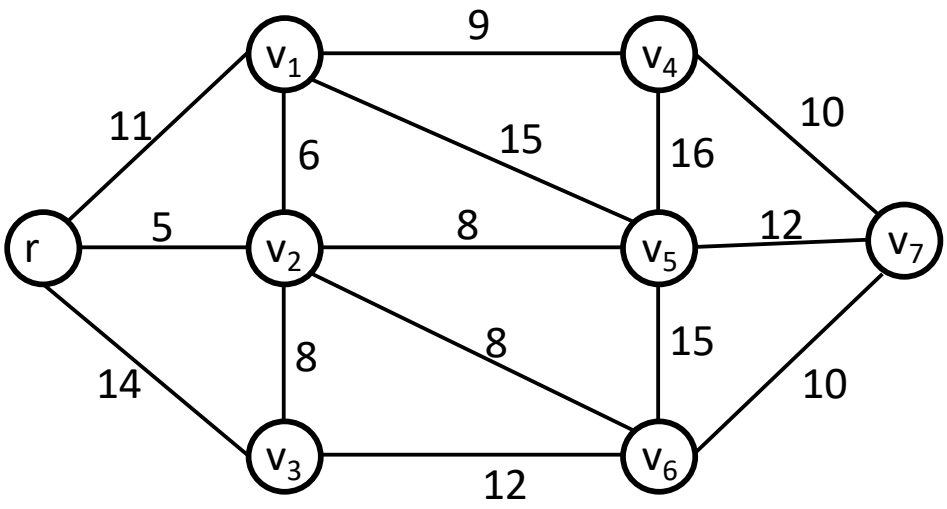
FURTHER O.R. TECHNIQUES

EXRCISES

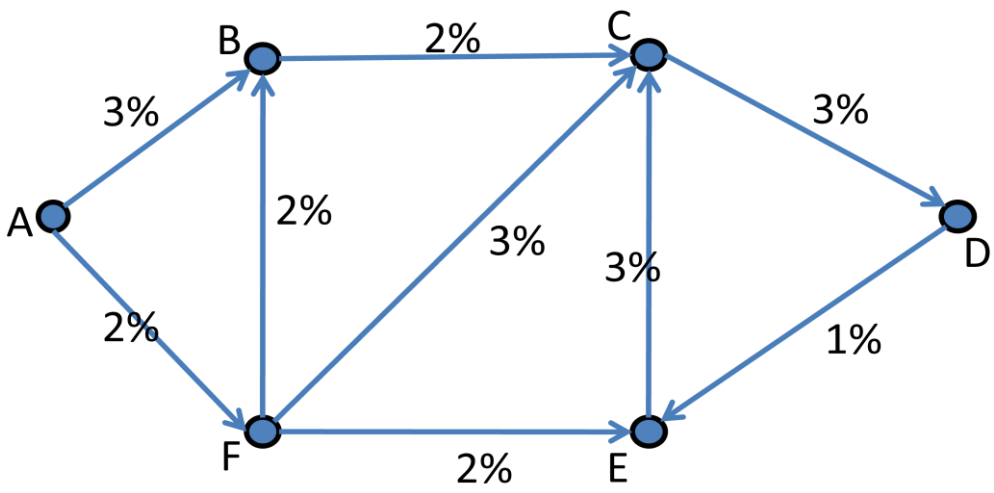
UNIT 1: Network Analysis

1. Node r in the network below shows the central warehouse of a courier service and nodes v_1 to v_7 clients served by the courier. The edges of the network represent the road network and the number next to each edge the time (in minutes) it takes to travel along it.



