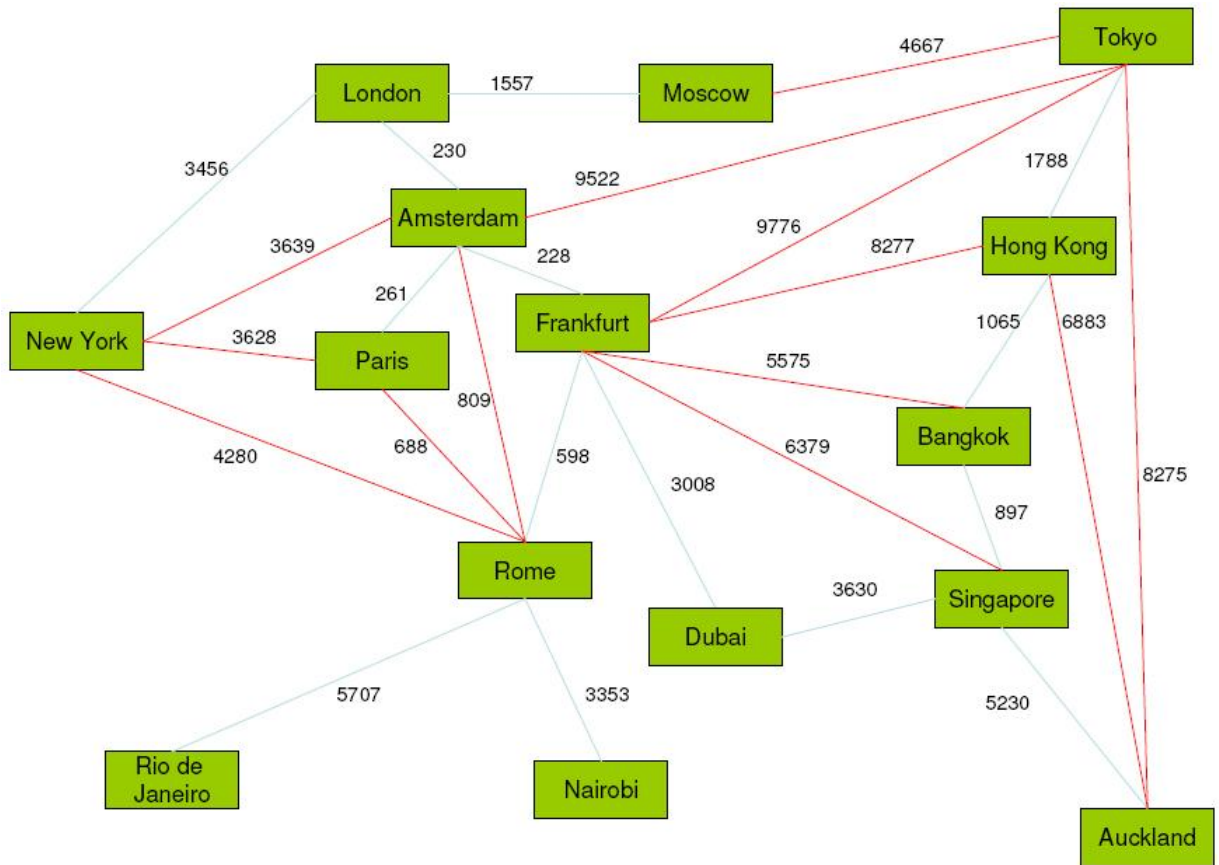
(c) In each of the 6 sections, choose the closest node v, if there is any, and add a directed link uv. This results in a directed subgraph $Y_k(u)$. The collection of these directed subgraphs forms the directed Yao graph $Y_k(V)$. Please find the answer in the diagram below:

$Y_k(V)$

K=6

α =60°