Example 1 (fair game):
It costs $10 to play the following game each time.

There are 2 red marbles and 3 blue marbles in a box.
A simple game consists of drawing one marble from the box.

If you draw a red marble, you win $15 (and get your $10 back).
If you draw a blue marble, you get nothing (and lose your $10 bet).
When you win, you win $3 for every $2 you bet, so we say the game "pays 3 to 2".

Out of every 5 plays, you can expect to win 2 times and lose 3 times.
In the "long run", you should expect to make $2(+$15) + 3(-$10) = $0 every 5 plays.
This is called a fair game. We say you expect to "break even".

expected value:

\[
P(\text{ red }) = \frac{2}{5} ; \quad \text{value( red )} = +15
\]

\[
P(\text{ blue }) = \frac{3}{5} ; \quad \text{value( blue )} = -10
\]

The expected value of a play is \(\frac{2}{5}(+15) + \frac{3}{5}(-10) = 0\).

Example 2 (losing game):
It costs $4 to play the following game each time.

There are 2 red marbles and 3 blue marbles in a box.
A simple game consists of drawing one marble from the box.

If you draw a red marble, you win $5 (and get your $4 back).
If you draw a blue marble, you get nothing (and lose your $4 bet).
When you win, you win $5 for every $4 you bet, so we say the game "pays 5 to 4".

Out of every 5 plays, you can expect to win 2 times and lose 3 times.
In the "long run", you should expect to make $2(+$5) + 3(-$4) = -$2 every 5 plays.
This is called a losing game. We say the house edge is $2/5 = $0.40

expected value:

\[
P(\text{ red }) = \frac{2}{5} ; \quad \text{value( red )} = +5
\]

\[
P(\text{ blue }) = \frac{3}{5} ; \quad \text{value( blue )} = -4
\]

The expected value of a play is \(\frac{2}{5}(+5) + \frac{3}{5}(-4) = -\frac{2}{5}\).