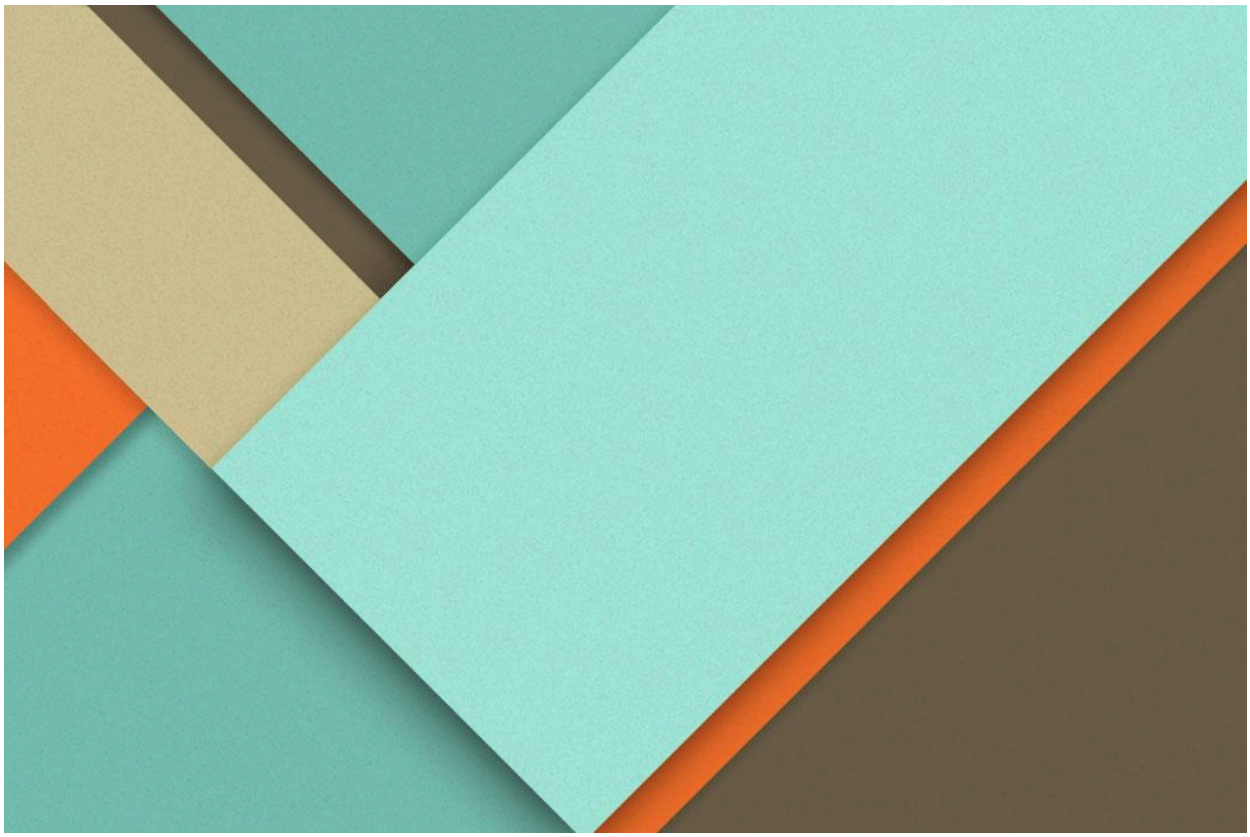

Simulation Course Project

Dolphin of the Aegean

30.11.2025

IE 305

Fall 25

Sabancı University

System Description

Dolphin of the Aegean Company produces car parts. The factory mainly produces wire harnesses for different car brands. The harnesses are produced at a factory in Izmir Serbest Ticaret Bölgesi. The factory floor consists of three production lines that manufacture subassemblies for the wire harness. Then there is an assembly station that puts the three subassemblies together and fuses them. Following the subassembly there is a testing station that applies certain electrical tests to the wire harness to make sure that it works according to the specification and that it is ready to be sent to the customer. The accepted products are then packaged and bundled to be picked up by the customer trucks.

Line 1 consists of three stations, Line 2 has 4 stations, and Line 3 has only two stations. The production at each line is controlled according to a Kanban policy since the factory follows Just-in-Time (JIT) principles. This means that each station needs a free Kanban to start production. The station Kanbans are attached to the subassemblies until they are removed when they are transferred to the next station. At that point the Kanban is free to authorize the start of a new operation and is put on a post at the station. Hence, we can think of each station as the production area and the following buffer. All the parts within the station will have the station's Kanban attached on top. The Kanbans are removed from the part as the next station's operator picks the part from the station's buffer and attaches to it the next station's Kanban. The operator will not go to pick up a new subassembly from the previous station unless there is a free Kanban on his/her station's Kanban post. The station operators take about 10 seconds (a uniformly distributed duration between 8 and 12 seconds) to walk to the previous station and return with a part before starting to process the part.

