Question 1

Consider the transfer of a large data file of 1 MBytes (1 million 8-bit characters) from station A to station B using packet switching technique. The two stations A and B are connected by a copper wire of 500 km long. The data rate of the line is 1 Gbps. The propagation speed is 2 x 10^8 m/s. The file is divided into frames, each of which has a frame size of 2000 bits including 160 bits overhead, before transmitting. Station A sends a block of 20 frames and waits for an acknowledgement (100-bit frame) from Station B before sending another block of 20 frames. Assume error-free transmission.

a) Compute the one-way propagation delay, the transmission time for one data frame and the transmission time for one acknowledgement frame.

b) Compute the total elapsed time for sending 20 frames and getting the acknowledgement frame.

c) Compute the total time to transmit the entire data file.

d) Compute the effective throughput of the system.

Question 2

a) Analyse TWO advantages of using X.25. X.25 is an example of Virtual Circuit Switching.

b) Implement a LAN for a company that has 100 employees, each has a desktop computer attached to the LAN. Recommend a suitable data rate for the LAN if the typical use of the LAN is as shown below. Justify your answers by working out the load for each requirement. State any assumption(s) that you have made in your answers.

- Each employee needs to retrieve a file of average size of 1000,000 bytes per second. An employee may do this on average 5 times during the 8 hours working time.
- Each employee needs to access the internet at 250 Kbps. This can happen for 10 employees simultaneously.
- Each employee may receive 10 emails per hour with an average size of 100KB. Half of the employees may receive email simultaneously.

Question 3

a) IEEE 802.3 and Ethernet use a technique known as binary exponential back-off.

(i) Assume that the data rate is 10Mbps. Compute all the possible delay values after 2nd attempt.

b) Figure Q3(b) shows a bridged network consisting of transparent bridges, B1 to B5, interconnecting 4 Ethernet LANs.

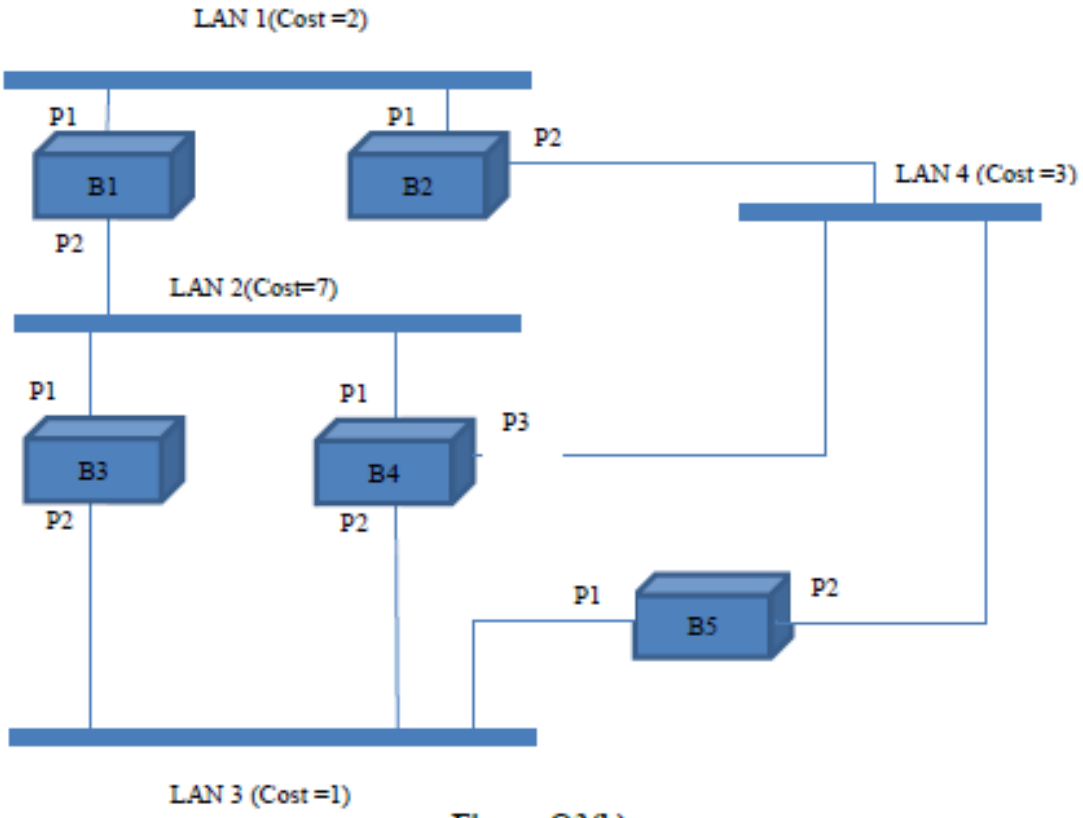

Figure Q3(b)

(i) Apply the standard spanning tree algorithm (STA) to construct the spanning tree for the network. In your answer, indicate clearly the root bridge, root ports, designated bridges and designated ports. Identify the bridges/ports that should be disabled? Assume that the bridge number indicates the bridge ID (B1 has a lower ID than B2 and B2 lower than B3 etc.) and bridges' priorities are ignored for simplicity.

(ii) Illustrate the resulted spanning tree.