

Probabilistic Simulation

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Practical Assignment

In this simulation, we had two problems to solve:

- divide 100 toy batches optimally between two contractors to minimize the total time and
- find the number of days that the work should be started before the deadline in order to finish the task with 95% confidence.

Our approach was to start by getting an estimate for the optimal split. This was implemented by processing each toy batch individually and passing it on to the contractor who first has their first service line machine ready to use. The histogram plot of average days required using the greedy algorithm is presented in Figure 1. We used 10^5 simulations.

We implemented a time-based simulation and an event-based simulation. Both of these implementations can be observed on GitHub, linked in the references section.

After greedy simulation, we got **217.9** as the value for the average days required. We stored the batch amount for each contractor and got the values **54** and **46** as the average amount of batches for each contractor. These values are now used as the basis for finding the optimal split ratio. The averages for the total days required are simulated using splits ± 4 around the estimated split ratio. The average days for each split are presented in Figure 2.

The best split ratio was found to be with values **52** and **48** with average total times required of **214.3**. Based on our simulation results, we have chosen this split ratio to be optimal for the contractors. Finally, we simulate the total times required by using the optimal split ratio. The histogram plot of the results is presented in Figure 3.

From the simulation results, we calculated that 95% of the simulated total days are below **221 days**. Therefore by starting the production at least 221 days before the deadline, all toys have been produced by the given deadline.

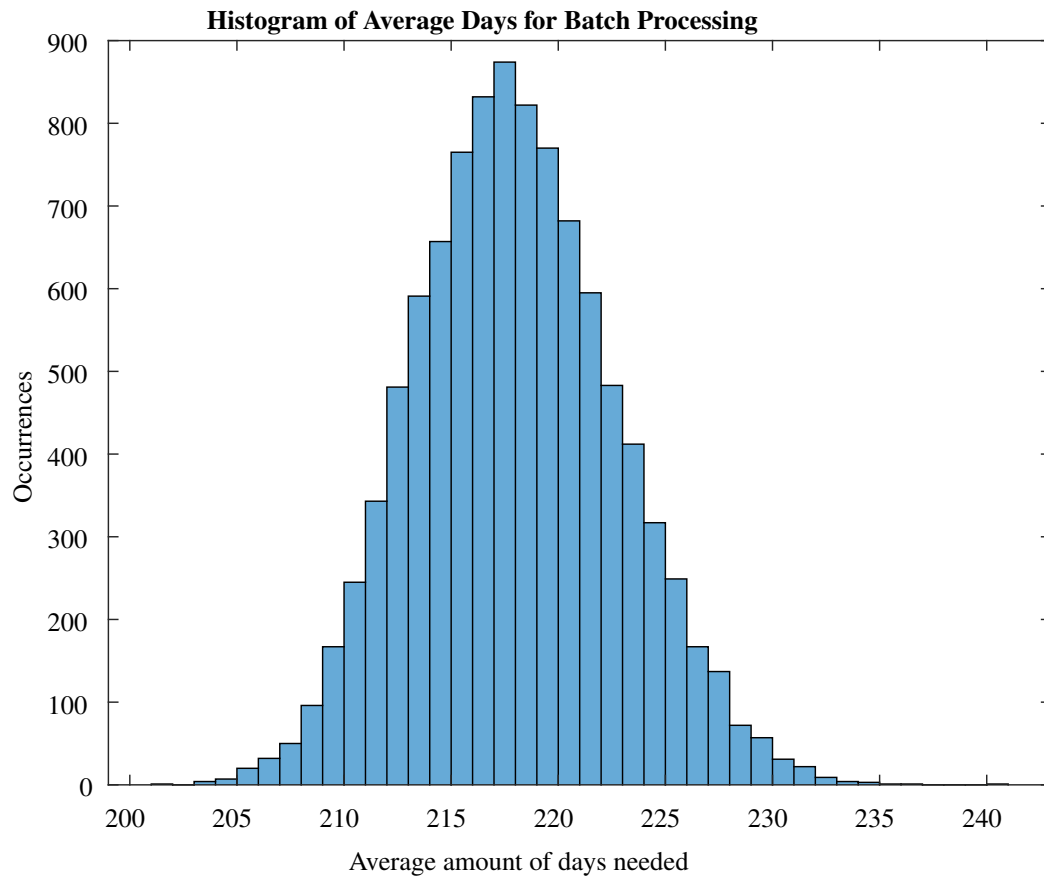


Figure 1: Histogram of the average days required with greedy algorithm

Conclusion

Based on our simulation results, the number of toys should be divided so that contractor 1 produces 5200 toys (52 batches) and contractor 2 produces 4800 toys (48 batches). By using this split, the shop should give the order to contractors 221 days before the deadline in order to have them ready by the deadline with 95% confidence.

