IE3081-MODELING AND DISCRETE SIMULATION COURSE

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In this project we are expected to determine a system that is dynamic stochastic system and we want to model and simulate. This project consists of 4 steps.

**STEP 1:**

In this step, we are expected to determine system components, relations between system components.

**System:** Refectory Business:

**Entities:**

1. Customer: Person that use the refectory
2. Meal: Food items provided by the refectory:

**Attributes:**

1. Customer: Meal Preference, Entry Time.
2. Meal: Type

**Activities:**

1. Queueing: The area where customers wait in line to get their meals.
2. Meal Service: The area where meals are served to customers.
3. Payment: The process where customers pay for their meals.

**Events:**

1. Customer Entry: A new customer enters the cafeteria.
2. Order Placement: The customer specifies their meal preference.
3. Meal Pickup: After waiting in line, the customer moves to the meal service area and picks up their meal.
4. Payment Transaction: The customer pays for their meal.
5. Customer Exit: The customer leaves the cafeteria.

**State Variables:**

1. Customer Count: The total number of customers in the cafeteria.
2. Queue Status: The number of customers waiting in line and the status of the queue (e.g., busy, idle).
3. Meal Service Status: The number of customers in the meal service area and its status.
4. Revenue: The total revenue generated from meal sales.

**Relations:**

1. **Customer Queue Relation:**

-Description: Customers form a queue to wait for their turn to get meals.

-Key Components: Queueing Activity,Customer Entities

1. **Meal Service Relation:**

-Description: Meals are served to customers who have waited in line.

-Key Components: Meal Service Activity, Customer Entities

1. **Order Placement Relation:**

-Description: Customers place orders before moving to the meal service area.

-Key Components: Order Placement Event, Customer Entities, Meal Entities

1. **Payment Transaction Relation:**

-Description: Customers complete the payment process after receiving their meals.

-Key Components: Payment Activity, Customer Entities

1. **Customer Exit Relation:**

-Description: Customers leave the cafeteria after completing the entire process.

-Key Components: Customer Exit Event, Customer Entities

1. **Revenue Generation Relation:**

-Description: Revenue is generated when customers make payments for their meals.

-Key Components: Payment Activity, Revenue State Variable

**Queue:** The customers create a queue.

**STEP 2:**

In this step, we are expected to define the objectives, re-determine system components, determine the performance metrics and alternative system design(s).

**Objectives:**

**Efficiency**: Minimize customer waiting time and optimize meal service to increase the throughput of customers.

**Revenue Maximization**: Maximize revenue generation through efficient meal sales.

**Customer Satisfaction:** Enhance the overall experience for customers, considering factors like wait times and service quality.

**Refined System Components:**

**Entities:**

**Attributes:** Include additional attributes such as customer satisfaction scores, service completion times, and meal waiting times.

**Activities:**

**Refinement:** Further detail the activities to include specific steps in the queueing, meal service, and payment processes.

**Events:**

**Refinement:** Specify additional events related to customer feedback, unexpected events (e.g., service disruptions), and special promotions.

**State Variables:**

**Refinement:** Enhance state variables to include detailed counts, such as the number of satisfied customers, the number of incomplete transactions, etc.

