Software Simulation Spring 2023

Final Project Assignment: Simulation of a base scenario

Deadline report: 12 June 2023, 23:30

Final exam (presentation): 26 June 2023, 10:00

WHAT-IF SCENARIOS (MODIFICATIONS/ALTERNATIVES TO THE BASE SCENARIO):

1. Each newly arriving CG g must be stored in a **single** YB which has the smallest remaining capacity among all available and compatible YBs. If two or more YBs have the same remaining capacity, then the closest YB to g's arrival point is prioritized.

2. The containers of a CG g can now be split into several YBs while being stored. Whenever a YB z has remaining capacity $o^{REM}<N_g$ and it is the closest available to g's arrival point, then o^{REM} containers of g are stored into z. Its remaining N_g-o^{REM} containers are left to be served by other YBs in the same manner.

3. CGs which arrive/depart with vessels are unloaded/loaded gradually in groups of C_{max} containers per hour (as a result of crane limited capacity per hour). This means that whenever a CG g is assigned an arrival time A_g, each group k of C_{max} containers in g must move to its YB at time A_g+k (in hours). Similarly, each group k should leave the YB at time D_g-k where D_g is the departure time which is equal to A_g + service time of g (LIFO). Experiment with C_{max}=60 and C_{max}=120.

4. Compare the following two alternative rules separately as well as together. In other words, (a), (b), and (a) and (b).

    a) The distance to define the "closest available" YB is now computed taking into account both arrival and departure point of a CG: $D=D(P_A,YB)+D(YB,P_D)$.

    b) MIX YBs can only be serving containers of a single flow type at any time.

From the aforementioned modifications (1-4) select as many as the members of your group. For each one of them implement an online discrete-event simulation and apply the corresponding (updated) rules, as was made for Project Assignment Part 2. You are strongly encouraged to introduce and analyze similarly an additional what-if scenario which is highly relevant and interesting (not too basic). This additional creative analysis will be rewarded through bonus points.

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.

Compare the new observations with each other, as well as with the base scenario simulation. 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.

Analyze the comparisons between different scenarios and justify any interesting observation. Your simulations should be visualized and presented to your colleagues. Final presentations might also be attended by external participants. Your presentation should be in English and include:

a) An explanation of how your algorithm works and a brief description of the group work division.
b) A short demonstration of your simulation.
c) Analysis of experiments you conducted including the scenarios you considered and your key findings/conclusions.
d) The most significant/difficult/challenging elements and a critical evaluation of your work.
e) Anything else you consider worth presenting.

The problem should not be a part of the presentation. The questions might be both related to the project or other topics.
Each group will have 6 minutes for their presentation.