Software Simulation Spring 2023

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Project Assignment Part II: Simulation of a base scenario

Deadline: 30 April 2023, 23:30 CET

Recall the yard system you analyzed in Project Assignment Part I. Implement a **Discrete-Event Simulation** of the system for future arrivals and service (storage) durations by taking into account the following rules:

1. Sample the CG interarrival times from a convenient probability distribution consistent with your analysis of the historical data in Part I. Note that it is important to pick a distribution that you can sample and analytically work when/if necessary.
2. For each CG arrival, sample the following variables from appropriate probability distributions (you may use the distributions you obtained from Part I):
    a. The number of containers
    b. The storage duration (service time)
    c. The arrival point (among the points provided in the historical data)
    d. The departure point (among the points provided in the historical data)
    e. The container type (recall that all containers in a CG are of identical type)
3. **Yard block (YB) assignment rule (base rule):** CGs are assigned to YBs based on a FIFO (first-come-first-served) rule. Assign all containers of a newly arriving CG to a single YB which has sufficient empty slots for the containers and closest to the arrival point of the CG. If there are no YBs available to accommodate them at the arrival, reject the CG.
4. Each CG must be stored in a single Yard Block (YB) for its entire storage duration, which starts at its arrival and ends at its departure time. The 48-hours rule for the truck-involved CGs hold.
5. Each CG must be stored in a YB which
    i) is **compatible** with both the content type (normal/reefer) and flow type (import/export) of the CG. YBs of flow type MIX are considered flow type-compatible with both import and export CG.
    ii) is **available**, meaning that it can store the CG **for its entire storage duration (service time)** without exceeding its occupancy at any time.
6. is the closest YB to the CG's arrival position among all compatible YBs which are available at the arrival time of the CG**.**
7. The distance between two points should be calculated using rectilinear (Manhattan) metric.

Implement an online simulation. Your implementation should permit adjusting the simulation period (e.g. 1 month, two months etc.). Run your simulation for a **sufficient number of times** to report the average values of the following variables over multiple simulation runs:

1- The number of containers rejected.
2- The number of CGs rejected.
3- For each container type, the number of containers rejected.
4- The total travel distance of containers.

5- The average travel distance of containers.
6- The maximum occupancy of each YB.
7- The average daily occupancy of each YB. Consider a day starts at 00:00 and ends at 23:59.
8- The average daily occupancy among all YBs.

Record and report any other relevant information you can think of. Creativity and critical thinking will be rewarded. In a short report, provide an analysis of your findings and observations. Clearly indicate which probability distributions you utilized for each random variable and state any assumptions you made.

Your final assignment will require an integrated visualization and comparison of multiple what-if scenarios under different rules. Feel free to progress as much as you can in this Part II assignment to already include elements from the final assignment (for example the visualization).