# Aycada Simulation Game for Production and Capacity Management

## Examination: Decision Paper of the Product Manager

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Group (D1, D2, D3 or BWL/Block): English 2

Companies (C1, C2, ... C11): C4 - Produkt 1

## Situation

The Executive Board makes monthly decisions on

* The planned production volumes for the four products offered by the company [PU/month] and
* The planned production capacity for the four production stages [hours/month].

Each month, the Executive Board as a body must therefore make eight individual decisions. The first decision is made for month 36.

Each board member has the task of creating a decision template, which serves in particular to support the first joint board decision for month 36. This paper answers the following questions:

## Questions

### Is it economically advantageous to offer the product? (2 points)

The production of product 1 is indeed economically advantageous. One can justify this by looking at the positive contribution margin over the past month which lies at 1,003,325 €/month. This means that Product 1 contributes to cover the overall fixed costs and therefore, should be produced further.

Moreover, the demand for the product has proven to be more or less constant during a certain period which enabled the company so far to fulfil every order placed, avoiding backlogged order costs. Product 1 has proven to be a secure stream of income and thus proves its economically advantage.

### Are there time-dependent patterns in past demand (measured in packaging units of the product)? (2 points)

### Product 1 is shown to have seasonal demand changes. Every 12 Months there appears to be a peak in incoming orders of numbers between 190,000 and 200,100. This suggests that the drug is needed in higher quantities in these times.

### In the meantime, the demand drops to a low of about 160,000 orders after around 6 months of the peak. Then the demand starts to rise once more.

This cycle repeated itself constantly over the given 36 months, which is why one can reasonably assume that this pattern will continue further.

### Which forecasting technique is best suited to provide the most accurate prediction of demand for the product? (2 points)

As product 1 has seasonal demand changes, a seasonal naïve approach or statistical techniques such as time series analysis are the most reliable methods to forecast future demand. While Moving average is also a very common method used, it’s not quite feasible for a seasonal demand curve as it would have too much of a smoothing effect.

As the seasonal naïve approach assumes constant values for each seasonal cycle, I came to the conclusion that the forecasting error would be too high throughout the 24 months we need to conduct numbers for.

In addition, there is an Excel tool which uses time series analysis to conduct forecasts which I decided on using due to its practicality, relative accuracy/reliability and speed. With this method you enter the given data, and the program conducts a forecast for the demanded number of future months for you.

This will prove to be practical when we have to make the actual decisions during the game as you are also able to adjust your numbers once you have been given the actual demand.

### How high will the demand be in the month (measured in packing units) in which the production quantity to be determined now is available to be delivered? (Note: To answer this question, use the forecast technique recommended above.) (3 points)

The month for which the production quantity to be determined now is available to be delivered would be month 39. This is because of the 3 months production/quarantine/inventory the product units must go through. So, in order to prepare an accurate production capacity, one must forecast the demand for a time period which lies 3 months ahead. The capacity we will decide on now will be the products ready to deliver in month 39.

As described above I am using the Excel function to forecast future demand. Feeding the program all the numbers of the past demand in the 36 months prior renders a predicted demand of 188,795 product units for month 39.

This number aligns with the pattern we observe in the first 36 months. After the peak ( here in month 38) the incoming orders always decline to about 183,000 – 190,000.

### What is the mean absolute deviation between the actual observed demand for the product and the forecast (both measured in packing units) for months 25 to 36 when the selected forecasting technique is applied? (2 points)

In order to answer this question, I needed to conduct apply my forecasting method for months 25 to 36.

Using the Excel tool (this time only feeding it the data up to month 24 and then letting it conduct a forecast for the next 12 months) I receive my demand predictions.

Now I can calculate the absolute difference between the forecasted demand and the given data of the actual demand and divide this by 12 to receive its average value.

Thus, the mean absolute deviation between the actual observed demand and the forecast is: 9,626 product units.

This number which represents an average error of about 5% of predicted incoming orders (dividing the mean absolute deviation by the average number of observed incoming orders) is reasonable considering there were only 17 months of data to work with

### What quantity of the product (measured in packing units) would you keep in inventory? (2 points)

To answer this question, I first considered the difference between Inventory costs (0.15€ per Unit/month) and order backorder costs (0.28€ per Unit/month). This already suggests that it is more profitable to have a secure inventory to cover incoming orders than to accept the possibility of backorders.

Now it is sensible to have a look at the deviation of the forecasting method used to see which frame of possible incoming orders the company could be experiencing this month. We did calculate the mean absolute deviation from month 25-36 which gave us an error of about 5%. This means our forecast is moving in a confidence interval of around 95% which is already a good starting point. However, it is reasonable to assume that the forecast will be more accurate considering that we have the months up to 36 as data to forecast until month 60.

Therefore, I think it is best to keep at least 4% more product units in inventory than the demand forecast predicts because the case of a surplus is less expensive than a case of unfulfilled orders. For month 37 where we forecasted 194,226 product Units, we would therefore aim to keep 201,995 product units in inventory.

### What planned production quantity of the product you are responsible for do you propose for month 36? (1 point)

As we know the number of incoming orders for month 36 from the data given to us (195,065 product units) I think it is sensible to plan the production quantity according to this number and not rely on the forecast (which is evidently less accurate). Thus, there is no need to add 4% to the production capacity.

### What quantity of the product (measured in packing units) will be in the production and quality control process (WIP – work in process) in month 37? (1 point)

Because of the time difference between planning production quantity and then the product being produced and afterwards being kept in quarantine we need to look at the released production quantity numbers from month 35 (180,671) and 36 (358,959) as these will still remain in work in process inventory at the beginning of month 37. The sum of these yields the quantity of 358959 product units in WIP at the start of month 37.

## Evaluation criteria

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| --- | --- | --- | --- |
|  | Insufficient | Satisfactory | Very good |
| Correctness of the answer | Answer is grossly incorrect | Answer is partially incorrect | Answer is correct |
| Justification of the answer | No justification available, neither in text form nor as a calculation | Satisfactory justification | Clear and convincing justification of the answer, with calculation (if applicable) |
| Correctness of the data/information used | Incorrect data/information used | Partly correct, partly incorrect data/information used | Correct and appropriate data/information used |