

Homework #3-6

5.9- a) bandwidth  $\times$  delay (RTT) =  $100\text{ms} \times 16\text{bps}$

$$\Rightarrow 100\text{ms} \times \frac{1024}{8} \text{MBps} \Rightarrow 100\text{ms} \times 128\text{MBps}$$

12.8MB

$$12.8\text{MB} = 13,107,200 \text{ bytes} \Rightarrow 12.8 = 12.8 \cdot 2^{20} = 13421772 \text{ bytes}$$
$$1\text{MB} = 2^{20}$$

[24]

$$2^{24} = 16777216$$

b)  $1\text{Gbps} \cdot 30\text{s} = \frac{30}{8} \text{GB} = 3.75\text{GB} \Rightarrow 3840\text{MB}$

$$3840\text{MB} = 4026531840 \text{bytes}$$
$$1\text{MB} = 2^{20}$$

$$3840\text{MB} = 3840 \times 2^{20} \text{B} = 4026531840 \text{bytes}$$

[32]

$$2^{32} = 4,294,967,296$$

5.12- a)  $1\text{Gbps} = \frac{1}{8}\text{GBps} = 0.125\text{GBps} = 0.125 \cdot 2^{30}\text{Bps}$

$$\text{TCP header} = 32\text{bits} \quad 2^{32} = 4,294,967,296$$

$$\frac{2^{32} \text{B}}{0.125 \cdot 2^{30} \text{Bps}} = [32s]$$

b)

$$32s \cdot \frac{2^{32}}{10^3} \Rightarrow 32 \cdot 2^{32} \cdot 10^{-3} \Rightarrow \frac{137438953472 \cdot 10^{-3}}{24 \cdot 3600 \cdot 365}$$

[4.35 years]