IE 306 - Fall 2025

Assignment

Due date: Thursday, November 06, 15:00

A cinema is showing the science fiction movie 'Dune 2' once a day at 18:30. The cinema can hold 250 people, and no tickets are sold after the starting time of the movie. People arrive at the ticket booth at random times starting from 10:00. The inter-arrival times are assumed to be exponential with a mean of 8 minutes. The number of tickets requested by each customer is historically known to be as follows.

%	Number of tickets requested
30	1
40	2
20	3
10	4

The length of ticket purchasing operation is independent of the number of tickets bought. However, it depends on the payment method. If the customer pays with a debit/credit card the transaction takes some time between 2 to 4 minutes. However, if the payment is made by cash, it takes between 2 to 7 minutes (Uniformly distributed and continuous-valued in both cases). It is assumed that 25% of the customers prefer to pay in cash.

The statistics to collect are:

- Average waiting time of lucky customers before they buy their tickets, and
- Average waiting time of unlucky customer before they realize their movie is sold out, and
- Utilization of the personnel who is selling the tickets, and
- Average length of the ticket queue

Tasks:

1. Identify the primary events for the described system, and considering also the statistics to be collected, write down the pseudo-codes for the event procedures (i.e. what needs to happen when a specific event happens). Provide the list of events and their pseudocodes in the report.

2. Prepare a formal "event-scheduling" hand-simulation table and hand-simulate the system for 30 minutes only. Assume that the ticket booth is empty initially. Submit the hand-simulation table in the report.
   Use the following LCG with the seed 541 to generate the RNs you may need;

   a=29, c=3, m=1289

   (When an arrival and a departure must be simultaneously scheduled, use the convention of scheduling the arrival first).

3. Using event-scheduling algorithm, write a Python program on a Jupyter Notebook to simulate the system described above. Organize your program using typical simulation variables and structures discussed in class and in your texts.

4. First run your simulation for 30 minutes using the RN generator and the seed you used in 2. Have your program print out the important variables line by line, producing a brief table that allows you to make a verification of your program, by comparing it against your results obtained part 2. Submit the results of the simulation run in the report, and discuss any differences from 2.

5. Next run for a full week (7 days), and repeat this 4 times with 4 different random seeds and report your statistics. Report the results from all 4 replications for all output metrics, as well as other key outputs that need to be collected (e.g. no of tickets sold, no of customers left without ticker, etc).

NOTE:

- Your program must have some minimum documentation between the code blocks for proper assessment.
- The program should implement the aforementioned RN generator, and it should be possible to modify the parameters and the seed of the RNG at one of the top code blocks.
- You are not allowed to use any specific package/library for random variate generation, event-scheduling or simulation for this homework.
- You are expected to deliver a pdf file for the report, and a Jupyter notebook file for the simulator. What needs to be included in the pdf files is highlighted at the end of each task.