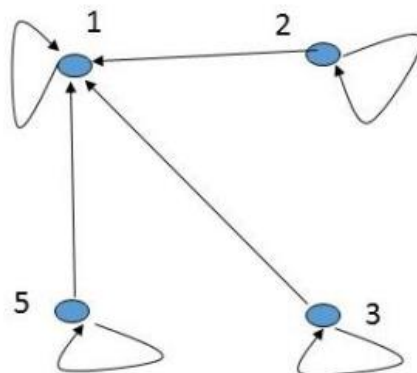
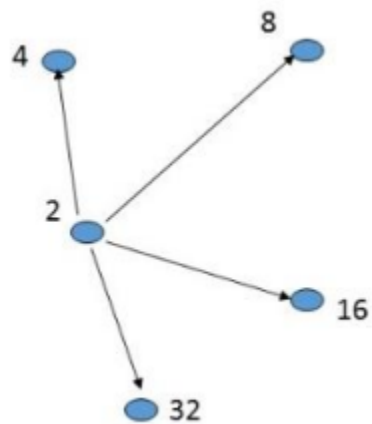
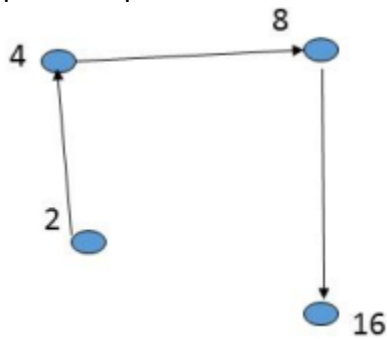


4COSC007C Mathematics for Computing

Tutorial 5

- For each of the following graphs represented in the diagrams below do the following:
 - form set V of all its nodes and set E of all its edges
 - determine if it is a directed or undirected graph
 - determine if it is a cyclic or acyclic graph, for a cyclic graph give an example of a cyclic path in it
 - determine a pattern a graph can represent



2. For each of the following graphs defined by the given set of nodes, V , and set of edges, E , do the following:

- draw its representation corresponding to the definition of V and E
- determine if it is a directed or undirected graph
- determine if it is a cyclic or acyclic graph, for a cyclic graph give an example of a cyclic path in it.

a. $V = \{d, e, f, g\}$; $E = \{(d, e), (e, f), (f, g), (g, d)\}$

b. $V = \{a, b, c, d, e\}$; $E = \{(a, b), (a, c), (a, d), (a, e), (b, c), (c, d), (d, e)\}$

c. $V = \{a, b, c\}$; $E = \{(a, a), (a, b), (b, b), (b, a), (b, c), (c, c), (c, b), (a, c), (c, a)\}$

3. We analyze the database for the National Express for the journeys from London between 8 am and 9 am on Friday 28th October 2016 to the following destinations: **Manchester, Birmingham, Bristol, Southampton, Glasgow, Edinburgh**. Consider a graph, G , with the following definition of sets of nodes, V , and edges, E :

$V = \{\text{Manchester, Birmingham, Bristol, Southampton, Glasgow, Edinburgh}\}$; E is a set of all pairs (x, y) , such that $x \in V$, $y \in V$ and the price for journey from London to x is less than the price for a journey from London to y

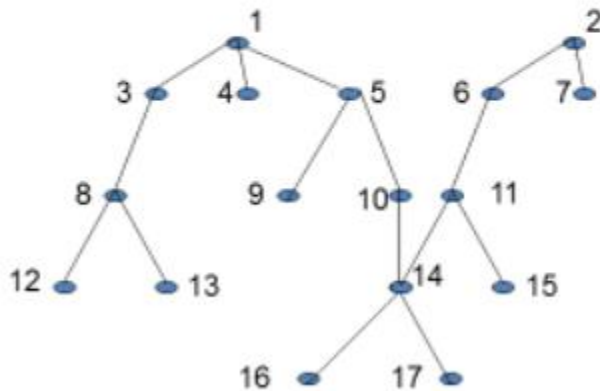
Manchester, at 9 am	£15.00	Southampton at 8 am	£7.20
Birmingham, at 8 am	£15.70	Glasgow at 8 am	£23.00
Bristol, at 8.30 am	£15.70	Edinburgh at 9 am	£30.00

Your task is

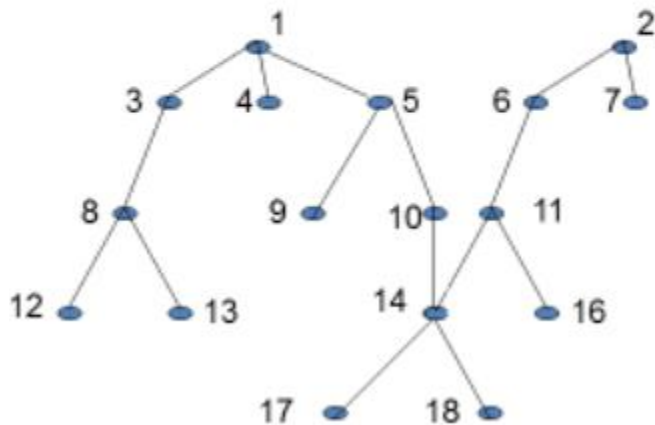
- To list all pairs $(x, y) \in E$
- To draw the representation of this graph showing its nodes and edges.