The number of Kanbans at each station is determined by the production engineers according to JIT principles. We assume that every line has access to raw material whenever there is a need for it. This means that the first stations on all the lines never experience starvation. The current number of Kanbans used at each station is given in the table below, followed by a second table with the process time distributions. The process times given on the table are in **seconds**.

Line / Station	Station 1	Station 2	Station 3	Station 4
Line 1	4	3	3	-
Line 2	2	5	4	2
Line 3	5	3	-	-

Table 1. Number of Kanbans at each station

Line / Station	Station 1	Station 2	Station 3	Station 4
Line 1	TRIA(8,12,16)	TRIA(3,6,9)	TRIA(10,11,12)	-
Line 2	NORM(7,1)	TRIA(8,10,12)	TRIA(20,25,30)	NORM(12,2)
Line 3	NORM(5,1)	TRIA(4,6,7)	-	-

Table 2. Process Time Distributions for the stations

Finally, the subassemblies 1, 2, and 3 that come out on each line need to be assembled to create the final product, the wire harness. For one wire harness, two Subassemblies 1, one Subassembly 2 and two Subassemblies 3 are to be assembled. The assembly operation takes a duration that has a triangular distribution within the range 1 second to 4 seconds with a most likely value of 3 seconds.

The machines at the stations experience a random failure on the average on every shift of 8 hours. The repairs take 20 minutes on average with a deviation uniformly distributed between negative and positive 10 percent. The repairs are all done by two repairmen. Repairman 1 takes care of the failures in Line 2 and the assembly station while Repairman 2 handles the failures in Line 1 and Line 3. The repairmen handle the failed machines in a first-failed-first-repaired fashion. Each repairman needs to first move from the previous failed machine to the next failed machine to start the repair. The repairman is assumed to move at a speed of 20 meters per minute. For each machine, after every 10 repairs, the next breakdown at the machine triggers an overhaul for the machine. The overhauls require both repairmen simultaneously and have priority over usual repairs. The overhaul times are supposed to be double the repair times.

Following the assembly, the harnesses go through quality control. On the average 2% of the harnesses fail the tests and are scraped. The harnesses that pass the tests are packaged into boxes of 5. The boxes are accumulated in the Finished Goods Inventory until the customers arrive and pick up as many as they request. If the customer's demand cannot be satisfied immediately, the customer is lost. This is extremely undesirable and Dolphin of the Aegean Company would like to limit the likelihood of lost demand to **3% of the customer arrivals**.

The factory only works for two shifts: 7:00-16:00 with a one hour break at 11:00 and 16:00-01:00 with a one hour break at 20:00. The sales department is open between 8:00- and 17:30 and is closed between 13:00 and 13:30. The customers that come wait their turn if there is a previous customer and take a uniform duration to complete their purchase

after they are accepted by a sales representative. The time for purchase varies between 5 and 10 minutes. There is only one sales representative dealing with the customer at any point in time.

Along with this document, you are provided with a text file that provides customer demand data for 200 days, a drawing for the layout of different process centers within the facility.

Deliverables

PART I (Due on 13.12)

Analyze the customer demand data. Based on your analysis, develop an input model for the demand process which involves both the time and the quantity of demand. Justify your model with statistical tools. What is the daily demand rate (harnesses/day) according to your model? Explain your calculations.

Write a report explaining your work in detail, and provide all your supplementary files for the statistical analysis. Submit all your documents in a single .zip file.

PART II (Due on 26.12)

Develop a simulation model in ARENA for the described production system of Dolphin of the Aegean Company. Submit your ARENA model and the Category Overview report. You should submit a report that explains the logic of your model and how different modules are combined to execute this logic. You should estimate the following throughputs by using parts of your system models:

1. Standalone Throughputs of Line 1, Line 2, and Line 3 (3 different estimations) without any breakdowns and repairs
2. Throughput of the Assembly Station without any breakdowns and repairs
3. Throughput of the Assembly Station with breakdowns and repairs
4. Daily demand rate (Harnesses/Day) (Use this for verification)

PART III (Due on 30.12)

Using your model, estimate and report the average throughput of the system along with the Work-in-Progress (WIP) in the system, and the fill rate for the customer demand. By changing the number of Kanbans at the stations, try to improve the throughput of the system without increasing the WIP. Discuss how you arrived at your suggested solution and how much improvement you are promising. What can be done to improve the fill rate of the production/inventory system? Employ proper **output analysis techniques** for all your results and document them in your report.