**Performance Metrics and Other Outputs:**

**Customer Waiting Time**: Measure the average time customers spend waiting in the queue and meal service areas.

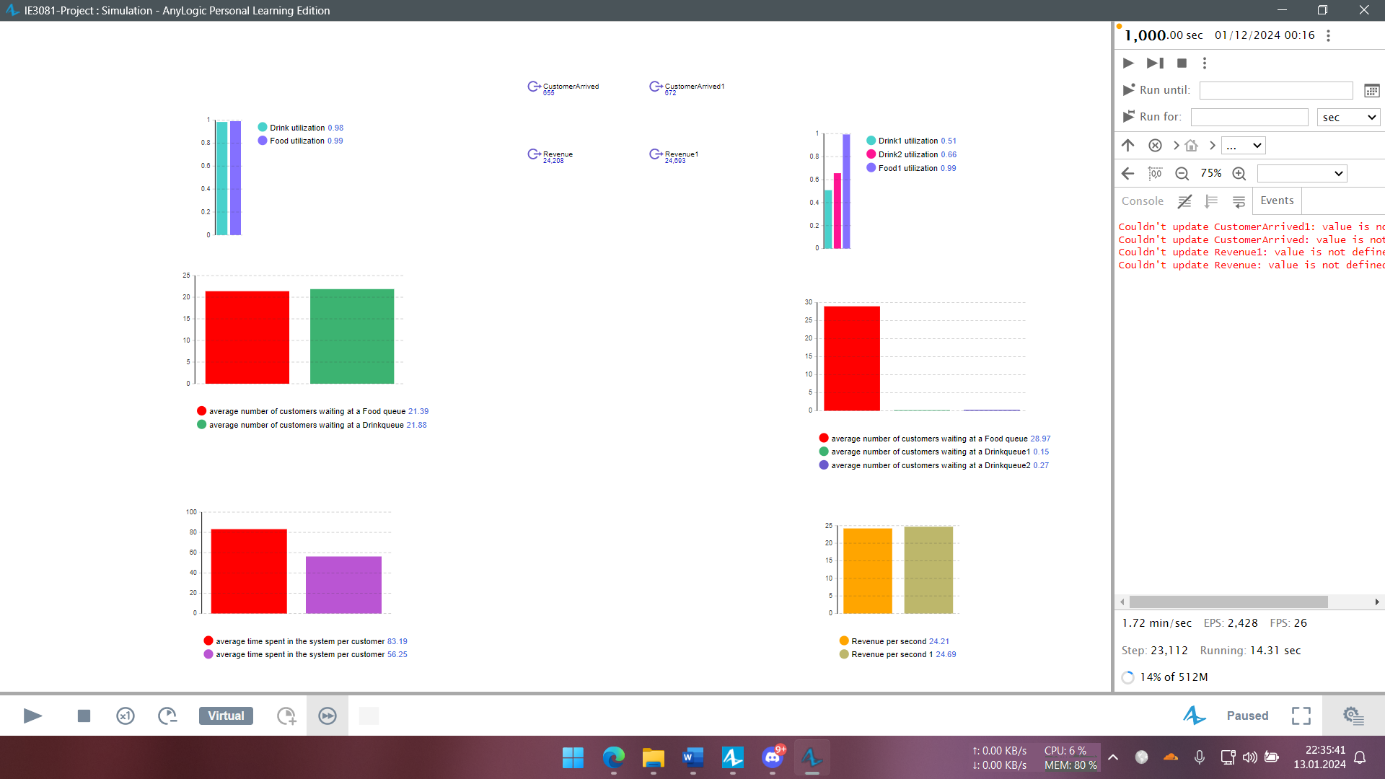
