Case 2

You have been hired by Beanie Limited, the coffee company, for a new project on their Diemen distribution center (DC). Your contact for this engagement is Jeroen Schotten, the manager of the facility.

The Diemen DC is the entrypoint of Beanie Limited's supply chain in Europe. Beanie Limited purchases raw coffee beans in different regions of Latin America that are sent by ship to docks in Europe. Once the beans reach Europe, all the stock is centralized in Diemen before continuing its path through Beanie Limited's network. The Diemen DC does not serve customers directly, but rather other distribution centers of Beanie Limited and some partner companies. These regional DCs are smaller and are the ones responsible for interacting with clients directly in their assigned areas.

As of today, Beanie Limited only handles raw coffee beans through it's sales network and supply chain. But this is going to change very soon, which is the reason Jeroen has decided to hire you.

Beanie Limited is currently working on an expansion of their Diemen DC, with the goal of adding a processing facility for coffee. This processing facility will be capable of producing roasted coffee beans, both regular and decaffeinated. The company expects to have this new extension operational by the start of next year, when it will expand its product portfolio from the current one (only raw coffee beans) to also include the new products (raw coffee beans, roasted coffee beans and decaffeinated coffee beans).

Roasted coffee beans are obtained by placing raw coffee beans into cylinders where hot air is blown. Beans are heated to ~250ºC for around 12 minutes. The cylinder rotates to ensure that beans are roasted evenly. On the other hand, decaff coffee can be obtained through several methods. Beanie Limited employs the chemical solvent method, which consists on steaming and rinsing the raw coffee beans with Ethyl Acetate. After removing the chemical agent, the beans are roasted just like regular coffee. The new facility comes with one limitation: there is only one cylinder production line. This means that, on any given day, it can only produce roasted or decaff coffee, but not both. Changing from one product to the other is a hefty task known as a changeover, which typically leaves the line out of order for some time.

Jeroen faces two challenges:

- On one hand, he must decide how will the production line be managed regarding how capacity gets split between the two processed products, roasted and decaff beans.
- On the other hand, the new changes also imply that Diemen's raw coffee beans stock will not only play the role of providing other regional DCs with the raw beans they need,

but will also be a raw material for the processing facility. Jeroen thinks that his replenishment policy should be reviewed to ensure that it satisfies the current situation.

In order to tackle this, Jeroen would like to receive proposals from you regarding the management of the production line and the policy to order shipments from Latin America. He trusts that your simulation and optimization skills will assist in providing a good solution, since the complexities of the operation have proven to be a tough bone for his team.

Detailed task definition

- Below you will find four levels of questions. Levels 1 to 3 are compulsory. Level 4 is optional.
- You need to write a report document where you answer the questions of the different levels. This report should be directed towards Jeroen, should give her clear recommendations and should justify these recommendations. It's important for you to reflect your methodology to back your proposals.
- Each level is worth 2 points out of a total of 10. The 2 missing points will grade the clarity and structure of your report and code.
- You need to use a Python notebook to solve all levels. A helper notebook is provided. Please attach a notebook that shows your solution/proposal/analysis.
- Include your team number, names and student IDs in all your deliverables.

Data and other facts

A few general facts provided by Jeroen's team:

- The production line can roast 125.000 daily kilograms of coffee, or 70.000 daily kilograms if it's decaffeinated.
- Since the company was not selling roasted and decaf coffee before, there is no historical data for sales. Nevertheless, these are the forecasts you have received:
  - Jeroen expects to receive about 3 orders per week for roasted coffee. He expects each order to be somewhere between 200.000 and 300.000, with 250.000 being the expected "typical" amount.
  - As for the decaff, he expects 1 order per week, with a similar sizing of the roasted coffee ones.
- Switching the line from one product to another takes somewhere between 24 to 48 hours. This also includes stopping the line to not produce anything, and starting the line again.
- You can assume that producing one kilogram of roasted coffee or one kilogram of decaff coffee consumes one kilogram of raw coffee beans.
- Jeroen's team have indicated that you should ensure that the line always runs production batches of at least 5 days. This means, once the line gets prepared for a

specific product, it should produce for at least 5 days before switching to another product or stopping. Running batches of more than 5 days is perfectly fine.
- Only one order from Latin America to Diemen can be active at the same time.

You have also received two tables that contain real data from the past 2 years:

- served_orders: this table shows every order that was served by the Diemen DC in the past years. This means, each record corresponds to one request of raw coffee beans that one of the regional DCs placed to Diemen and Diemen served. The units are kilograms.
- sourcing_events: this table shows the Purchase Orders Diemen placed to it's Latin American providers. For each order, there are two dates: the date when the order was placed, and the date where the beans actually reached Diemen. The units are kilograms.

Notebook

A notebook with some helping code has been provided. The code contains a small simulation engine that can help you simulate a year of activity for the distribution center. The instructions on how to use the code are in the notebook itself.

Levels

- Level 1
  - Jeroen wants you to provide a purchasing policy and a production line policy. This means your policies define when to buy more beans and how much, and what production should be on the production line everyday.
  - He would like to achieve a service level of 99% for raw coffee beans, and of 95% for roasted and decaff beans.
- Level 2
  - As part of the new processing facility, additional warehousing space will also be added to the Diemen DC. Currently, the location can hold up to 20,000 tons of beans. Jeroen would like your advice on how much additional storage should be built to guarantee that the warehouse never exceeds its capacity.
- Level 3
  - Traditionally, Jeroen's team has followed a rule of only having one shipment coming from Latin America to Diemen at the same time, mostly for simplicity's sake. Nevertheless, Jeroen is wondering: how much would allowing up to 3 shipments to be on the way simultaneously help Diemen? Would it improve any metrics significantly?
  - Bear in mind that any orders placed to Latin American providers should be of, at least, 3000 tons of beans.
- Level 4

- Out of the three products that Diemen will handle, decaffeinated beans are the smallest one in volume and relevance. Jeroen is wondering: if the service level was downgraded from the original 95% to 75%, how much would that benefit the DC and its metrics?