Introductory Exercise:

Stock Dynamics by hand

This little exercise will help you understand the principle of stock-driven models. It is **essential** that you understand this principle before you start programming this type of model in Python.

# Inflow-driven model – 4 years sharp lifetime

In this example, we will assume a lifetime of exactly 4 years.

In an input-driven model, only the past inflows and the lifetime of each cohort are given.

**Task:** Calculate the missing data in the table below. Assume that the lifetime of the products in the stock is 4 years. While filling out the table, reflect on the following:

• What **operations** do you conduct to calculate the different dependent variables?

• In what **sequence** do you conduct the operations to fill out the entire table (e.g., column by column, row by row, or some kind of iteration…)?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Annual stock**  (end of the year) | **Stock change**  (during the year) | **Inflow**  (during the year) | **Outflow**  (during the year) |
| **Year t** | **St**  **[tons]** | **dSt/dt**  **[tons/yr]** | **It**  **[tons/yr]** | **Ot**  **[tons/yr]** |
| t0=2000 | 0 | 0 | 0 | 0 |
| 2001 | 100 | 100 | 100 | 0 |
| 2002 | 300 | 200 | 200 | 0 |
| 2003 | 700 | 400 | 400 | 0 |
| 2004 | 1500 | 800 | 800 | 0 |
| 2005 | 3000 | 1500 | 1600 | 100 |
| 2006 | 5800 | 2800 | 3000 | 200 |
| 2007 | 9400 | 3600 | 4000 | 400 |
| 2008 | 13600 | 4200 | 5000 | 800 |
| 2009 | 17500 | 3900 | 5500 | 1600 |
| 2010 | 20500 | 3000 | 6000 | 3000 |
| 2011 | 22500 | 2000 | 6000 | 4000 |
| 2012 | 23500 | 1000 | 6000 | 5000 |

Stock-driven models

A stock-driven model is a model in which the stock (measured at the end of the accounting year) and the lifetime of each cohort are given; both as independent variables. Subsequently, the stock change, the inflow, and the outflow are calculated (dependent variables).

**Task:** Calculate the missing data in the table below. Assume that the lifetime of the products in the stock is 4 years. While filling out the table, reflect on the following:

* What **operations** do you conduct to calculate the different dependent variables?
* In what **sequence** do you conduct the operations to fill out the entire table (e.g., column by column, row by row, or some kind of iteration…)?

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| --- | --- | --- | --- | --- |
|  | **Annual stock**  (end of the year) | **Stock change**  (during the year) | **Inflow**  (during the year) | **Outflow**  (during the year) |
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|  |  |  |  |  |
| t0=2000 | 0 | 0 | 0 | 0 |
| 2001 | 100 | 100 | 100 | 0 |
| 2002 | 200 | 100 | 100 | 0 |
| 2003 | 400 | 200 | 200 | 0 |
| 2004 | 800 | 400 | 400 | 0 |
| 2005 | 1600 | 800 | 900 | 100 |
| 2006 | 3000 | 1400 | 1500 | 100 |
| 2007 | 4000 | 1000 | 1200 | 200 |
| 2008 | 5000 | 1000 | 1400 | 400 |
| 2009 | 5500 | 500 | 1400 | 900 |
| 2010 | 6000 | 500 | 2000 | 1500 |
| 2011 | 6000 | 0 | 1200 | 1200 |
| 2012 | 6000 | 0 | 1400 | 1400 |

**Next step: how to write these algorithms in Python, using a for loop?**