Homework 2

1. **Ex. 1.2.2** (a) Modify program `ssq1` by adding the capability to compute (1) the maximum delay, (2) the number of jobs in the service node at a specified time (known at a compile time), and (3) the proportion of jobs delayed.
   (b) What was the maximum delay experienced?
   (c) How many jobs were in the service node at `t=400`, and how does the computation of this number related to the proof of Theorem 1.2.1?
   (d) What proportion of jobs were delayed and how does the proportion related to the utilization?

2. **Ex. 1.2.6** The text file `ac.dat` consists of the arrival times $a_1, a_2, ..., a_n$ and the departure times $c_1, c_2, ..., c_n$ for $n = 500$ jobs in the format

   ```
   a1 c1
   a2 c2
   ...
   an cn
   ```

   (a) If these times are for an initially idle single-server FIFO service node with infinite capacity, calculate the average service time, the server's utilization, and the traffic intensity.
   (b) Be explicit: For $i = 1, 2, ..., n$, how does s_i related to a_{i-1}, a_i, c_{i-1} and c_i?

3. **Ex. 2.3.4:** Suppose that each die in a pair of dice is loaded (un-fair) in such a way that the 6-face is four times as likely as the opposite 1-face and each of the other four faces are twice as likely as the 1-face.
   (a) Use Monte Carlo simulation to estimate the probability that, if the dice are rolled, the sum of the two up-faces will be 7.
   (b) What is the axiomatic probability?

4. **Ex. 2.3.5:** (a) If two points are selected at random on the circumference of a circle of radius ρ, use Monte Carlo simulation to estimate the probability that the distance between the points is greater than ρ.
   (b) How does this probability depend on ρ?