Homework #2

1. The Press Department of an automobile manufacturing facility runs two main operations, each with its own press machine: front-plate press (FPP) operation and rear-plate press (RPP) operation. These operations can be performed in any order, but both have to be performed for each arriving plate. Plates (jobs) arrive randomly and their inter-arrival times are exponentially distributed with a mean of 5 minutes. The service time in the FPP operation is distributed uniformly Unif(1,5) minutes and the RPP is distributed Unif(2,6) minutes. A plate joins the queue of the press operation with the least number of plates waiting at the time (since there is no sequencing requirement), and on completion joins the queue of the other operation following which it departs from the system. (Hint: You must build an expression involving the variable NQ to control which queue the plate joins). Finally, the Press Department is a 3-shift facility running 24 hours a day.

   a) Develop an Arena model of the Press Department and run it for one year.
   b) Estimate the following statistics:
      - Average time arriving jobs spend in the Press Department.
      - Utilization of the press machine in each operation.
      - Average queue delay at each operation.
      - Average time of those arriving plates that join the RPP queue first, then proceed to the FPP queue.

2. An office that dispenses automotive licenses has divided its customers into categories to level the office workload. Customers arrive and enter one of three lines based on their residence location. Model this arrival facility as three independent arrival streams using an exponential inter-arrival distribution with a mean of 10 minutes for each stream, and an arrival at time 0 for each stream. Each arrival is assigned a single separate clerk to process the application forms and accept payment, with a separate queue for each. The service time is UNIF(8,10) minutes for all customer types. After completion of this step, all customers are sent to a single, second clerk who checks the forms and issues the plates (this clerk serves all three customers types, who merge into a single first-come-first-served queue for this clerk. The service time of this facility is UNIF(2.66,3.33) minutes for all customer types.

   a) Develop a model of this system and run it for 5000 minutes, observe the average and maximum time in system for all customer types combined.
   b) A consultant has recommended that the office not differentiate between customer types at the first stage and suggests using a single queue line with three clerks who can process any customer type. Develop a second model, run it for 5000 minutes, and compare the results with the first system model.