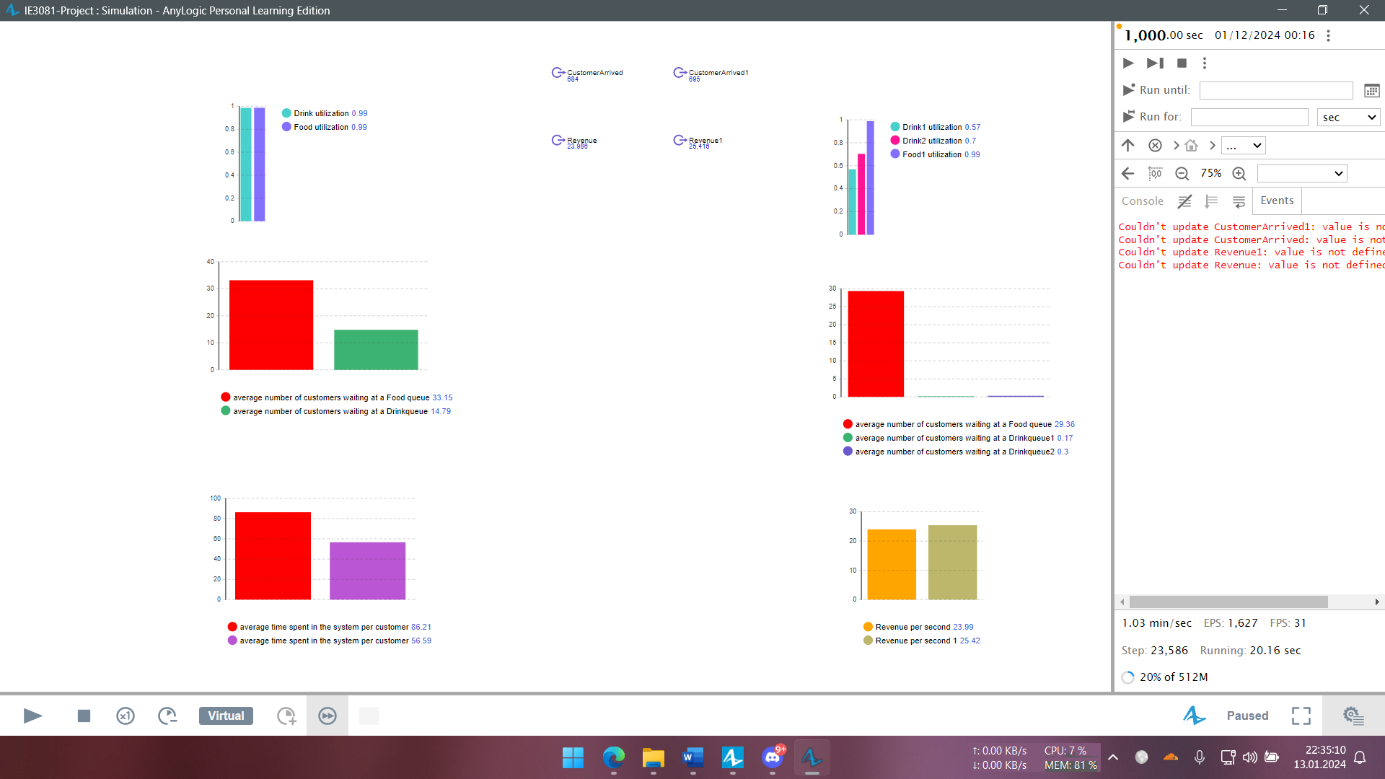
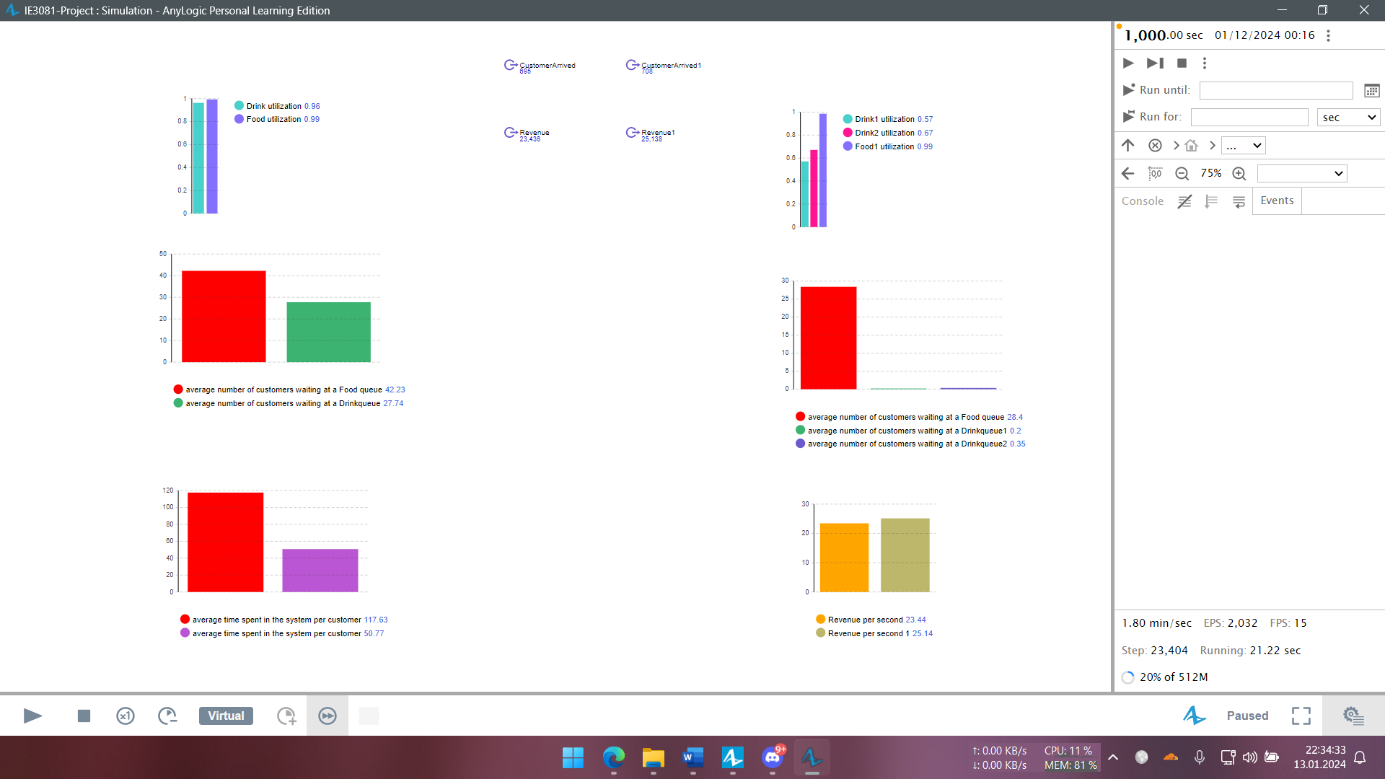
