CSE 160: HW1-3

1.12 How "wide" is a bit on a 1-Gbps link? How long is a bit in copper wire, where the speed propagation is $2.3 \cdot 10^8$ m/s?

* "wide" - means how much time a single bit will take to transmit a unit of data 1 Gbps $= 10^9$ bps

* 1 bit on 1 Gbps link is $1/10^9$ bps; a single bit is 10^{-9} s = 1 ns wide
  - "Long" it is meant that how long a single bit occupies virtually in the channel

length = speed · time => Length = $1\text{ns} \cdot 2.3 \cdot 10^8$ m/s
$= 10^{-9}\text{s} \cdot 2.3 \cdot 10^8$ m/s
$= 2.3 \cdot 10^{-1}$ m
$= 0.23$ m

1.14 Suppose a 100-Mbps point-to-point link is being set up between Earth and a new lunar colony. The distance from the moon to the Earth is approximately 385,000 km, and data travel over the link at the speed of light - $3 \cdot 10^8$ m/s

a) calculate the minimum RTT for the link

$$\text{Propagation delay} = \frac{\text{length of link}}{\text{speed of signal}} \Rightarrow \frac{385{,}000\text{ km}}{3 \cdot 10^8\text{ m/s}} = \frac{386 \cdot 10^6\text{ m}}{3 \cdot 10^8\text{ m/s}} = 1.28\text{s}$$

b) $1.28 \cdot 2 = 2.56$s => minimum RTT

calculate delay x bandwidth product for link

delay bandwidth product = delay x bandwidth
$= 2.56\text{s} \cdot 1\text{Gbps} \Rightarrow 2.56\text{s} \cdot 1 \cdot 10^9$ bps
$= 2.56 \cdot 10^9\text{ bits} = \frac{2.56}{8}$

* $8 \cdot 10^9$ bits in a GB

$= 0.32$ GB