

## C++ Exercise

Write the bus simulation. For random number generator, you can use any open source or available code online.

### Simulation parameters.

- 10 bus stops
- 5 buses
- The time to drive between any two contiguous stops is 5 minutes
- The passenger's mean arrival rate at each stop is 5 persons/min
- The boarding time is for 10 seconds for each passenger
- The total simulation time is 8 hours.

The purpose of the simulation is to observe the behavior of the system, and answer the following questions:

1. Does the distance between the buses keep uniform? If not, what should be done to ensure it is uniform?

>> Distance between the buses doesn't keep uniform. It is because at every bus stop there are a different number of people waiting to board the bus and only after everyone is boarded the bus will depart i.e., buses can depart at different stops at different timings which makes the distance between the bus change. My recommendation would be to make the bus departure timing fixed i.e., buses will leave at a fixed time no matter whether all the passengers boarded the bus or not. Passengers who are left to board the bus can catch the next bus. By implementing this, the distance between the buses will be uniform.

2. What is the average size of a waiting queue at each stop (and what are its maximum and minimum?) (You may provide this information on an hourly [simulation time] base.)

>> Average size of a waiting queue at each stop, its maximum and minimum are available in the file "snapshot.txt" in the folder "Output Files" at the GitHub link. The

data is generated for each hour and is reset every hour. Please check below table for average, minimum & maximum waiting for the first hour.

The formula used for calculating average waiting is

Average waiting = (Total people coming in a queue in the hour)/ (Total buses coming at the stop in the hour)

1st Hour	Minimum Waiting	Maximum Waiting	Average Waiting
Stop 1	0	139	297
Stop 2	0	284	287
Stop 3	0	59	305
Stop 4	0	260	154
Stop 5	0	162	288
Stop 6	0	160	165
Stop 7	0	209	298
Stop 8	0	86	148
Stop 9	0	208	289
Stop 10	0	29	133

Please note, average waiting is greater than maximum waiting because when people arrive in the queue, they get boarded i.e., maximum waiting doesn't count all the people coming in the queue.

3. Plot the positions of buses as a function of time (you will need to generate periodic snapshots of the system for that).

>> Snapshots for positions of buses as a function of time is generated every hour and can be found in the file "snapshot.txt" in the folder "Output Files" at the GitHub link. The complete output for 8 hrs. can be found in the file "log.txt" in the folder "Output Files" at the GitHub link.

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