

**Step function:**

$$\text{step}(z) = \begin{cases} 0 & \text{if } z < 0 \\ 1 & \text{otherwise} \end{cases}$$

**Rectified linear unit (ReLU):**

$$\text{ReLU}(z) = \begin{cases} 0 & \text{if } z < 0 \\ z & \text{otherwise} \end{cases} = \max(0, z)$$

**Sigmoid function:** Also known as a *logistic* function, can be interpreted as probability, because for any value of  $z$  the output is in  $(0, 1)$

$$\sigma(z) = \frac{1}{1 + e^{-z}}$$

**Hyperbolic tangent:** Always in the range  $(-1, 1)$

$$\tanh(z) = \frac{e^z - e^{-z}}{e^z + e^{-z}}$$

**Softmax function:** Takes a whole vector  $Z \in \mathbb{R}^n$  and generates as output a vector  $A \in (0, 1)^n$  with the property that  $\sum_{i=1}^n A_i = 1$ , which means we can interpret it as a probability distribution over  $n$  items:

$$\text{softmax}(z) = \begin{bmatrix} \exp(z_1) / \sum_i \exp(z_i) \\ \vdots \\ \exp(z_n) / \sum_i \exp(z_i) \end{bmatrix}$$