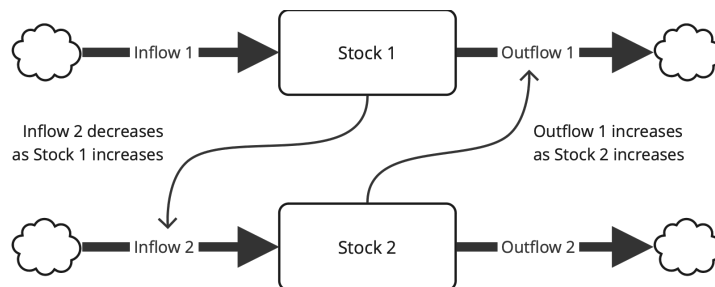School of Architecture, Civil and Environmental Engineering, EPFL
CIVIL 534: Computational Systems Thinking for Sustainable Engineering
Spring 2024

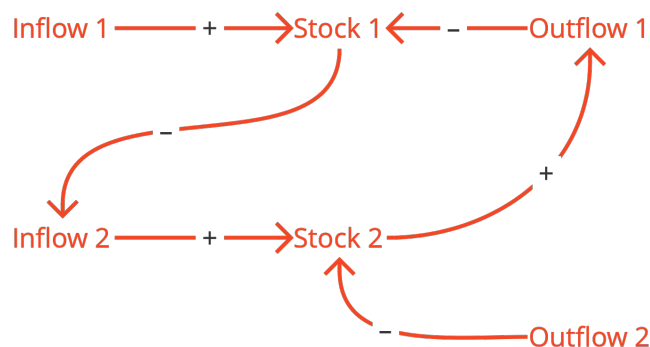EXAM 1 practice questions

Question 1

The following figure shows a stock and flow diagram for a simple two-stock system.

[X pts]   Draw a causal loop diagram for this system, including the +'s and –'s that
               indicate the direction of the relationships between each variable.

[X pts]   How many feedback loops are present in the system?

               One loop: stock 1 → inflow 2 → stock 2 → outflow 1 → stock 1

[X pts]   Indicate whether the feedback loop(s) are balancing or reinforcing.

               Reinforcing: an increase in stock 1 causes inflow 2 to decrease, causing stock 2
               to decrease, causing outflow 1 to decrease, causing stock 1 to increase further

Question 2

[X pts]   The city you live in has parks that you like to spend time in. You have noticed over the past several years more and more litter appearing in the parks. First, it was just a little bit. But recently, it is getting worse. One day, you see a city truck collecting recycling from the bins. They collect the recycling from the bins, but they leave behind the litter around the park. You muster up the courage to ask them why they are not collecting the rest of the litter. They respond by saying that there's always litter around, and picking up some of it isn't going to help.

What system trap does this story represent? What policy would you put in place to finally clean up the parks?

This story represents the trap of "drift to low performance." A policy that could correct this system trap is to set an absolute performance threshold, such as a zero-tolerance policy for litter.

Question 3

[X pts]   What type of feedback loop is necessary for system resilience and why?

Balancing – we need a loop that stabilizes stocks for resiliency

Question 4

[X pts]   Consider the following urban water system which has the following relationships:

- Some companies in a city extract groundwater for their economic activity
- As the groundwater levels drop, groundwater pollution levels increase
- If the groundwater pollution levels are too high, companies' economic value decreases (because the water is not of high enough quality for their activities)
- The economic activities of the companies increase the groundwater pollution levels
- If groundwater pollution gets too high, alternative sources of water must be found, and less groundwater is used

Draw a stock and flow diagram representing the structure of the system. Try to identify the feedback loops, whether they are balancing or reinforcing, and what interventions could play a role in this system!