Example game

- Flip coin. If H, roll one die, X is score. If T, roll two independent dice, X is sum of score.
- What is the probability that $\mathbb{P}(X \leq 4)$?

$$\begin{aligned}\mathbb{P}(X \leq 4) &= \mathbb{P}(X \leq 4|H)\mathbb{P}(H) + \mathbb{P}(X \leq 4|T)\mathbb{P}(T) \\ &= \frac{2}{3} \cdot \frac{1}{2} + \frac{1}{6} \cdot \frac{1}{2} \\ &= \frac{1}{2} + \frac{1}{12} = \frac{5}{12}.\end{aligned}$$

k	1	2	3	4	5	6	7	8	9	10	11	12
$P(X=k\|H)$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	0	0	0	0	0	0
$P(X=k\|T)$	0	$\frac{1}{36}$	$\frac{1}{18}$	$\frac{1}{12}$	$\frac{1}{9}$	$\frac{5}{12}$	$\frac{1}{6}$	$\frac{5}{12}$	$\frac{1}{9}$	$\frac{1}{12}$	$\frac{1}{18}$	$\frac{1}{36}$
$P(X=k)$	$\frac{1}{12}$	$\frac{7}{72}$	$\frac{1}{9}$	$\frac{1}{8}$	$\frac{5}{36}$	$\frac{7}{24}$	$\frac{1}{12}$	$\frac{5}{24}$	$\frac{1}{18}$	$\frac{1}{24}$	$\frac{1}{36}$	$\frac{1}{72}$