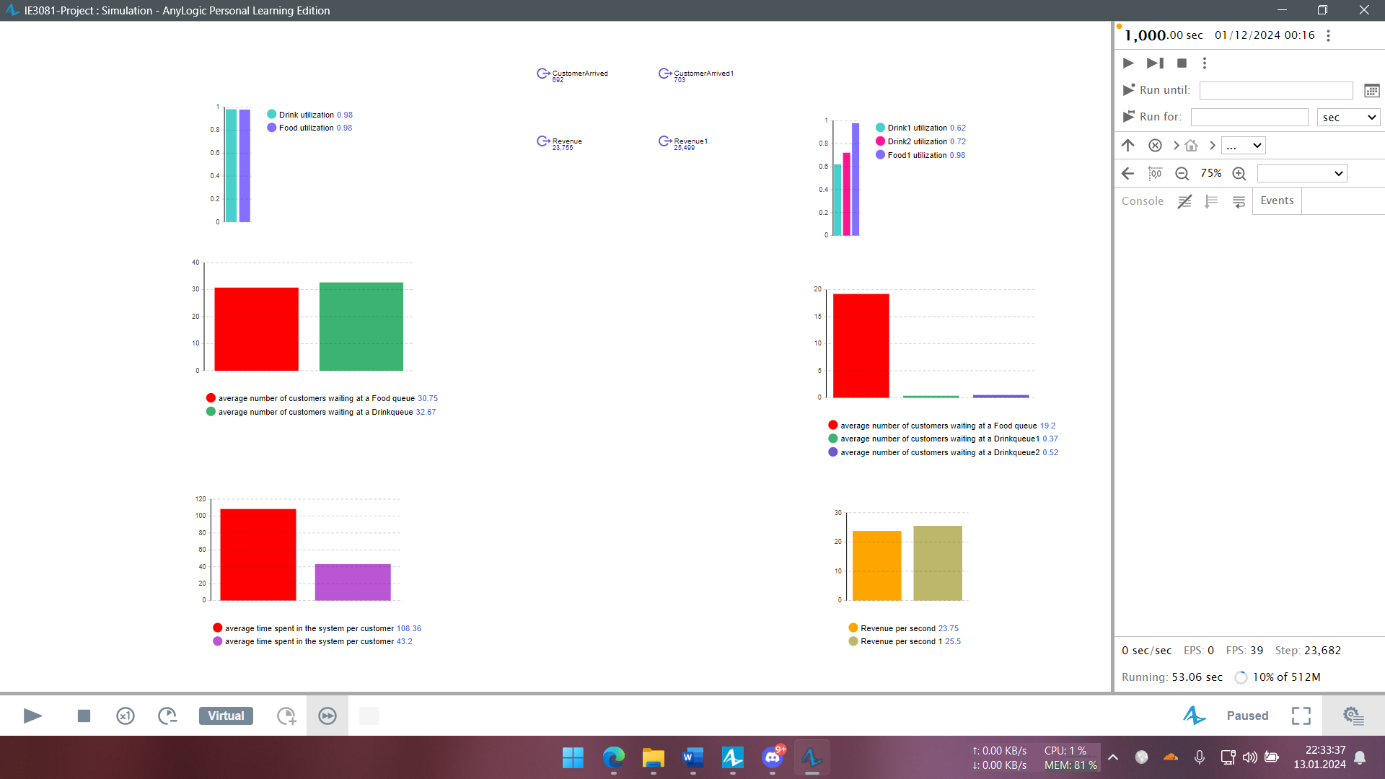
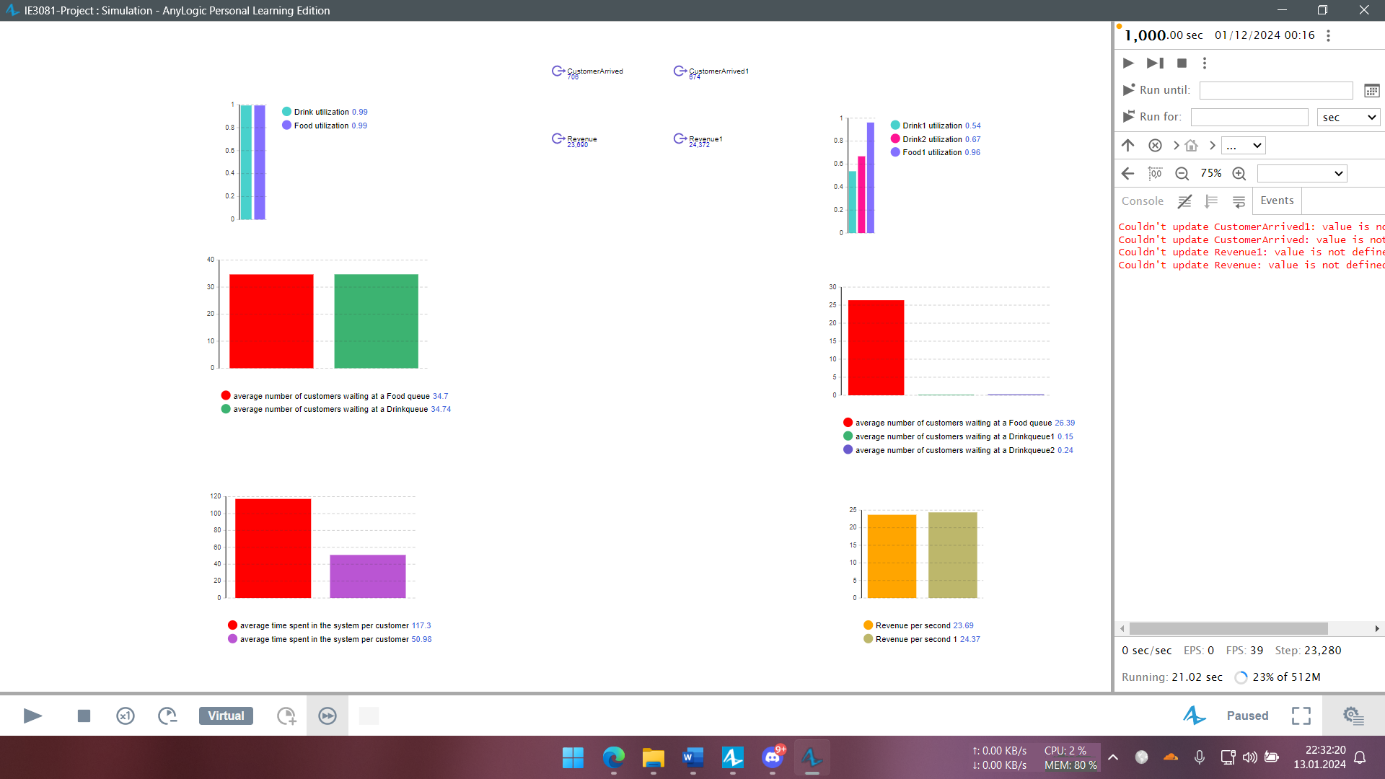
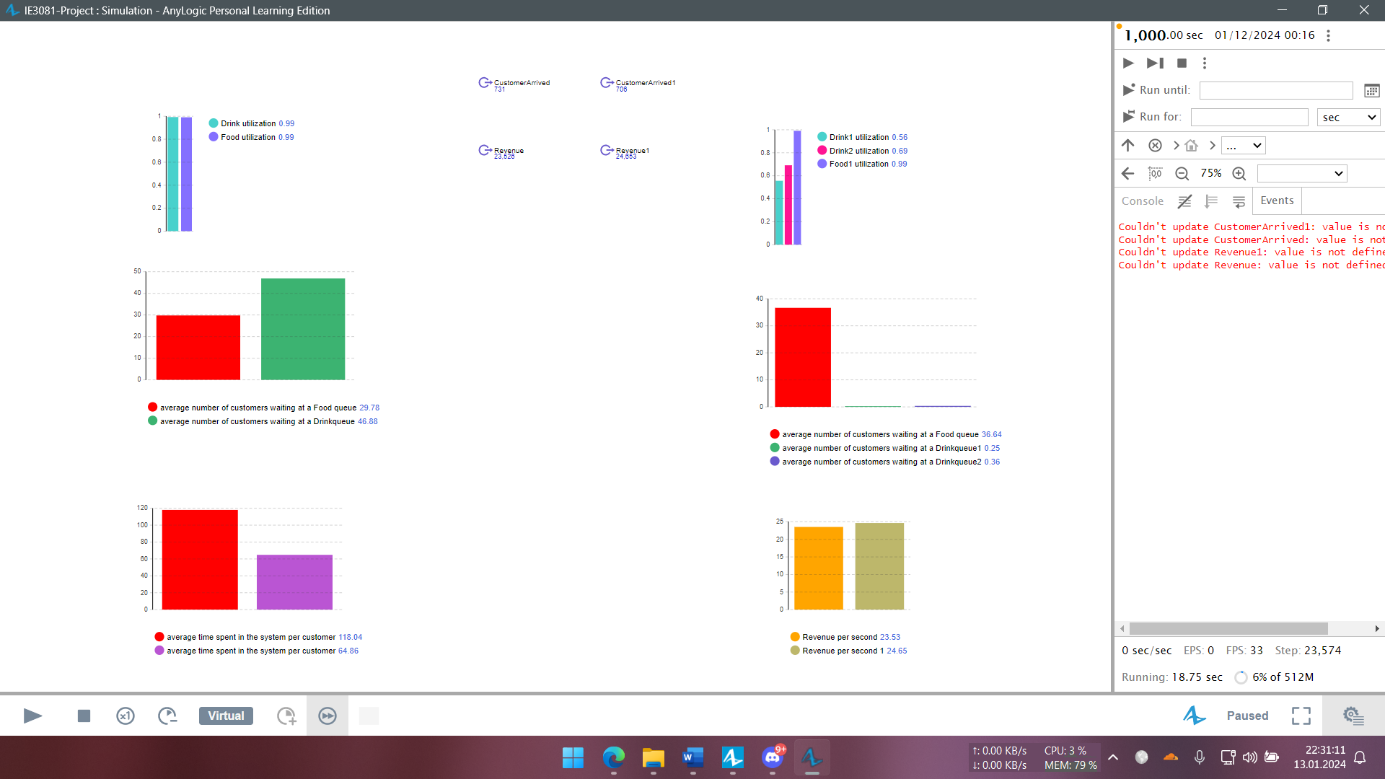
**Revenue Generation Rate**: Track the rate at which revenue is generated per unit of time.