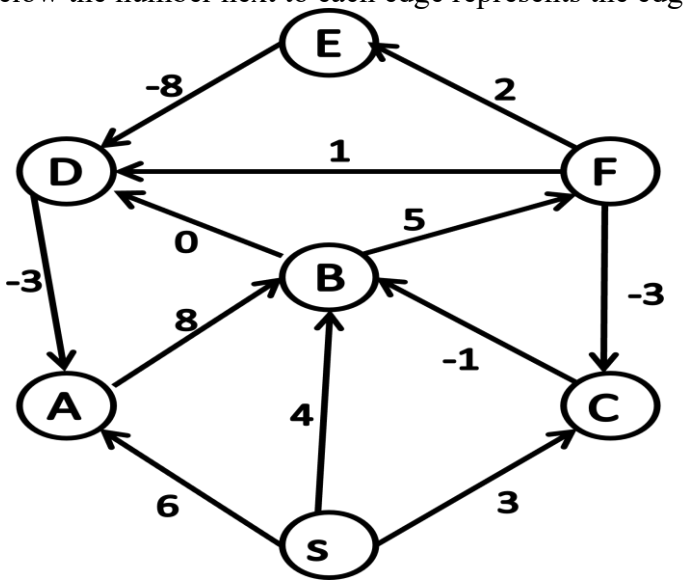
Find the shortest path from r to v_7.

2. In the following network the nodes represent computers and the edges connections. The number next to each edge denotes the probability that the edge fails.



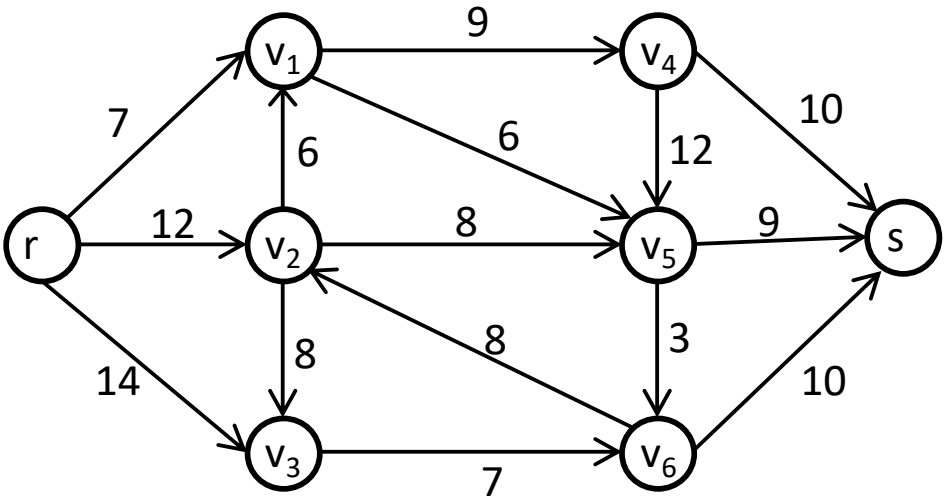
Suppose that we need to send a message from computer A to computer D in the most reliable manner. Formulate the problem as a network analysis problem and find the safest route for sending the message. (Suppose that the edges operate independently to each other).

3. In the network below the number next to each edge represents the edge's weight.



Calculate the length of the shortest path from node s to all other nodes of the network.

4. (a) In the graph below node r represents a sports hall and node s the entrance to the nearest highway. The remaining nodes denote crossings and the edges the local road network. The number next to each edge denotes the maximum number of cars per minute that can be directed through the corresponding road. Calculate the maximum number of cars per minute that can be directed through the road network from r to s.



(b) The managers of the sports hall feel that the number of cars calculated in (a) is not sufficient and needs to be increased. To this end, they consider widening some of the roads in order to increase their capacity. Which roads need to be widened?

5. During a busy day, patients arrive at a hospital in need of blood. Suppose that each patient requires one unit of blood. The distribution of the supply of blood and the demand per blood group is given in the table below:

	A	B	O	AB
Supply (units)	46	34	45	45
Demand (units)	39	38	42	50

Patients in blood groups A and B may accept blood from their own blood group or from group O. Patients in group O may accept blood only from their own group. Finally, patients in group AB may accept blood from any group.

Formulate a network analysis problem so that the management of the hospital may cover the patients' needs in the best possible way.