P1.

a) source port : 467   destination port : 23.

b) source port : 513   destination port : 23.

c) source port : 23   destination port : 467

d) source port : 23   destination port : 513

e) It's possible.

f) The source port numbers can't be the same.

P26

a. The size of the MSS is irrelevant, it's $2^{32} \approx 4.19$ Gb.

b. Segement number is $\left[\frac{2^{32}}{536}\right] = 8012999$.

66 bytes of header can be added to each segement.

So it's 528857 834 bytes of header.

Total number of transmitting bytes is $2^{32} + 528857834$

So it would take 249 seconds to transmit these files.

P32

a) EstimatedRTT$^{(4)}$ = x SampleRTT$_1$ + (1-x)[x SampleRTT$_2$ +

$(1-x)$ [x SampleRTT$_3$ + (1-x) SampleRTT$_4$]]

= x SampleRTT$_1$ + (1-x) x SampleRTT$_2$ +

$(1-x)^2 x$ SampleRTT$_3$ + $(1-x)^3$ SampleRTT$_4$

b) EstimatedRTT$^{(n)}$ = $x \sum_{j=1}^{n-1} (1-x)^{j-1}$ SampleRTT$_j$ + $(1-x)^{n-1}$ SampleRTT$_n$

c) when $n \to \infty$ $\lim_{n \to \infty}$ EstimatedRTT$^{(n)}$ = $\frac{x}{1-x} \sum_{j=1}^{\infty} (1-x)^j$ SampleRTT$_j$

= $\frac{1}{9} \sum_{j=1}^{\infty} 9^j$ SampleRTT$_j$.

P45

a) L equals number of packets lost divides the number of packets sent.

The number of packets sent in a cycle:

$$\frac{W}{2} + (\frac{W}{2}+1) + \cdots + W = \sum_{n=0}^{W/2}(\frac{W}{2}+n)$$

$$= (\frac{W}{2}+1)\frac{W}{2} + \sum_{n=0}^{W/2} n$$

$$= (\frac{W}{2}+1)\frac{W}{2} + \frac{W/2(W/2+1)}{2}$$

$$= \frac{W^2}{4} + \frac{W}{2} + \frac{W^2}{8} + \frac{W^2}{4}$$

$$L = \frac{1}{\frac{3}{8}W^2 + \frac{3}{4}W}$$

b. If W is large. $\frac{3}{8}W^2$ is much longer than $\frac{3}{4}W$.

$$L \approx \frac{8}{3W^2}$$. average throughput $= \frac{3}{4}W \frac{MSS}{RTT}$

$$= \frac{1.22 \cdot MSS}{RTT\sqrt{L}}.$$

P54

Advantage: TCP wouldn't need to go through slow start and congestion avoidance to ramp up to the throughput value obtained at c_1

Disadvantage: They might be inaccurate.