**Service Completion Rate**: Monitor the percentage of completed transactions compared to the total attempted transactions.

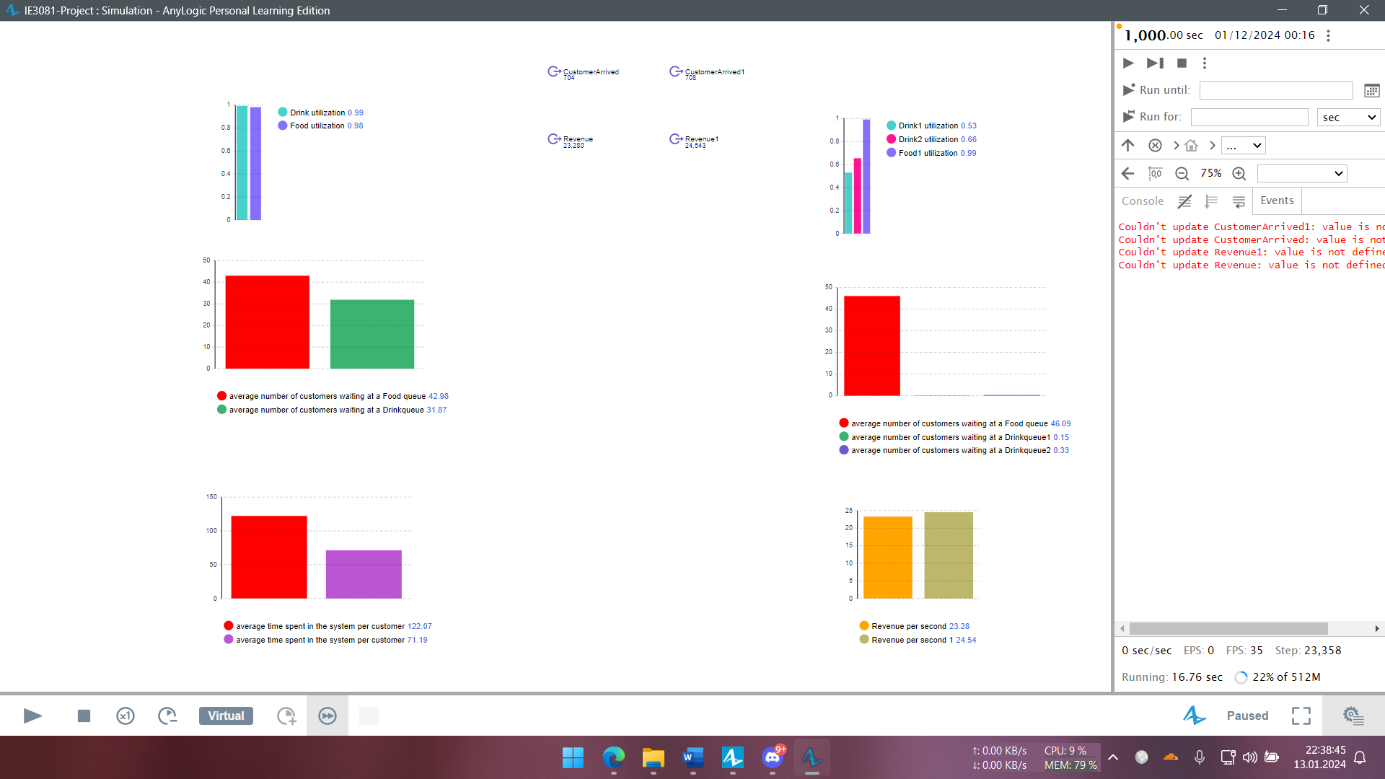
**Customer Satisfaction Score**: Collect and analyze customer satisfaction scores through feedback surveys or direct observations.

