Expected value

Expected value of a function $f(x)$

$$E[f(x)] = \sum_{x \in A} f(x)p(x)$$

Sample estimate of $E[f(x)]$:
take $N$ values $x_i$ and average

$$\hat{f} = \frac{1}{N} \sum_{i=1}^{N} f(x_i)$$

Caution!! Expected “value” is a math-term which has nothing to do with the value-function!
Expected value

**Expected value of a function** \( f(x) \)

\[
E[f(x)] = \sum_{x \in A} f(x)p(x)
\]

**important examples:**

**Mean of a distribution:**

\[
E[x] = \mu = \sum_{x \in A} x p(x)
\]

**Sample estimate of** \( E[f(x)] \):

\[
\hat{f} = \frac{1}{N} \sum_{i=1}^{N} f(x_i)
\]

**Sample mean:**

\[
\hat{\mu} = \frac{1}{N} \sum_{i=1}^{N} x_i
\]
Expected value

Expected value of a function $f(x)$

$$E[f(x)] = \sum_{x \in A} f(x)p(x)$$

important examples:

Mean of a distribution:

$$E[x] = \mu = \sum_{x \in A} x \cdot p(x)$$

Variance of a distribution:

$$E[(x - \mu)^2] = \sigma^2 = \sum_{x \in A} (x - \mu)^2 p(x)$$

Sample estimate of $E[f(x)]$:

$$\hat{f} = \frac{1}{N} \sum_{i=1}^{N} f(x_i)$$

Sample mean:

$$\hat{\mu} = \frac{1}{N} \sum_{i=1}^{N} x_i$$

Sample variance:

$$\hat{\sigma}^2 = \frac{1}{N} \sum_{i=1}^{N} (x_i - \mu)^2$$