Short answers to the exercises of second set in Internet Protocols:

3.45

transmission time = (packet length)/(bandwidth) =(8,000,000 bits) / (200,000 bps) = 40 s

3.46

(bit length) = (propagation speed) × (bit duration)

The bit duration is the inverse of the bandwidth.

a. Bit length = (2 ×108 m) × [(1 / (1 Mbps)] = 200 m. This means a bit occupies 200 meters on a transmission medium.

b. Bit length = (2 ×108 m) × [(1 / (10 Mbps)] = 20 m. This means a bit occupies 20 meters on a transmission medium.

c. Bit length = (2 ×108 m) × [(1 / (100 Mbps)] = 2 m. This means a bit occupies 2 meters on a transmission medium.

3.47

a. Number of bits = bandwidth × delay = 1 Mbps × 2 ms = 2000 bits

b. Number of bits = bandwidth × delay = 10 Mbps × 2 ms = 20,000 bits

c. Number of bits = bandwidth × delay = 100 Mbps × 2 ms = 200,000 bits

3.48

Latency = processing time + queuing time + transmission time + propagation time

Processing time = 10 × 1 µs = 10 µs = 0.000010 s

Queuing time = 10 × 2 µs = 20 µs = 0.000020 s

Transmission time = 5,000,000 / (5 Mbps) = 1 s

Propagation time = (2000 Km) / (2 × 108) = 0.01 s

Latency = 0.000010 + 0.000020 + 1 + 0.01 = 1.01000030 s

The transmission time is dominant here because the packet size is huge.

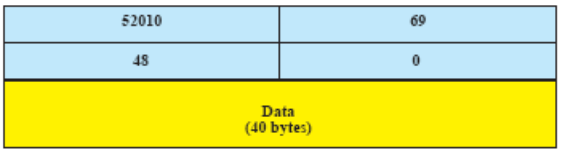
21.19

The appropriate ICMP message is destination unreachable message. This type of message has different types of codes to declare what is unreachable. In this case, the code is 0, which means the network is unreachable (The codes are not discussed in the chapter; consult references for more information).

21.24

The router will not need the services of ARP because the frame is broadcast at the physical address level.

23.13



23.16

This datagram cannot be transferred using a single user datagram.

23.17

16 bytes of data / 24 bytes of total length = 0.666

23.18

16 bytes of data / 44 bytes of total length = 0.364

23.19

16 bytes of data / 72 byte minimum frame size = 0.222

23.20

a. Port number 1586

b. Port number 13

c. 28 bytes

d. 20 bytes (28 – 8 byte header)

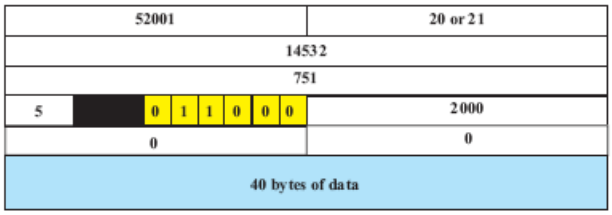
e. From a client to a server

f. Daytime

23.22

0111 in decimal is 7. The total length of the header is 7 × 4 or 28. The base header is 20 bytes. The segment has 8 bytes of options.

23.23



23.24

a. The source port number is 0x0532 (1330 in decimal).
b. The destination port number is 0x0017 (23 in decimal).
c. The sequence number is 0x00000001 (1 in decimal).
d. The acknowledgment number is 0x00000000 (0 in decimal).
e. The header length is 0x5 (5 in decimal). There are 5 × 4 or 20 bytes of header.
f. The control field is 0x002. This indicates a SYN segment used for connection establishment.
g. The window size field is 0x07FF (2047 in decimal).

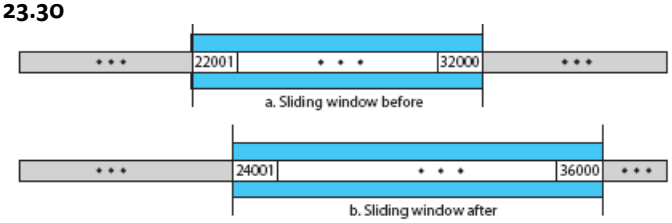
23.26

3000 − 2000 = 1000 bytes

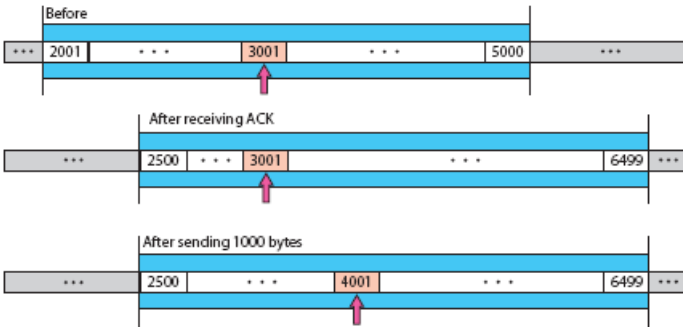
23.28

a. At TCP level:
16 bytes of data / (16 bytes of data + 20 bytes of TCP header) ≈ 0.44 or 44 percent
b. At IP level:
16 bytes of data / (16 bytes of data + 20 bytes of TCP header
+ 20 bytes of IP header) ≈ 0.29 or 29 percent
c. At data link level (assuming no preamble or flag):
16 bytes of data / (16 bytes of data + 20 bytes of TCP header + 20 bytes of IP header
+ 18 bytes of Ethernet header and trailer ≈ 0.22 or 22 percent,

23.30



23.31



24.19

Input: (100/60) × 12 + 0 × 48 = 20 gallons
Output: 5 gallons
Left in the bucket: 20 − 5 = 15

24.20

Second 1:
Initial: → n = 8000
Frame **1** is sent → n = 4000
Frame **2** is sent → n = 0 **Stop: n < Frame 3**

Second 2:
Initial: → n = 8000
Frame **3** is sent → n = 4000
Frame **4** is sent → n = 0 **Stop: n < Frame 5**

Second 3:
Initial: → n = 8000
Frame **5** is sent → n = 4800
Frame **6** is sent → n = 1600 **Stop: n < Frame 7**

Second 4:
Initial: → n = 8000
Frame **7** is sent → n = 4800
Frame **8** is sent → n = 4400
Frame **9** is sent → n = 4000
Frame **10** is sent → n = 2000
Frame **11** is sent → n = 0 **Stop: n < Frame 12**

Second 5:
Initial: → n = 8000
Frame **12** is sent → n = 6000 **Stop: no more frames**