Arena Simulation Project Report: Butcher Shop

Introduction

This report outlines the design, implementation, and analysis of a simulation model for a butcher shop using Arena Simulation software. The primary objective of this project was to model the customer service process at the butcher shop, verify the model, run multiple simulations, analyze the results.

Project Objectives

- Model the System: Create an accurate simulation model of the butcher shop's operations.
- Validate the Model: Ensure the model accurately represents the real system's operations.
- Create operational: create the operational model using arena.
- Verify the model: verify the implemented model.
- Run Simulations: Conduct multiple simulation runs to gather data.
- Analyze Results: Evaluate the performance of the system using the simulation data.

The system selected for this project is a butcher shop where customers arrive to purchase meat. Customers can order meat of type one, type two, or both types. The probabilities for each type of order are as follows:

Type 1: 50%

Type 2: 30%

Both Types: 20%

Data Collection and Assumptions

To build the simulation model, the following data was collected:

- Customer arrival rate: customers arrival time follows a uniform distribution with mean of 25 and variance of 100.
- Service times for each type of order: service times follow a uniform distribution with mean of 45 and variance of 400.
- Probability distribution of order types: it uses a discrete experimental distribution.
- Workforce availability and shift schedules: we assume workers work all the time using the problem's assumptions.

Model Development

Model Components

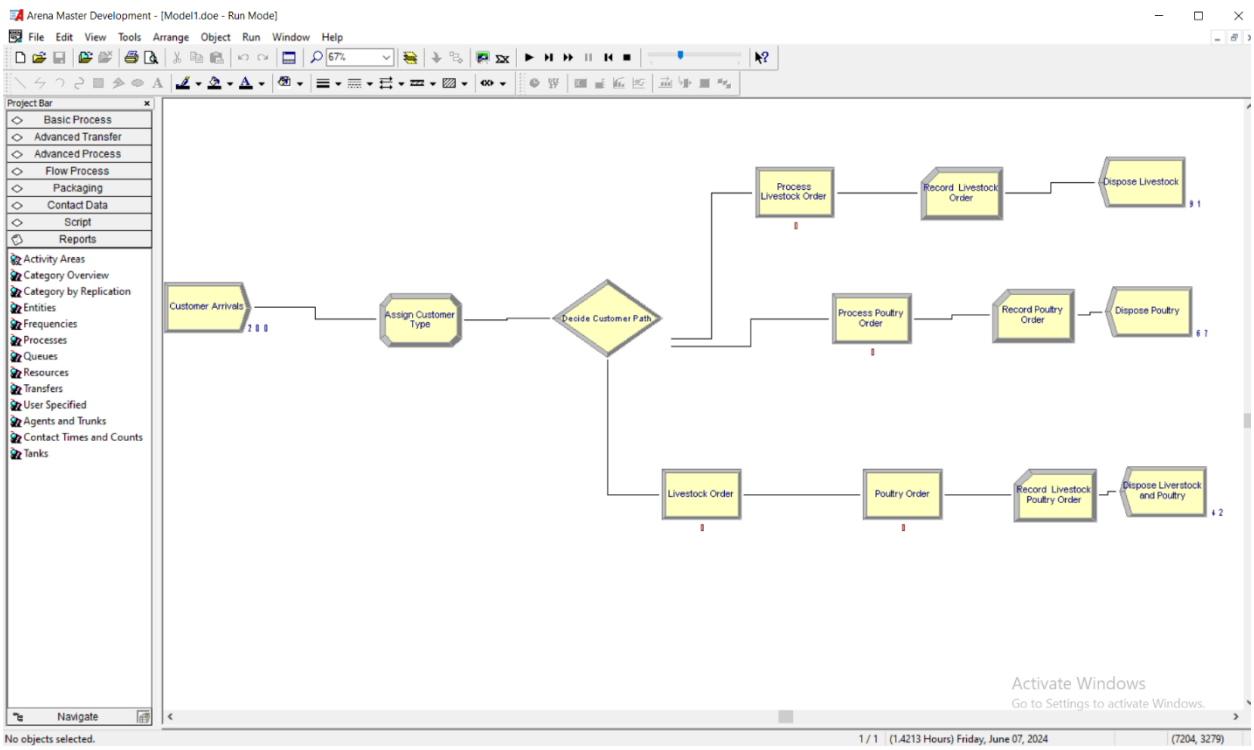
- Entities: Represent customers.
- Resources: Represent butcher shop staff and equipment.
- Processes: Simulate the order taking and meat preparation stages.
- Queues: Manage the flow of customers between processes.