4. In the figures below you will see attempts to draw rooted trees. Justify if graphs drawn are trees. For those cases where you established trees identify
- All leaves of a tree
 - Depth of a tree
 - If a tree is a binary tree

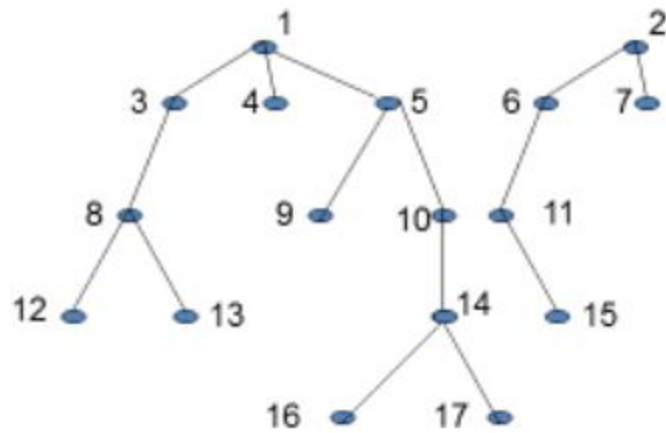
a.) In a graph below we attempt to have a tree with root nodes 1 and 2



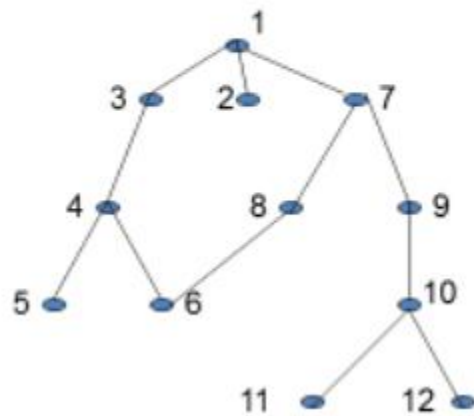
b.) In a graph below we attempt to have a tree with root node 1 and a subtree with the root 2



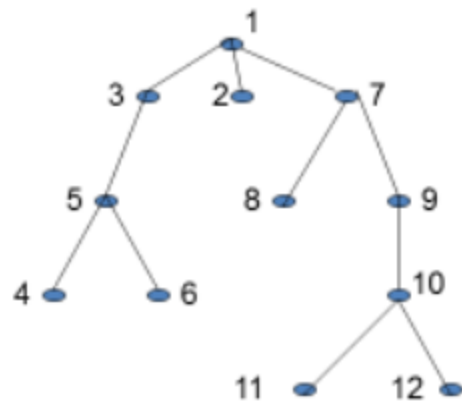
c.) In a graph below we attempt to have a tree with root node 1 and a subtree with the root node 2



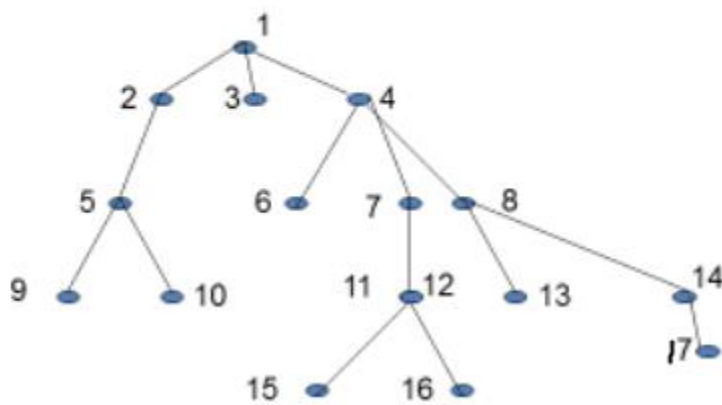
d.) In a graph below we attempt to have a tree with root node 1 and a subtree with the root node 7



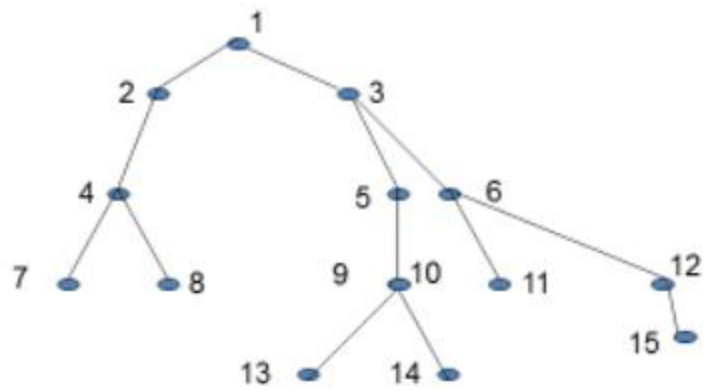
e.) In a graph below we attempt to have a tree with root node 1 and a subtree with the root node 7



f.) In a graph below we attempt to have a tree with root node 1



g.) In a graph below we attempt to have a tree with root node 1



h.) In a graph below we attempt to have a tree with root node 1

