Chapter 1 sample questions' answers

R13.
a) 2 users can be supported because each user requires half of the link bandwidth.
b) Since each user requires 1Mbps when transmitting, if two or fewer users transmit simultaneously, a maximum of 2Mbps will be required. Since the available bandwidth of the shared link is 2Mbps, there will be no queuing delay before the link. Whereas, if three users transmit simultaneously, the bandwidth required will be 3Mbps which is more than the available bandwidth of the shared link. In this case, there will be queuing delay before the link.
c) Probability that a given user is transmitting = 0.2
d) Probability that all three users are transmitting simultaneously is

$$\binom{3}{3}p^3(1-p)^{3-3} = (0.2)^3 = 0.008$$

Since the queue grows when all the users are transmitting, the fraction of time during which the queue grows (which is equal to the probability that all three users are transmitting simultaneously) is 0.008.

R18.
10msec; d/s; no; no

R19.
a) 500 kbps
b) 64 seconds
c) 100kbps; 320 seconds

R23.
The five layers in the Internet protocol stack are – from top to bottom – the application layer, the transport layer, the network layer, the link layer, and the physical layer. The principal responsibilities are outlined in Section 1.5.1.

R26.
a) Virus: Requires some form of human interaction to spread. Classic example: E-mail viruses.
b) Worms: No user replication needed. Worm in infected host scans IP addresses and port numbers, looking for vulnerable processes to infect.

P3.
a) A circuit-switched network would be well suited to the application, because the application involves long sessions with predictable smooth bandwidth requirements. Since the transmission rate is known and not bursty, bandwidth can be reserved for each application session without significant waste. In addition, the overhead costs of setting up and tearing down connections are amortized over the lengthy duration of a typical application session.

b) In the worst case, all the applications simultaneously transmit over one or more network links. However, since each link has sufficient bandwidth to handle the sum of all of the applications' data rates, no congestion (very little queuing) will occur. Given such generous link capacities, the network does not need congestion control mechanisms.

P8.
  a) 20 users can be supported
  b) $p = 0.1$
  c) $\binom{120}{n} p^n (1-p)^{120-n}$

P29.
Recall geostationary satellite is 36,000 kilometers away from earth surface.
  a) 150 msec
  b) 600,000,000 bits

E2. Circuit switching versus packet switching
i. In a circuit switching network, when Alice wants to communicate with Bob, a physical "circuit" is
established between Alice and Bob before any data can be sent.

 a. Why do you think this is necessary?

 This is necessary because in a circuit switching network, resources must be reserved beforehand
along the path that will be used to carry data between Bob and Alice.

 b. What is(are) the advantage(s)?

 Circuit switched networks provide predictable performance/quality of service.

 c. What is(are) the disadvantage(s)?

 Circuit switched networks do not always make best use of available resource (i.e. resources may be under-utilized when calls are idle)

ii. In a packet switching network, when Alice wants to communicate with Bob, no circuit is established and Alice simply starts sending data to Bob.

 a. What is(are) the advantage(s)?

 This fully utilizes the bandwidth available along the path between Alice and Bob. It is also more
resilient to faults (e.g. if a link is severed, packets can take alternate paths)

b. What is(are) the disadvantage(s)?

Packet switched networks are "best effort" and on demand-- no guarantee about reliability or
performance. Unpredictable.