

# COMPENG 4DK4 Lab 1 Report

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## Random Number Generator Seeds

For the experiments in this lab, we used the same set of 18 random number seeds for all experiments. Experiment 2 instructs us to use at least 10 different random number generator seeds and that our *McMaster IDs* as had to be among these seeds. We used our *McMaster IDs* and shifted them by one digit at a time to create 9 different seeds from each our IDs, for a total of 18 different seeds. All the random number generator seeds can be seen in Table 1. In the C code used for the experiments, leading zeroes are removed.

400188200	400190637
001882004	001906374
018820040	019063740
188200400	190637400
882004001	906374001
820040018	063740019
200400188	637400190
004001882	374001906
040018820	740019063

Table 1: Random Number Generator Seeds

## Experiment 2

If we set `SERVICE_TIME` to a value of 10, we need to set  $0 < \text{ARRIVAL\_RATE} < 0.1$  to satisfy  $0 < \text{ARRIVAL\_RATE} \times \text{SERVICE\_TIME} < 1$ . We selected the following values for `ARRIVAL_RATE`: 0.001, 0.01, 0.03, 0.05, 0.07, 0.09, 0.095, 0.099. We doubled the variable `NUMBER_TO_SERVE` from the default to  $50 \times 10^6$  to  $100 \times 10^6$ . We modified the provided code to run to loop through each arrival rate with all 18 random number generator seeds, and print out the average results of the seeds for each arrival rate. A plot of the average mean delay vs. arrival rate is shown in Figure 1. At low arrival rate values, we see the mean delay approach 10. This is because at low arrival rates

## Experiment 3

As we increase the arrival rate such that the product of `ARRIVAL_RATE` and `SERVICE_TIME` exceeds 1, we see the fraction of customers served begins to drop.

## Experiment 4

When setting the `SERVICE_TIME` to 30, we similarly adjusted our `ARRIVAL_RATE` values by dividing the rates used in experiment 2 by 3. We kept all other parameters the same (including the random number generator seeds) and reran the simulation. A plot of the mean delay vs. arrival rate of both experiments 2 and 4 are shown in Figure 2. We can see that

