Stochastic Processes 160B, Assignment 6

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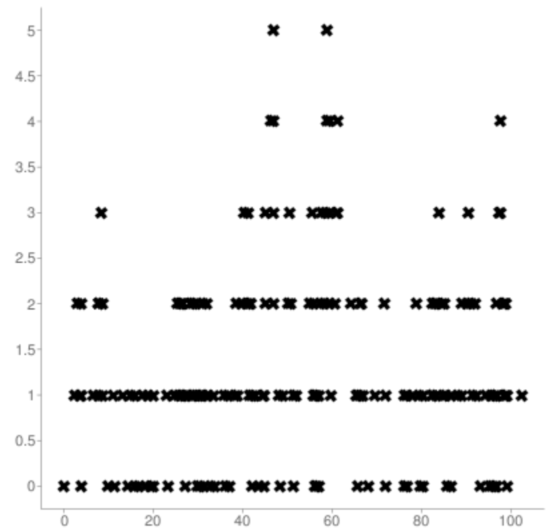
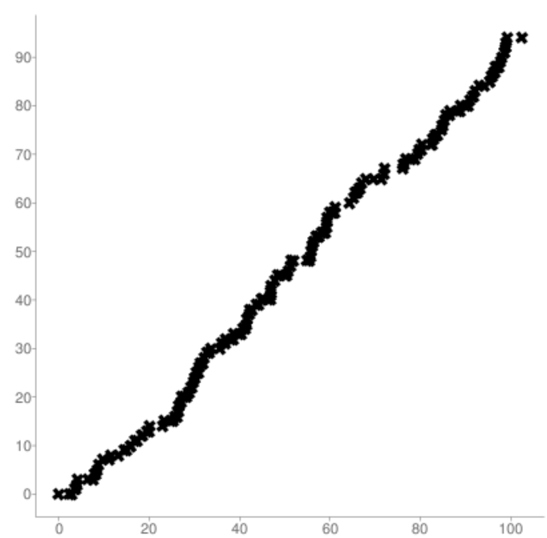
Part A

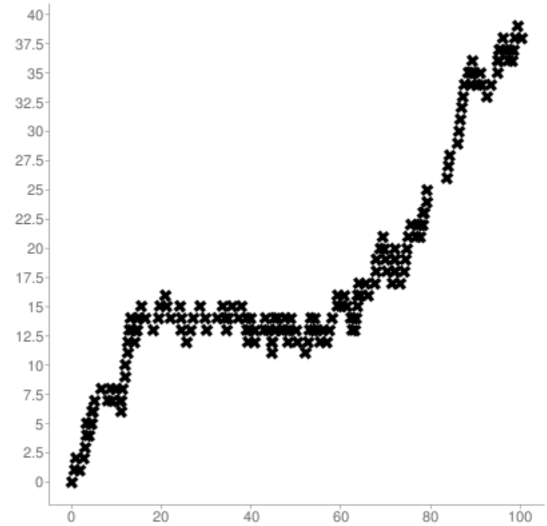
My code simulates a continuous time Markov Chain whose states are the number of customers in the system at time t. It is a birth/death process beginning at state 0, changing state at randomly determined jump times. If a customer arrives before either server finishes serving another customer, the state increases. If either server finishes serving a customer before another customer arrives, the state decreases. Below, find the states of the Markov Chain $X(t)$ and the total customers served $Y(t)$, respectively.

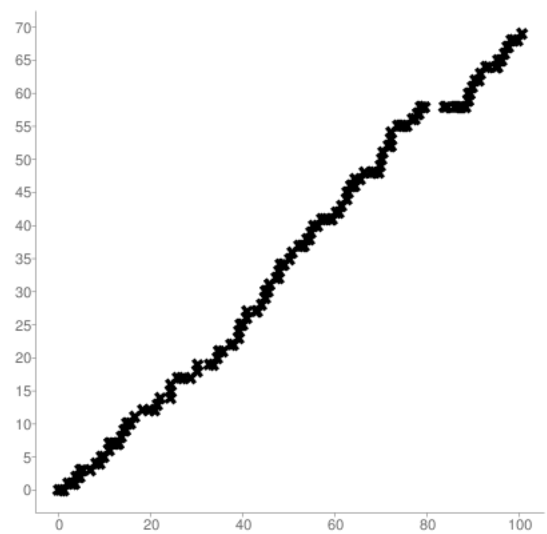




Part B

For this section, my code is essentially the same as the last, except that it uses a different value for λ:





In comparison to the graph on the previous page, $X(t)$ builds up to a much larger number. This makes sense: if servers take three times as long to serve each customer, the number of waiting customers should increase.

Meanwhile, $Y(t)$ appears to have the same shape, but only reaches about 70 instead of around 95. This means fewer customers are served in the same amount of time as when λ was 1.

Part C

This final part of my program simulates the same continuous-time Markov Chain as in Part A, but for 1,000 time units without recording. Then it records another 1,000 units of time in the Markov Chain, and prints the relative frequencies of the states hit in this time. Here is an example of the output:

```
State:  0 , Frequency:  0.1817258883248731
State:  1 , Frequency:  0.3538071065989848
State:  2 , Frequency:  0.25076142131979695
State:  3 , Frequency:  0.116751269035533
State:  4 , Frequency:  0.0583756345177665
State:  5 , Frequency:  0.026395939086294416
State:  6 , Frequency:  0.008121827411167513
State:  7 , Frequency:  0.003045685279187817
State:  8 , Frequency:  0.0010152284263959391
```