

## IE3081 – Modeling and Discrete Simulation Course

*Marmara University, Istanbul, Turkey  
October 14, 2024*

### **Project**

The project consists of 4 steps. At each step, there are items to be answered and responded to in the final report.

#### **Step 1**

Please determine a system that you want to model and simulate. (Please note that you will build a discrete model of a dynamic stochastic system.) You will also determine the requirements defined below.

- Determine system components (e.g. entities, their attributes, activities, events, and state variables)
- Determine the relations between system components
- Your model must include at least one queue.

**Reporting:** Include your answers for the items asked above in the report (see Deliveries).

#### **Step 2**

Build the conceptual model of the system that you would like to model and simulate. For this purpose, you need to provide the following items as well:

- Define the objectives
- Re-determine/refine system components (e.g. entities, their attributes, activities, events, and state variables)(you worked on this in the previous homework)
- Determine the performance metrics (as well as other outputs)
- Determine the alternative system design(s) that you consider to test

**Reporting:** Include your answers for the items asked above in the report (Deliveries).

#### **Step 3**

Build the computerized model of the system that you built the conceptual model previously. Please use the *Anylogic* simulation tool. Your computerized model will include the following items.

- system components
- the relations between system components
- generation of random variates

- 2D view of the model
- 3D view of the model
- the input variables (describe as the decision variables and uncontrollable variables)
- the type and the values (might be a pdf) of input variables (parameters).
- the output variables (parameters), e.g. average time spent in the system per customer, the average number of customers waiting at a specific queue. In your project, you have to measure at least one delay-related output parameter.
- Output values and responses

#### **Step 4**

In this final step, you are required to simulate and perform the evaluation.

For the system you defined and built in previous steps, simulate the system. Please answer the following items;

- Collect data on the system you built. Regarding the input parameters,
  - o Estimate the mean values for the output (performance) parameters you defined above. You have to run (replicate) the simulation several times with different seed values. Estimates should be the mean of all runs (replications).
  - o Compute the 95% confidence intervals for the output parameters.
  - o Estimate the total number of replications needed to estimate mean output parameters with 10% enhancement (narrowing the CI for 10%).
  - o Compute the 95% prediction intervals for the output parameters.
- Change your system design and collect data on the changed system. Answer the following questions:
  - o Are these two systems (the first one and the changed one) statistically different? Please answer your question for the 95% confidence interval.
  - o Estimate the additional replications needed to reduce the half-width of the confidence interval by 10% for the differences of the estimated values of the performance parameters.

**Reporting:** Include your answers for the items asked above in the report (see Deliveries).

**Deliveries:**

The following deliveries will be submitted via your personal **Turnitin** account.

1. The **model** that is designed in AnyLogic. Please use the link for “Project Code” in Turnitin.
2. A final **report** including the following items. Please use the link for “Project Report” in Turnitin.
  - a. Answers to the questions in Step 1
  - b. Answers to the questions in Step 2
  - c. Input and output parameters and the values of the input values.
  - d. Answers to the questions in Step 4.

This is an individual/group project for students. Collaboration and cooperation between groups are not allowed.

The due date is December 16, 2024, until 23:59.

Ask any unclear matter to the lecturer. Good luck...

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