EECS 509 – WINTER 1997

Problem Set #5 – Assigned Feb. 13 – Due in class Feb. 20

1. An approach to a fixed-cycle signal has a 25 sec. effective green, a saturation flow of 1300 veh/hr, and a degree of saturation less than 1. If the cycle length is 60 sec. and Allsop's delay formula estimates a delay that is 34 sec/veh higher than that estimated by considering deterministic (uniform) arrivals, determine the vehicle arrival rate.

2. Using the P-K formula presented in class, show that:

   (a) An M/D/1 queue has the smallest value (among M/G/1 queues with same $E[X]$) of:
   (i) expected waiting time in the queue (denoted $E[W_q]$);
   (ii) expected residual service time upon an arrival (denoted R).

   (b) $E[W_q]$ and R for an M/D/1 queue are half what they are for an M/M/1 queue.

   Can you give an intuitive explanation of these results?

3. Consider an unsignalized intersection of two one-way streets with a stop sign for the minor road (as studied in class). Using reasonable values for the parameters of interest, discuss if (or when) it is better (in terms of vehicle delay) for a driver on the minor road to face twice the traffic on the major road than to require a critical gap twice as long to cross the intersection?

   After you have done your analysis, use INTEGRATION to see how this simulator will treat this situation and what results it will give. You should make sure you randomize the headways of departing vehicles (see section 3.9 of Volume I of the User's Guide) to be consistent (to the extent possible) with the Poisson arrivals assumption used in the analysis. Also, refer to Volume II of the User's Guide (p. 14) for changing the gap acceptance parameters. Provide your input and output data.