

- 1
- What is the difference between a repeater and a bridge? And explain how a bridge learns the location of computers on LAN automatically?
 - What is socket programming? And explain its basic functions.
 - How does Transmission Control Protocol (TCP) differ from User Datagram Protocol (UDP) in terms of functionality and characteristics?
 - Explain TCP connection establishment and termination procedure between two devices.
- (2+2+3+3 = 10p)

- 2
- Explain TCP congestion control mechanism.
 - If a size of a congestion window of a TCP connection is 32 kB, the round-trip time is 100 ms, and the maximum segment size is 2 kB. Calculate the time (ms) taken by a TCP connection to get back to the 32 kB congestion window in case of 'timeout occur'.
 - Find the minimum cost-spanning tree for the graph shown in Figure 1 using Kruskal's Algorithm. Also, write down the calculation steps.

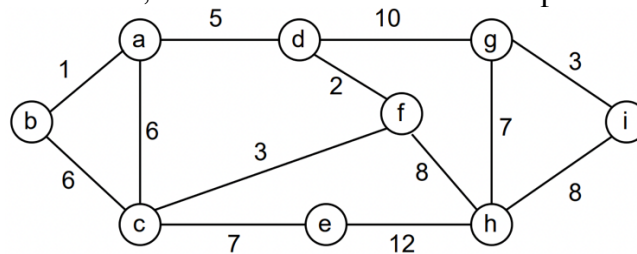


Figure 1.

- How many spanning trees are possible for a complete graph of 6 nodes (or vertices)?
- (3+2+4+1 = 10p)
- 3
- Explain the role of Dynamic Host Configuration Protocol (DHCP). Explain how DHCP works.
 - Explain the role of Address Resolution Protocol (ARP). Explain how ARP works.
 - Explain the role of Internet Control Message Protocol (ICMP). Explain how ICMP works.
 - Apply Dijkstra's link-state routing algorithm to the graph (Figure 2), in order to calculate the shortest path from 'a' to 'f'. Write the systematic steps and calculation table.

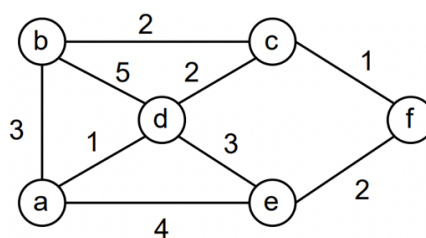


Figure 2.

(2+2+2+4 = 10p)

- 4 a) Consider a message $M = 110101$. Suppose a CRC polynomial $P = x^3 + x + 1$ to detect errors in the transmission of this message. What is the remainder 'R' when 'M' is divided by 'P'? Show the calculation.
- b) Consider four, 7-bit items of data, 1001101 1111010 0011101 1010101. Compute the two-dimensional parity bits for each data. Assume even parity is followed.
- c) How does the CSMA/CA protocol ensure that multiple devices do not transmit at the same time, leading to a collision?
- d) List the three main types of channelization (multiple-access methods) and the characteristics of each.

(3+3+2+2 = 10p)

- 5 a) On Internet both Fine-Grain and Coarse-Grain QoS have been researched and protocols for both types have been developed. Give a brief description of each of these types and some Internet standard related to each type. What is the current typical solution for QoS on Internet?
- b) RTP is a protocol used for streaming media. In an RTP packet you have several fields. Two of them are TIMESTAMP and SEQUENCE NUMBER. What are these used for?
- c) What is the purpose of using buffers in clients when you have a high jitter in a network and how does it work?

(4+3+3 = 10p)

- 6 a) Mention one routing protocol that can be used inside an **Autonomous System** and one that can be used to route between **Autonomous Systems**.
- b) Give some of the basic properties for the two protocols mentioned above (metrics used, type of transport protocol used, what type of information is exchanged between routers etc.).
- c) There are several problems that you need to think about carefully when you design a routing protocol or choose to implement a certain protocol. Describe the following routing problems and what you can do about them:

- **Black hole Routing**

- **Route Flapping**

(2+4+4 = 10p)