1. (a) Compare and contrast a packet-switched network and a circuit-switched network. What are the relative advantages and disadvantages of each?
(b) Explain why STDM (Synchronous Time-Division Multiplexing) is a cost-effective form of multiplexing for a voice telephone network and FDM (Frequency-Division Multiplexing) is a cost-effective form of multiplexing for television and radio networks, yet we reject both as not being cost effective for a general-purpose computer network.

2. (a) One useful property of an address is that it is unique; without uniqueness, it would be impossible to distinguish between nodes. List other useful properties that addresses might have.
(b) A packet or frame can be lost due to bit errors or intermediate resources (e.g., buffers or queues) becoming unavailable forcing the packet or frame to be literally dropped. What should the sender do if a large proportion of the packets / frames are “lost”? Does your solution work for both types of losses?

3. Two blue armies are each poised on opposite hills preparing to attack a single red army in the valley. The red army can defeat either of the blue armies separately but will fail to defeat both blue armies if they attack together. The blue armies communicate by an unreliable communications system with a 50% success rate (a foot soldier that can go AWOL or get shot by the red army). The commander, with one of the blue armies, would like to attack at noon. His problem is this: If he sends a message ordering the attack, he cannot be sure it will get through. He could ask for an acknowledgment but that might not get through. Sketch your solution to the problem. [Note: What has this got to do with computer networks? TCP has the same problem since IP is unreliable]

4. (a) How “wide” is a bit on a 1-Gbps fibre optic link?
(b) How long does it take to transmit $x$ KB over a $y$-Mbps copper wire link to a station $z$-meters away?

5. Consider a two stations A and B, 50 km apart that can communicate using either a 50 Mbps satellite link or a 33.6 Kbps telephone link.
(a) Which link would you use to transfer a large file? Why?
(b) Which link would you use for a telnet session? Why?

6. A broadcast network is one in which a transmission from any one attached station is received by all other attached stations over a shared medium. Examples are a bus-topology local area network, such as Ethernet, and a wireless radio network. Discuss the need or lack of need for a network layer in a broadcast network.

7. Hosts A and B are located on Ethernet LANs in two different cities (Perth and Albany). Cities are interconnected by Frame Relay networks. A user on host A in Perth needs to send some data to a user on host B in Albany over a TCP/IP connection. Sketch how the data is handled through each layer of the network, especially encapsulation and segmentation and reassembly effects (Ethernet has an MTU of 1500 bytes, and Frame Relay can have an MTU as low as 200 bytes).