References

MATLAB scripts used: GitHub repository

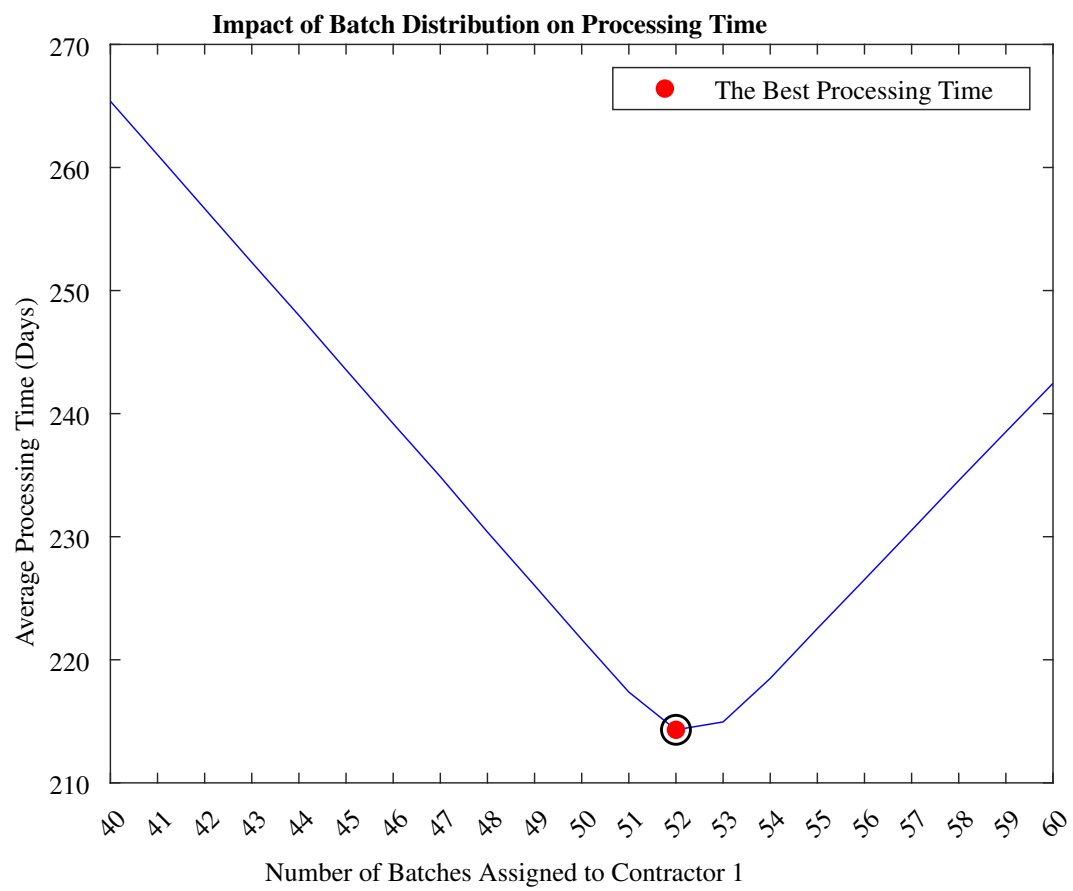


Figure 2: Average total days required with respect to the batch division used

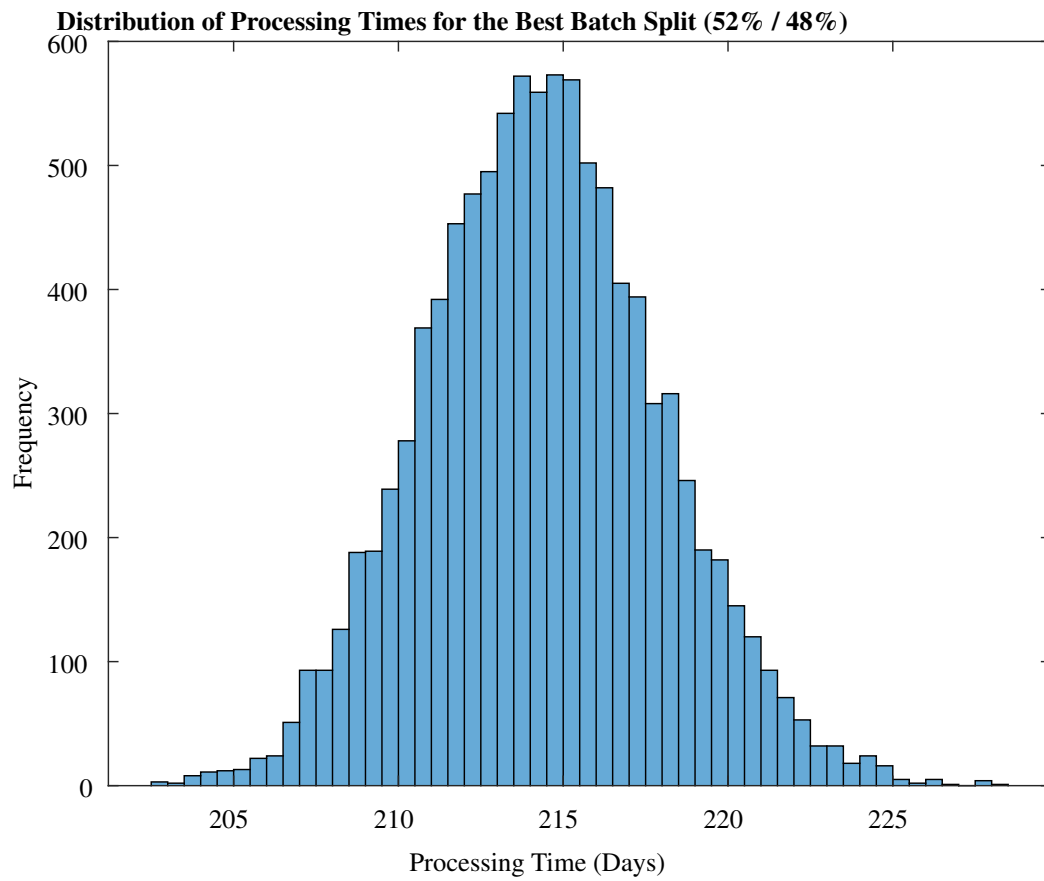


Figure 3: Histogram of the average days required with the optimal split of 52/48 batches