**Alternative System Designs:**

**Multi-Queue System:** Implement multiple queues for different types of meals or services to reduce waiting times.

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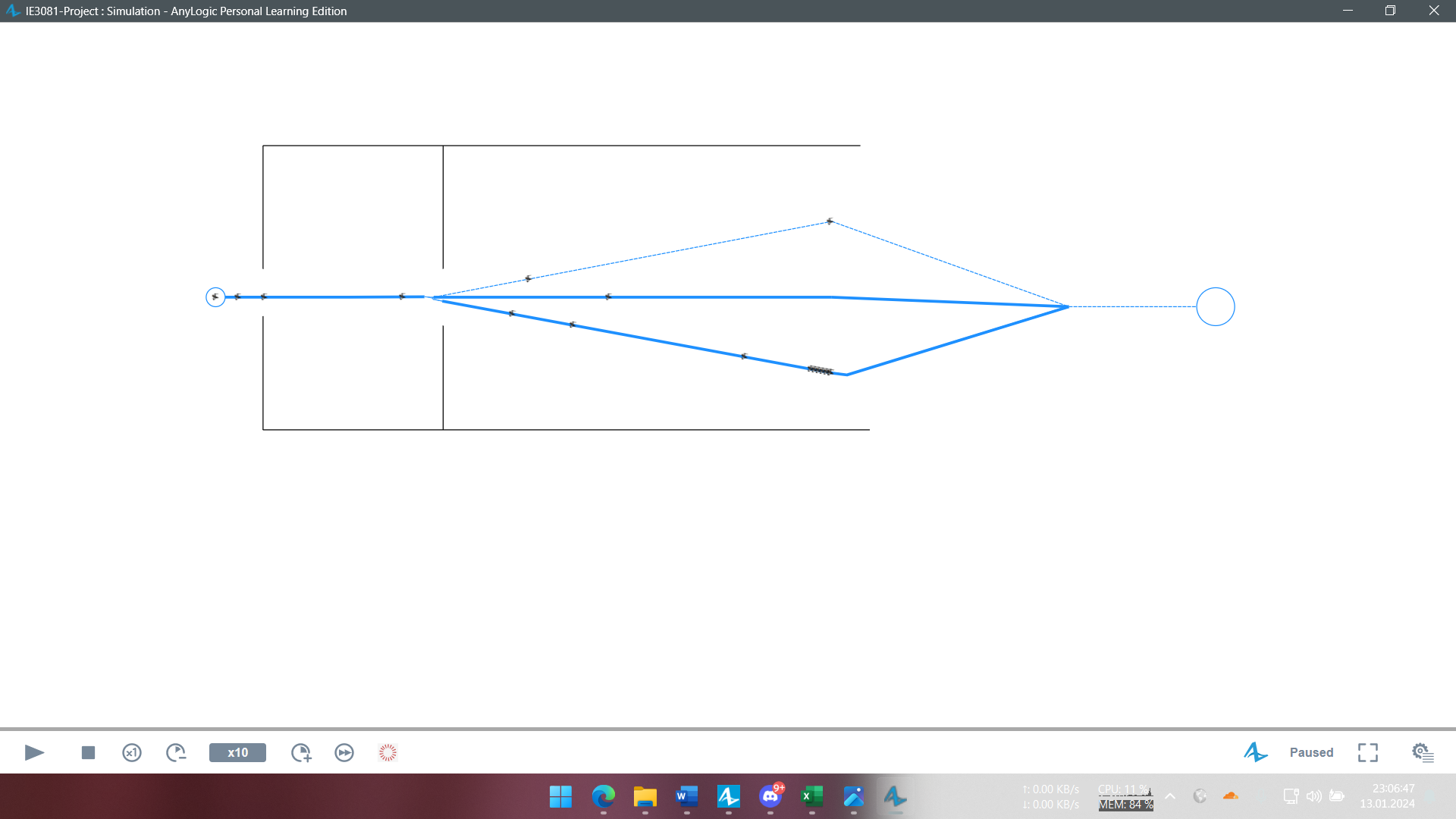
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Step 4:

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