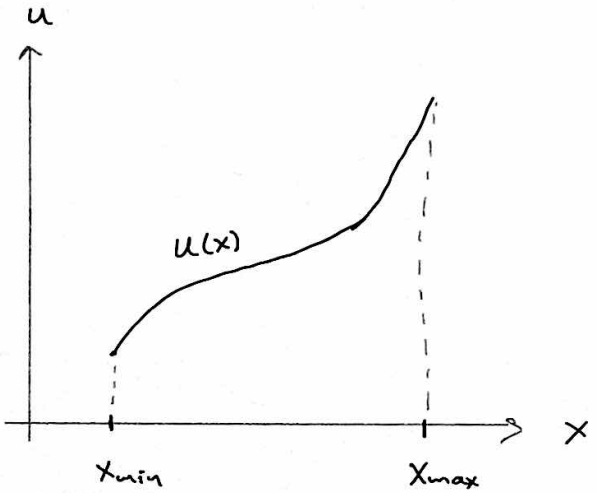
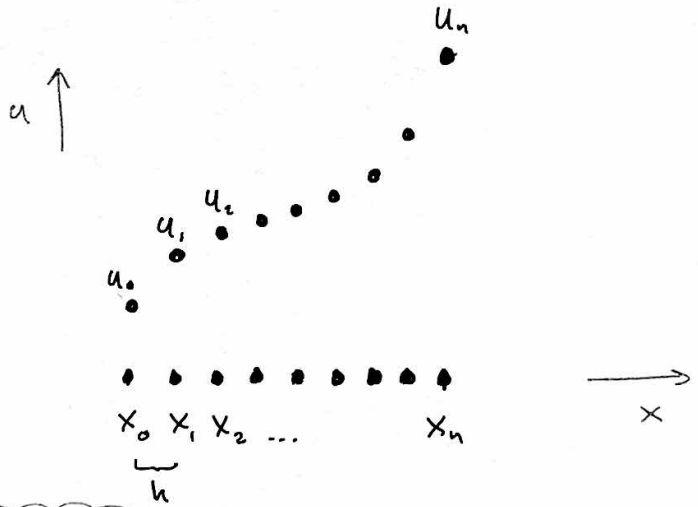
Discretization of cont. function

- Computers can't represent all possible numbers (finite range and "resolution")
  ↳ Need to discretize!
- Some function $u(x)$, $x \in [x_{min}, x_{max}]$

  ($u(x)$ is e.g. solution of our diff. eq. in proj. 1)
- u and x are <u>continuous</u> quantities



- Discretized version:



Tip! When testing your code, it's often useful to make plots of only your data points, i.e. not draw lines between them

h: step size

- My notation

$$x \longrightarrow x_i$$

$$u(x) \longrightarrow u(x_i) \equiv u_i$$

$$u(x \pm h) \longrightarrow u(x_i \pm h) \equiv u_{i \pm 1}$$

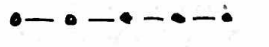
- So far u_i is the exact $u(x)$ at point $x = x_i$
- Our numerical methods will find an approximation to the exact u_i.

  Will sometimes call this approx. v_i, to highlight difference. (Proj. 1)

- Relations
  - $x_i = x_0 + ih$, $i = 0, 1, 2, \ldots, n$
  - h = step size = $x_1 - x_0 = \frac{x_2 - x_0}{2} = \ldots = \frac{x_n - x_0}{n}$ $(x_0 = x_{min}, x_n = x_{max})$ (Δx)
  - n steps $\longleftrightarrow$ n+1 points

Always make a sketch!

4 steps



x_0 x_1 x_2 x_3 x_4

5 points