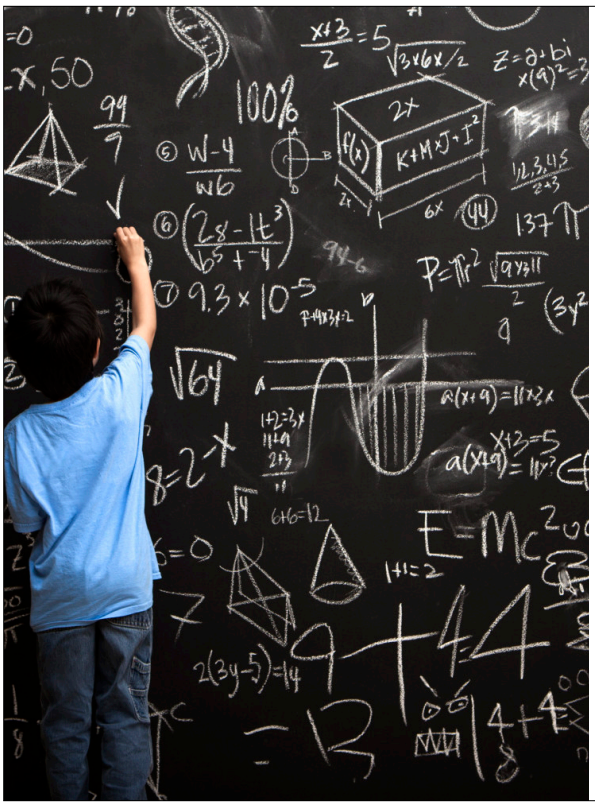
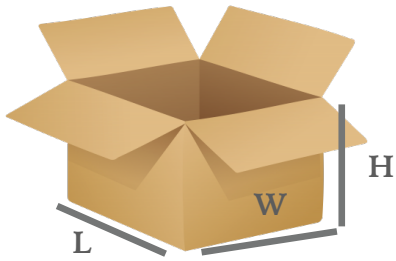


COMP4030 DATA MODELLING AND ANALYSIS (DMA)

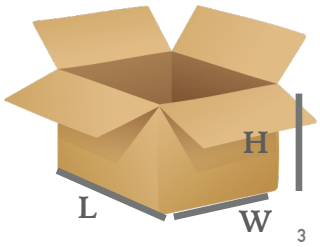
Lecture 2: Introduction to Modelling (Examples)

CLASSIFICATION OF MODELS EXAMPLE: BOX OPTIMISATION

- A food company wants to maximise the amount of items they can ship on boxes they send to supermarkets.
- Create a model to calculate the space inside their current shipping boxes.
- You know the box's height (H), width (W), and length (L).
- **S? S_r? M? Q?**
- **What assumptions are we making?**



CLASSIFICATION OF MODELS EXAMPLE: BOX OPTIMISATION



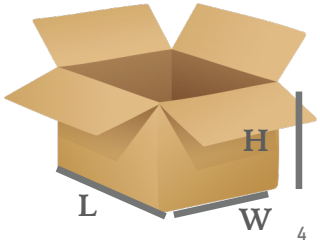
CLASSIFICATION OF MODELS EXAMPLE: BOX OPTIMISATION

- **S:** company and its boxes
- **Sr:** l = box's length, w = box's width,
  h = box's height , t = box's thickness
  s = space inside the box
- **Q:** {How much space is there inside the boxes?}
- **M** = $\sum = l * w * h = s$

$$M = \sum = (l - 2t) * (w - 2t) * (h - 2t) = s$$

- **Which glaring assumption are we making here?**

We are not considering the thickness of the boxes



CLASSIFICATION OF MODELS EXAMPLE: BOX OPTIMISATION

- Classification?
  - Phenomenological / mechanistic
  - Static / Dynamic
  - Lumped / Distributed
  - Natural / artificial
  - Stochastic / deterministic
  - Continuous / discrete
  - Direct/ Inverse
  - Research / Management
  - Field of application?

CLASSIFICATION OF MODELS EXAMPLE: BOX OPTIMISATION

- Classification?
  - Phenomenological / **mechanistic**
  - Linear / **Non-linear**
  - **Static** / Dynamic
  - **Lumped** / Distributed
  - Natural / **artificial**
  - Stochastic / **deterministic**
  - Continuous / **discrete**
  - **Direct**/ Inverse
  - **Research** / Management
  - Field of application? **Manufacturing**

CLASSIFICATION OF MODELS EXAMPLE 3: POPULATION CHANGES OF RED FOXES

- We want to model the population of urban (red) foxes in London.
  - Model changes in a monthly basis.
- Foxes reproduce quickly and die slowly, which can be carry a potential risk of overpopulation.
- In London:
  - Foxes reproduce at a monthly rate of r = 0,25
  - Foxes die at a monthly rate of d = 0.1
- Initial number of foxes in London is estimated at 150.
- **S? S_r? M? Q?**
- **What assumptions are we making?**

CLASSIFICATION OF MODELS EXAMPLE 3: POPULATION CHANGES OF RED FOXES

CLASSIFICATION OF MODELS EXAMPLE 3: POPULATION CHANGES OF RED FOXES

- S = {Red foxes population in London}
- Sr = {F = red foxes, F(n) = red foxes at month n,
- Parameters: r = reproduction rate, d = death rate}
- Q = {How does the population of red foxes in London change monthly?}
- M = { F(n) = F(n-1) + r * F(n-1) - d* F(n-1) =

  = F(n-1) * (1 + r - d) }

CLASSIFICATION OF MODELS EXAMPLE 3: POPULATION CHANGES OF RED FOXES

- Classification?
  - Phenomenological / mechanistic
  - Linear / non-linear
  - Static / Dynamic
  - Lumped / Distributed
  - Natural / artificial
  - Stochastic / deterministic
  - Continuous / discrete
  - Direct/ Inverse
  - Research / Management
  - Field of application?

CLASSIFICATION OF MODELS EXAMPLE 3: POPULATION CHANGES OF RED FOXES

- Classification?
  - Phenomenological / **mechanistic**
  - **Linear** / non-linear
  - Static / **Dynamic**
  - Lumped / **Distributed**
  - **Natural** / artificial
  - Stochastic / **deterministic**
  - Continuous / **discrete**
  - **Direct** / Inverse
  - Research / **Management**
  - Field of application? **City Planning** / **Ecology**