LECTURE 12:
SYSTEM DYNAMICS:
STOCKS AND FLOWS
Solution to Exercise 1

- Represent a system of plants and animals as a stock and flow model.
  - Growth of new plants is positively related to the number of plants
  - Growth of new plants is positively related to the amount of sunlight.
  - Death of plants is positively related to the number of animals (due to consumption).
  - Birth of animals is positively related to the number of animals.
  - Death of animals is negatively related to the number of plants (starvation).
  - Death of animals is positively related to the number of animals (death by natural causes).
Step 1: Identify Values

- sunlight
- plant growth
- plant population
- plant death
- animal births
- animal population
- animal death
Step 2a: Causality (stated)

- Sunlight
  - Plant growth
    - Plant population
      - Animal births
        - Animal population
          - Animal death
            - Plant death
              - Plant growth

- Plant population
  - Animal population
    - Animal death
      - Plant death
Step 2b: Causality (implied)

Sunlight → (+) Plant Growth → (+) Plant Population

Plant Population → (+) Animal Births → (+) Animal Population

Animal Population → (+) Animal Births → (+) Animal Population

Animal Population → (+) Plant Population → (+) Plant Death

Plant Death → (+) Animal Death
Step 3: Identify stocks, flows, other

- Sunlight
  - Constant
  - Plant growth
  - Flow

- Plant population
  - Stock
  - Animal births
  - Flow

- Animal population
  - Stock
  - Plant death
  - Flow

Stocks:
- Plant population
- Animal population

Flows:
- Plant growth
- Animal births
- Sunlight

Other:
Step 4: Stock/flow symbols

- Sun
- Plant growth
- Plant population
- Plant death
- Animal births
- Animal population
- Animal death
Step 5: Connect flows to stocks

These are the “implied” causalities from step 2b.
Step 6: Communication Links

These are the “stated” causalities from step 2a.
Step 7: Enter model into STELLA
Step 8: Add values and equations

- STELLA:
  - Move to the model tab
  - Double-click on objects to bring up equation editor