1. Problem 5

   (a) A:
   Delay = 150/100 = 1.5 hrs
   Toll booth delay = 12 sec
   10 cars ⇒ 120sec
   3 toll booths ⇒ 3 ∗ 2mins ⇒ 6mins
   End-to-end delay ⇒ 1.5hrs + 6mins ⇒
   End-to-end delay 1 hour 36 minutes

   (b) B:
   Same delay
   Same toll booth delay
   8 cars ∗ 12 seconds ⇒ 96 seconds
   96 seconds ∗ 3 ⇒ 4 mins 48 seconds
   End-to-end delay ⇒ 1.5 hrs + 4 mins 48 seconds
   End-to-end delay ⇒ 1 hour 34 mins 48 seconds

2. Problem 10
   End-to-end delay = $\frac{L}{R1} + \frac{L}{R2} + \frac{L}{R3} + \frac{d1}{s1} + \frac{d2}{s2} + \frac{d3}{s3} + d_{proc} + d_{proc}$
   Packet size = 1500 bytes
   Propagation speed = $2.5 * 10^8$
   Transmission rate = $2Mbps$
   Packet switching delay = $3msec$
   Link length = 1) 5000km, 2) 4000km, 3) 1000km
   $\frac{L}{R1} = \frac{1500*8}{2*10^6} \Rightarrow 6msec$
   $\frac{d1}{s1} = \frac{5000*10^3}{2.5*10^8} \Rightarrow 20msec$
   $\frac{L}{R2} = 6msec$
   $\frac{d2}{s2} = \frac{4000*10^3}{2.5*10^8} \Rightarrow 16msec$
   $\frac{L}{R3} = 6msec$
   $\frac{d3}{s3} = \frac{1000*10^3}{2.5*10^8} \Rightarrow 4msec$
   End-to-end delay
   $= 6msec+6msec+6msec+20msec+16msec+4msec+3msec+3msec =$
   $64msec$

3. Problem 11
   Transmission Rate $R_1 = R_2 = R_3 = R$
   $d_{proc} = 0$
   ⇒
   End-to-end delay $= 6msec + 20msec + 16msec + 4msec = 46msec$