

# Introductory Exercise:

## Stock Dynamics by hand

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

### 1. 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 $t$	$S_t$ [tons]	$dS/dt$ [tons/yr]	$I_t$ [tons/yr]	$O_t$ [tons/yr]
$t_0=2000$	0	0	0	0
2001			100	
2002			200	
2003			400	
2004			800	
2005			1600	
2006			3000	
2007			4000	
2008			5000	
2009			5500	
2010			6000	
2011			6000	
2012			6000	

## 2. 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...)?

	Annual stock (end of the year)	Stock change (during the year)	Inflow (during the year)	Outflow (during the year)
Year $t$	$S_t$ [tons]	$dS_t/dt$ [tons/yr]	$I_t$ [tons/yr]	$O_t$ [tons/yr]
$t_0=2000$	0	0	0	0
2001	100	100	100	0
2002	200			
2003	400			
2004	800			
2005	1600			
2006	3000			
2007	4000			
2008	5000			
2009	5500			
2010	6000			
2011	6000			
2012	6000			

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