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Market Analysts Position - Recruitment process: Example tasks

1. Hydro Production Forecast Model

a) In a given dataset '**Hydro.xlsx**' one can find realized production of **Iron Gate** hydro power plant which is located on the Serbian and Romanian border (Wiki) and river inflow just before the power generators on a daily resolution. **Build a linear numerical model** which describes the relationship between river inflow and electricity production.

$$y = f(x) = k * x + n,$$

where $x -$ *is river flow* $[m^3/s]$ and $y -$ *realized daily energy production* $[MWh/day]$.

Based on your model determine what will be daily energy production at river inflow of $4000\ [m^3/s]$ and 11000 $[m^3/s]$?

b) Can you develop a **non-linear model** that would better describe the relationship between river flow and energy production?

c) Hydro production model has now been built on historical data of measured/realized river flow. Think about a daily forecasting process, what would an analyst need to forecast daily energy production for a few days ahead? Which data would be needed and how would you get it? Present your idea in a short paragraph.

d) There are various factors that affect electricity prices on wholesale exchanges. Apart of hydro production, what are, in your opinion, those factors that are influencing electricity prices on a daily basis? Do you expect any significant changes on electricity markets in the following years?

2. Price value of electricity

File **data_1.csv** contains the following data:

- Hourly price of power [€/MWh]
- Hourly production of solar power plants in Slovenia [MWh]
- Hourly production of hydro power plants in Slovenia [MWh]
- Hourly production of wind power plants in Slovenia [MWh]
- Hourly production of nuclear power plant in Slovenia [MWh]
- Hourly production of lignite power plants in Slovenia [MWh]
- Hourly power consumption of Consumer X [kWh]

Timestamp in the first column represents **start of the hourly period**. For example, line starting with 1.1.2020 00:00 represents the hour between 1.1.2020 00:00 in 1.1.2020 01:00.

Helpful definitions used in the questions:

- **Baseload trading product** represents equally distributed power each hour throughout the delivery period.
- **Peakload trading product** represents power between 8:00 and 20:00 from Monday to Friday (60 hours per week) in the selected period – equally distributed at each hour that meet the criteria.

a) What's the price value of **baseload product** for the whole year 2019 in €/MWh? What about the value of **individual months** throughout the 2019 be?

b) Calculate the price value of individual **monthly peakload** products for year 2019.

How much of electricity in **MWh** was produced by individual power plants in 2019 in Slovenia. What was the total consumption of Consumer X in MWh?

c) Calculate the **average value** of power produced by power plant type in 2019. What is **average value of power consumed** by the consumer X?

3. *Price scenarios

**This task is additional one and therefore optional.*

Analyst has prepared 100 different scenarios of price movements of an unknown product and saved them in file **data_2.csv.** Unit used is €/MWh.

a) What is the expected value of the product **on 1.4.2020**?

Colleagues are preparing an algorithm that is going to trade with this product. Number of trades is not limited, but algorithm can own at most **one unit of the product at the time**. Algorithm is **not allowed to sell** more units than it has bought. Due to an error made during the creation of the testing environment, the algorithm knows the price of the following day, so it always makes the best possible trades.

b) Calculate the **profit** of the algorithm in **scenario #77**. Keep in mind that on the last trading day algorithm has to sell any purchased products that it has not already sold before. Profit is calculated as **a difference between selling and buying price**.

c) Calculate the profit of the algorithm for other scenarios as well. Which scenario would be the most profitable for the algorithm?

*Our trading partner offers us a **call option**, which would give us the right, but not the obligation, to buy the product on **1.4.2020 at 55 €/MWh**, regardless of the market price on that day.*

d) Using the given price movement scenarios, calculate the value of the offered option product.

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