S1. Consider a single-server queue. The arrival times, AT, and service times, ST, of the first 10 customers were generated from corresponding distributions as follows:

| AT   | 3.2, 10.9, 13.2, 14.8, 17.7, 19.8, 21.5, 26.3, 32.1, 36.6 |
| ST   | 3.8, 3.5, 4.2, 3.2, 2.4, 4.3, 2.7, 2.5, 3.4            |

(a) Simulate this system by hand showing all the details in a graphical form *exactly* like we did in the power point presentation in the class. (You do not have to use power point. Just sketch the corresponding system snapshots). Stop the simulation when the 10th customer arrives to the system.

(b) Estimate measures of performance based on the simulation in (a).

(c) Check the validity of Little's law on the estimates in (b). If the law is not valid, briefly explain the reason.

S2. Redo the simulation in S1 in a compact tabular form as was done in class. Estimate the mean delay in queue per customer.

S3. Redo S2 with the same arrival times, but with two servers and each of the 10 customers requiring twice the service times in S2. (This is like a replacing a fast single server with two servers each of whom is half as fast.)

S4. Redo the (s, S) simulation done in class with (i) s = 20 and S = 60; and (ii) s = 51 and S = 83.

(a) For each case, plot the sample path of inventory position and net inventory, and estimate the mean weekly cost.

(b) Which of three policies (the one done in class and these two) do you *think* is better?


(a) Provide an analytical validation for the Arena results on this problem.

(b) Determine, approximately, the increase in the mean service time in the parallel system that will make the series system performs better (in terms of customers having less delay)?