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**EEX5362- Performance Modeling**

**MINI PROJECT DELIVERABLE\_01**

**E-commerce Order Fulfillment Warehouse (Daraz)**

**1. System Overview**

Daraz operates centralized fulfillment centers and regional distribution hubs across Sri Lanka. Under the Fulfilled by Daraz (FBD) model, sellers store products in Daraz-managed warehouses, where staff handle inventory storage, picking, packing, labeling, quality checks, and dispatch via the Daraz Express (DEX) network. Non-FBD orders are coordinated from sellers to hubs for fulfillment.

During normal operations, processing is steady. However, during high-demand campaigns such as Daraz 11.11 Sale, Avurudu Sale, and Flash Deals, order volumes can spike 3×–8×, causing dynamic queue growth and resource strain.

**2. Problem Context**

Orders in the warehouse pass through multiple stages: order verification → picking → packing → dispatch. This factors contribute to bottlenecks, late dispatches, and decreased customer satisfaction during peak demand periods. Challenges include:

* **Order prioritization:** Express orders, premium customers, cash-on-delivery, and re-shipments may preempt standard orders.
* **Shared resources:** Packing stations, barcode scanners, forklifts, and trucks are limited, leading to competition and delays.
* **Variable conditions:** Fluctuating arrival rates, diverse product sizes and storage locations, and differences in worker performance create unpredictable processing times.

**3. Performance Objectives**

3.1 Latency (Order Processing Speed)

* Goal: Minimize total time an order spends in the warehouse from entry to dispatch.
* Metric: Average processing time per order.
* Target: Reduce to <8 hours for priority (Express) orders, supporting next-day delivery.
* Benefit: Faster fulfillment, higher customer satisfaction, and reliable peak-period operations.

3.2 Throughput (Daily Dispatch Capacity)

* Goal: Increase the number of orders processed and dispatched per 24 hours.
* Metric: Total orders dispatched per day.
* Target: ≥10,00 orders/day at the Colombo Central Fulfillment Center under normal conditions.
* Benefit: Handles seasonal surges, prevents backlogs, and supports platform growth.

3.3 Resource Optimization (Operational Efficiency)

* Goal: Efficiently utilize warehouse labor and equipment to maintain stable workflow.
* Metric: Packing station utilization rate.
* Target: 70–85% utilization.
* Benefit: Avoids idle resources and overwork, reduces bottlenecks, and ensures consistent throughput.

**4. High-Level Problem Statement**

Growing e-commerce demand in Sri Lanka, along with seasonal and promotional peaks, creates processing delays, packing bottlenecks, and uneven use of resources in Daraz fulfillment centers. These problems can result in late deliveries and lower customer satisfaction.

Solution Approach: The order fulfillment workflow will be analyzed and modeled using a simulated dataset. This will help identify bottlenecks, optimize resource allocation, and improve throughput while keeping latency low. The simulation will include both normal and high-demand (campaign) periods, with order volumes increased by approximately 3× to study system performance under stress.

**5. Data Set Specification for Simulation**

| **Field Name** | **Purpose / Description** |
| --- | --- |
| Order\_ID | Unique identifier to track each order through the system. |
| Priority\_Level | Determines processing priority (1 = Express, 2 = Standard). |
| Pick\_Time\_Duration | Time taken to locate and retrieve items from inventory racks. |
| Pack\_Time\_Duration | Time required to package, seal, and label an order. |
| Station\_Assigned | Identifies the packing/picking station used |
| Order\_Arrival\_Date | Date when the order enters the warehouse |
| Order\_Arrival\_Time | Time when the order enters the warehouse system. |
| Dispatch\_Date | Date when the order exits the warehouse for delivery. |
| Dispatch\_Time | Time when the order exits the warehouse for delivery. |

* Data set : DarazWarehouse\_SimulationData.csv
* The dataset includes 500 simulated orders

**6. References for Dataset :**

1. South Asia E-Commerce Orders Dataset – [Mendeley Data](https://data.mendeley.com/datasets/ggbkd8ck3x/1?utm_source=chatgpt.com)
2. E-Commerce Order & Supply Chain Dataset – [Kaggle](https://www.kaggle.com/datasets/bytadit/ecommerce-order-dataset?utm_source=chatgpt.com)
3. Warehouse Order Picking Dataset – [Mendeley Data](https://data.mendeley.com/datasets/pf2w725pw3/1?utm_source=chatgpt.com)