

# Comparison between our optimization library and AnyLogic OptQuest optimization experiment

We compared the results of our optimization library to the results of the optQuest optimization experiment in AnyLogic to see if we will get similar or even better results. We use 2 models that are example models from AnyLogic. Below is the description and breakdown of the comparison.

As a first step, since the varying number of replications feature currently doesn't work correctly, it's not possible to do the comparison using that option. Instead, we will use the fixed number of replications. So, in order to approximate how many replications are needed to reach a certain confidence level, we conducted a MonteCarlo experiment using our MonteCarloExperiment library before doing the optimization experiment.

## Model 1: Activity based costing analysis

**Model Link:** <https://cloud.anylogic.com/model/1aa9a167-bc87-441e-ab54-d31a3234245f?mode=SETTINGS>

### Step 1: MonteCarlo

Using the default values for the parameters as indicated in the model, the conducted experiment showed that 3 replications only were needed to reach a 95% confidence level with a 0.05 error percent related to the expression `totalCostPerProduct()`. Accordingly, we used 5 replications for the comparison. This means that in our experiment, we set both the minimum replications and the maximum replications to 5, and the optQuest we set the fixed number of replications to 5.

To compare the results of the 2 experiments, it is not enough to run each experiment once and compare the 2 results. This is because when using a random seed, every time we run an experiment we will get different results. This is true for both optQuest and our optimization experiment. So again, to get reliable results we will run both experiments enough times until a 95% confidence level is reached with a 0.05 error percent. The error percent will be calculated progressively after each run until 0.05 or less is reached. The objective of the experiments is to minimize the expression `totalCostPerProduct()`.

### Step 2: Optimization using our library

30 replications or runs were needed to reach the 95% confidence level, with an average of 80.42.

### Step 3: Optimization using AnyLogic optQuest

11 replications or runs were needed to reach the 95% confidence level, with an average of 92.97.

### Step 4: Comparison

The results are summarized in the table below. We can see that our experiment gave better results than optQuest since we got a smaller average and the objective is minimization, with a 15.6% difference. However, it is to note that we needed a higher number of replications to reach the same confidence level and error percent in our experiment compared to optQuest.

	Number of replications required	Average expression result
Noorjax optimization	30	80.42
AnyLogic optQuest	11	92.97

## Model 2: Supply chain

**Model Link:** <https://cloud.anylogic.com/model/a17b5bbe-7c9d-4460-9be7-15c9820ebec0?mode=SETTINGS>

### Step 1: MonteCarlo

Using the default values for the parameters as indicated in the model, the conducted experiment showed that 5 replications only were needed to reach a 95% confidence level with a 0.05 error percent related to the expression `meanDailyCost()`. Accordingly, we used 5 replications for the comparison. This means that in our experiment, we set both the minimum replications and the maximum replications to 5, and the optQuest we set the fixed number of replications to 5.

The objective of the experiments is to minimize the expression `meanDailyCost()`.

### Step 2: Optimization using our library

7 replications or runs were needed to reach the 95% confidence level, with an average of 810.24.

### Step 3: Optimization using AnyLogic optQuest

5 replications or runs were needed to reach the 95% confidence level, with an average of 804.81.

## Step 4: Comparison

The results are summarized in the table below. The results show that optQuest gave better results than our experiment since it gave a smaller average and the objective is minimization, with a 0.67% difference only.

	Number of replications required	Average expression result
Noorjax optimization	7	810.24
AnyLogic optQuest	5	804.81

## Model 3: Slotting policies in drive-in storage

**Model Link:** <https://cloud.anylogic.com/model/a0e5e826-a517-44d6-86bc-cc37a99767fb?mode=SETTINGS>

### Step 1: MonteCarlo

Using the default values for the parameters as indicated in the model, the conducted experiment showed that 3 replications only were needed to reach a 95% confidence level with a 0.05 error percent related to the expression totalTime. Accordingly, we used 5 replications for the comparison. This means that in our experiment, we set both the minimum replications and the maximum replications to 5, and the optQuest we set the fixed number of replications to 5.

The objective of the experiments is to minimize the expression totalTime.

### Step 2: Optimization using our library

The minimum number of replications chosen, which is 5, were enough to reach the 95% confidence level, with an average of 3907.27.

### Step 3: Optimization using AnyLogic optQuest

The minimum number of replications chosen, which is 5, were enough to reach the 95% confidence level, with an average of 3883.28.

## Step 4: Comparison

The results are summarized in the table below. The results show that optQuest gave better results than our experiment since it gave a smaller average and the objective is minimization, with a 0.62% difference only.

	Number of replications required	Average expression result
Noorjax optimization	5	3907.27
AnyLogic optQuest	5	3883.28

## Conclusion

	Number of replications required		Average expression result		% difference
	Noorjax optimization	AnyLogic optQuest	Noorjax optimization	AnyLogic optQuest	
Activity based costing analysis	30	11	80.42	92.97	15.6
Supply chain	7	5	810.24	804.81	0.67
Slotting policies in drive-in storage	5	5	3907.27	3883.28	0.62

The above summary table shows that 2 out of 3 times optQuest gave better results with a low % difference and for the third test our experiment gave better results with a 15.6% difference.