1. Find the time to transmit a 1 GByte video file from Lawrence to Tokyo, Japan, a distance of about 10,000 km, over a 100 Gb/s fiber optic link. The speed of light is \( \sim 2 \times 10^8 \) m/s in fiber. Clearly state any assumptions:

   a) For a network using datagram packet switching.
   b) For a network using virtual circuit packet switching.

2. Host A has a 3000 Byte message to send to destination host B. The network can only support 1500 Byte packets, so it takes 2 packets to send this message. Host A is connected to router 1 over a 20.0 km fiber link operating at 100 Mb/s; Router 1 is connected to router 2 over a 200 km fiber link operating at 1 Gb/s; and router 2 is connected to the destination host B over a 20 km fiber link operating at 100 Mb/s. Assume no overhead. Find the time to transmit the 3000 Byte message for:

   a) datagram packet switching.
   b) virtual circuit packet switching.

   Clearly state any assumptions. The speed of light is \( \sim 2 \times 10^8 \) m/s in fiber.

3. For a 10 Gb/s link with a BER of 1 bit error in \( 10^{13} \) bits transmitted, what is the time between bit errors?

4. Network topologies:

   a) Draw a 5 node ring network, how many links are in the 5 node ring network.
   b) Draw a 5 node full mesh network, how many links are in the 5 node full mesh network.

5. Find the reliability for the tree and ring networks given in the notes when \( p=0.005 \).

6. How does a virtual circuit packet switched networks provide QoS?

7. A TDMA system has a frame time of 125\( \mu \)s, 96 slots/frame, and 8 bits/time slot.

   a) Using the TDMA system with the user assigned one time slot/frame how long does it take to transmit a customer packet of length 2880 Bytes?
   b) Using the TDMA system with the user assigned 50 time slots/frame how long does it take to transmit a customer packet of length 2880 Bytes?

   b) For statistical multiplexing: Using the same parameters given above find the link rate and then using statistical multiplexing long does it take to transmit a customer packet of length 2880 Bytes? State any assumptions.