Verification and validation

Verification of the system was achieved using the examination of logical outputs.

Steps for validation were not violated through the simulation.

Simulation Runs



Simulation run for 200 entities.

Results and Analysis

Number of livestock order: order of type 1	91.0000
Number of poultry order: order of type 2	67.0000
Number of both:	42.0000
Average resource usage:	0.9959
Average waiting time of entities:	0.04688698
Average VA time:	0.00707776
Average total time of entities in system:	0.05396474

Further analysis results are in the following pages.

Unnamed Project

Replications: 1

Replication 1

Start Time: 0.00 Stop Time: 1.42 Time Units: Hours

Entity

Time

VA Time	Average	Half Width	Minimum	Maximum
Entity 1	0.00707776	(Insufficient)	0	0.02902778

NVA Time	Average	Half Width	Minimum	Maximum
Entity 1	0	(Insufficient)	0	0

Wait Time	Average	Half Width	Minimum	Maximum
Entity 1	0.04688698	(Insufficient)	0	0.1304

Transfer Time	Average	Half Width	Minimum	Maximum
Entity 1	0	(Insufficient)	0	0

Other Time	Average	Half Width	Minimum	Maximum
Entity 1	0	(Insufficient)	0	0

Total Time	Average	Half Width	Minimum	Maximum
Entity 1	0.05396474	(Insufficient)	0	0.1408

Other

Number In	Value
Entity 1	200

Number Out	Value
Entity 1	200

WIP	Average	Half Width	Minimum	Maximum
Entity 1	7.5935	(Insufficient)	0	14.0000

Queue

Time

Unnamed Project

Replications: 1

Replication 1

Start Time: 0.00 Stop Time: 1.42 Time Units: Hours

Queue

Time

Waiting Time	Average	Half Width	Minimum	Maximum
Livestock Order.Queue	0.03108326	(Insufficient)	0	0.07029673
Poultry Order.Queue	0.03622381	(Insufficient)	0.00160019	0.06805024
Process Livestock Order.Queue	0.04062553	(Insufficient)	0	0.07575920
Process Poultry Order.Queue	0.04259068	(Insufficient)	0.01365186	0.07803301

Other

Number Waiting	Average	Half Width	Minimum	Maximum
Livestock Order.Queue	0.9185	(Insufficient)	0	4.0000
Poultry Order.Queue	1.0704	(Insufficient)	0	4.0000
Process Livestock Order.Queue	2.6010	(Insufficient)	0	7.0000
Process Poultry Order.Queue	2.0077	(Insufficient)	0	6.0000

Resource

Usage

Instantaneous Utilization	Average	Half Width	Minimum	Maximum
Butcher	0.9959	(Insufficient)	0	1.0000

Number Busy	Average	Half Width	Minimum	Maximum
Butcher	0.9959	(Insufficient)	0	1.0000

Number Scheduled	Average	Half Width	Minimum	Maximum
Butcher	1.0000	(Insufficient)	1.0000	1.0000

Scheduled Utilization	Value
Butcher	0.9959

Total Number Seized	Value
Butcher	242.00

Unnamed Project

Replications: 1

Replication 1

Start Time: 0.00 Stop Time: 1.42 Time Units: Hours

System

Other

Number Out	Value
System	200

User Specified

Counter

Count	Value
Record Livestock Order	91.0000
Record Livestock Poultry Order	42.0000
Record Poultry Order	67.0000