5.1.2

In a 10 Mbps CSMA/CD network, the ~~at~~ ~~maximum~~ maximum distance is 2500 m. What should it be if ~~we~~ ~~are~~ set the data rate to:

a) 100 Mbps

~~Keeping T_{tx} constant~~ $T_{prop} = \dfrac{D}{v_{prop}}$, where v_{prop} ~~is~~ is constant

$\cancel{D'} \quad v_{prop} = \dfrac{D}{T_{prop}} = \dfrac{D'}{T_{prop}'} \Rightarrow D' = \dfrac{T_{prop}'}{T_{prop}} D$

~~Since $T_{tx} = 2 T_{prop}$~~

Keeping S_f constant: $T_{tx} = \dfrac{S_f}{R} \Rightarrow S_f = \dfrac{T_{tx}}{\cancel{R}} / \dfrac{T_{tx}'}{\cancel{R'}} \Rightarrow T_{tx}' = \dfrac{R}{R'} T_{tx}$ $\left.\begin{array}{c} R T_{tx} = R' T_{tx}' \\ \\ \end{array}\right\} \Rightarrow$

$T_{tx} \geq 2 T_{prop} \Rightarrow T_{prop} \leq \dfrac{1}{2} T_{tx}$

$\Rightarrow \dfrac{D}{\frac{1}{2} T_{tx}} = \dfrac{D'}{\frac{1}{2} T_{tx}'} \Rightarrow D' = \dfrac{T_{tx}'}{T_{tx}} D = \cancel{\dfrac{R}{R'}} \dfrac{T_{tx}}{T_{tx}} D = \dfrac{R}{R'} D$

$D(R = 100 \text{ Mbps}) = \dfrac{10 \text{Mbps}}{100 \text{Mbps}} \cdot 2500 \text{m} = \boxed{250 \text{ m}}$

b) 1 Gbps

$D(R = 1 \text{Gbps}) = \cancel{\dfrac{1 \text{Gbps}}{10 M}} \dfrac{10 \text{Mbps}}{1 \text{Gbps}} \cdot 2500 \text{m} = \boxed{25 \text{m}}$

c) 10 Gbps

$D(R = 10 \text{Gbps}) = \dfrac{10 \text{Mbps}}{10 \text{Gbps}} \cdot 2500 \text{m} = \boxed{2.5 \text{m}}$