Problem Description

We aim to visualize the simulations of a Single Server Queueing (simulation code attached) using the python library **dash**. Our goal is to visualize the delays of each customer for a given set of parameters.

FIFO Single Server model

There is one server (e.g. an ATM machine) behind which forms a queue (waiting system for arriving customers). The n^{th} Customer C_n arrives as time t_n where

$$0 = t_0 < t_1 < t_2 ..... < t_n < .....$$

With $\lim_{n \to \infty} t_n = \infty$

The interarrival time T_n is the length of time between the arrival of successive customers C_n and C_{n+1} i.e.

$$T_n = t_{n+1} - t_n$$

Let S_n denote the service time of C_n

Let D_n denote the waiting time of C_n then:

$$D_{n+1} = \max(D_n + S_n - T_n, 0)$$

We want to plot the series of D_ns for different parameters. For our case we will assume that the service time of C_n is a Poisson Distribution with mean λ and the Interarrival time is a Uniform distribution with a = 1. The user can choose λ from a set of $\{1.0, 3.0, 5.0\}$ and b from a set of $\{3.0, 5.0, 7.0, 10.0\}$

$$S \sim Poiss(\lambda)$$

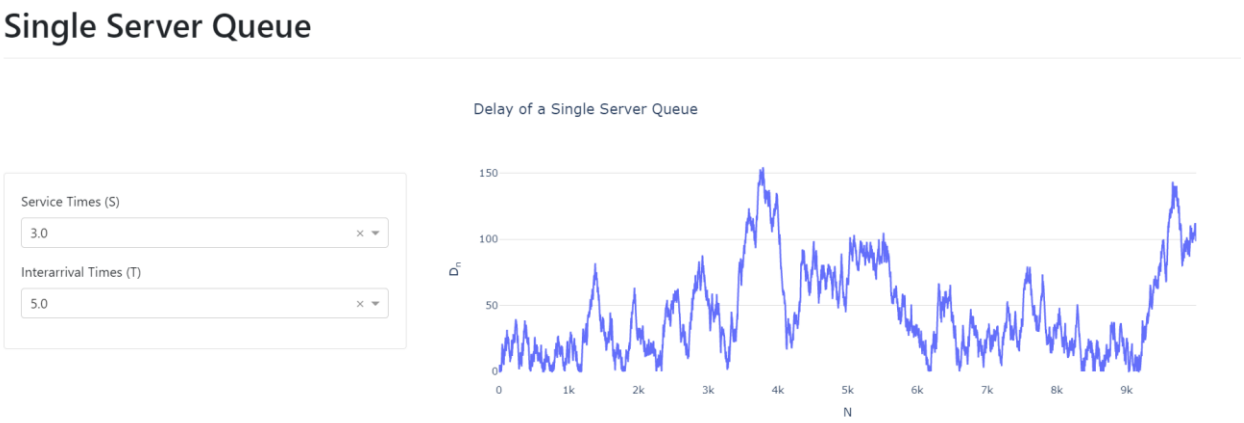
and

$$\mathrm{T} \sim \mathrm{Unif}(1, \mathrm{b})$$

Note: a sim.py file is attached with this test to provide a helper simulation class. You can simulate the Single Server Queue (SSQ) as follows

```
from sim import Sim
ssq = Sim()
S, T, D = ssq.simulateSSQ(lam=3.0, b=5.0, size=1000)
```

Expected Output



The title of the dashboard is **Single Server Queue**

The title of the graph is **Delay of a Single Server Queue.** The color code of the grid lines is #dddddd with x-gridlines disabled and the current values in the dropdown selector are disabled i.e. the user cannot select the current values. The label of the x-axis is **N** and y-axis is $\mathbf{D_n}$**.** The Service time (S) dropdown will be used for selecting λ (default: 3.0) and Interarrival Times (T) for selecting b(default: 5.0).

This is the minimum expectation; in fact, you are encouraged to add some useful features on your own which you believe would make the dashboard easier for the end-user to understand.

Submission

We expect you to create a GitHub repo and submit its link. We will clone the repo and run it in a fresh python virtual environment. Please do not forget to add the **requirements.txt** file.

Please submit the test by **August 28, 2020 11:59 PM ET**