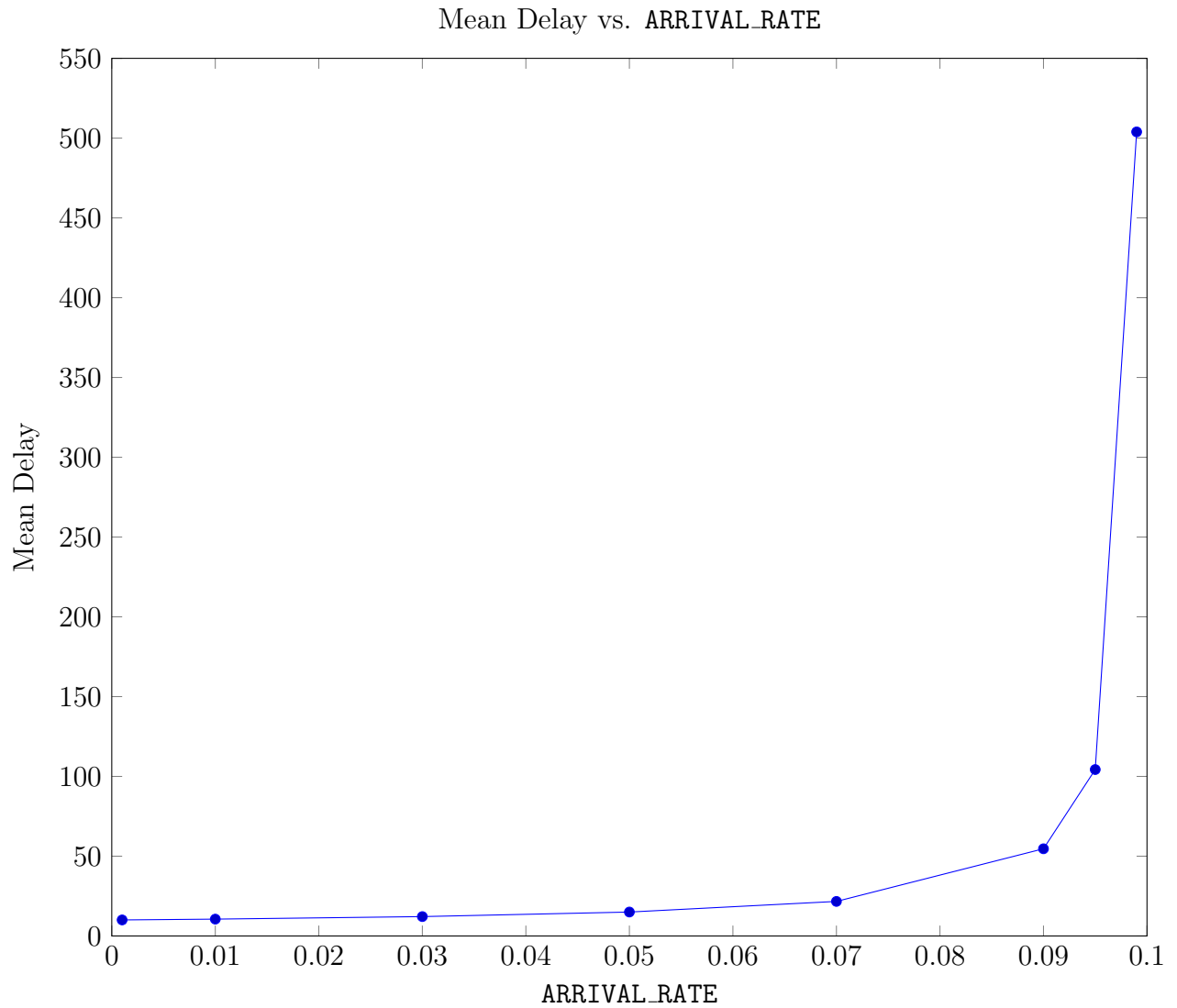


Figure 1: Experiment 2: Mean Delay vs. Arrival Rate

in this experiment, with a larger service time the mean delay increases significantly faster at the same arrival rates.

**Experiment 5**

**Experiment 6**

**Experiment 7**

**Experiment 8**

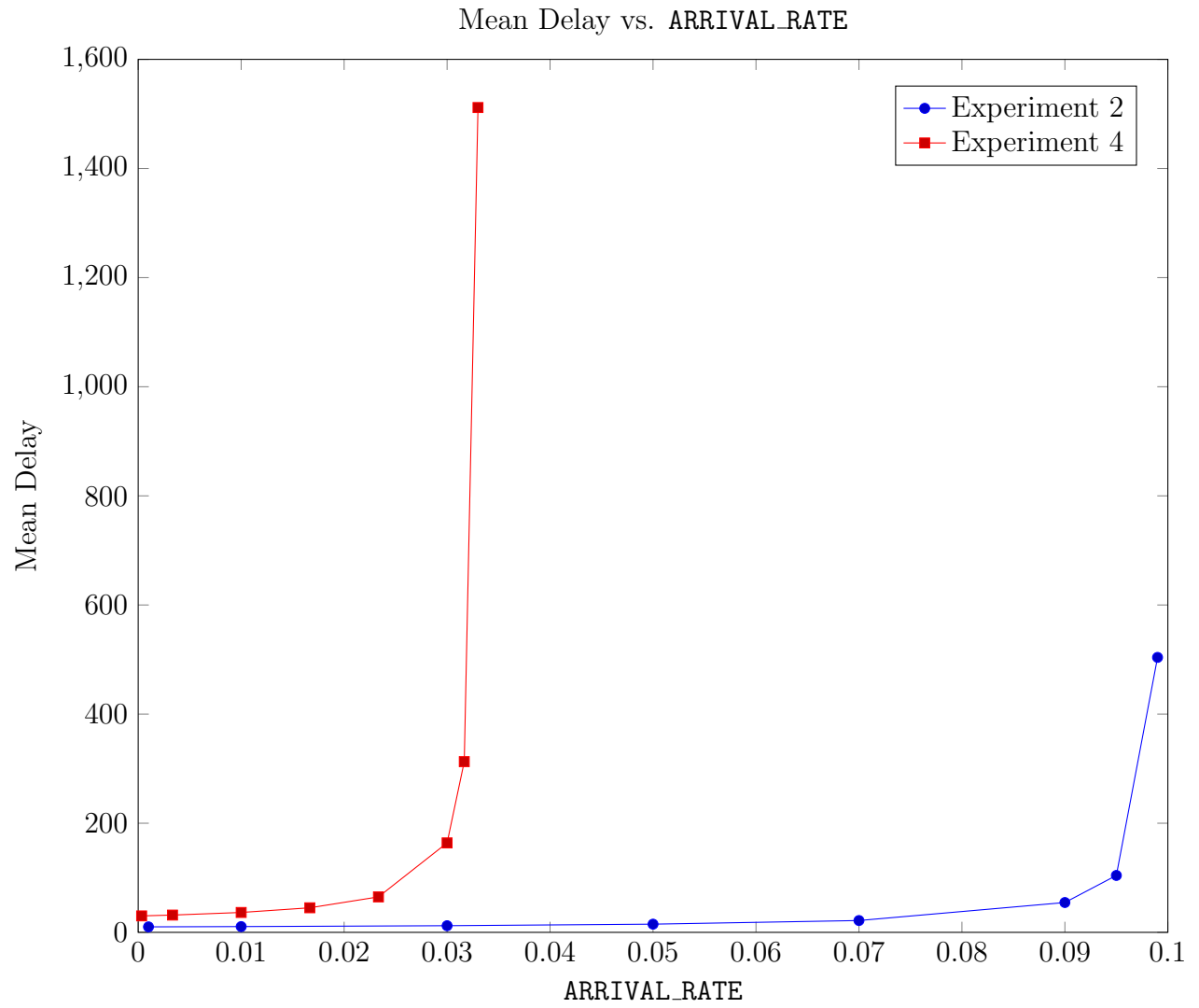


Figure 2: Experiment 4: Mean Delay vs. Arrival Rate