$$
\begin{aligned}
P_{X|A}(1) &= P(X=1|X<5) \\
&= \frac{P(X=1 \text{ and } X<5)}{P(X<5)} \\
&= \frac{P(X=1)}{P(X<5)} = \frac{1}{4}.
\end{aligned}
$$

Similarly, we have

$$P_{X|A}(2) = P_{X|A}(3) = P_{X|A}(4) = \frac{1}{4}.$$

Also,

$$P_{X|A}(5) = P_{X|A}(6) = 0.$$

For a discrete random variable X and event A, the **conditional PMF** of X given A is defined as

$$
\begin{aligned}
P_{X|A}(x_i) &= P(X=x_i|A) \\
&= \frac{P(X=x_i \text{ and } A)}{P(A)}, \quad \text{for any } x_i \in R_X.
\end{aligned}
$$

Similarly, we define the **conditional CDF** of X given A as

$$F_{X|A}(x) = P(X \leq x|A).$$

Conditional PMF of X Given Y:

In some problems, we have observed the value of a random variable Y, and we need to update the PMF of another random variable X whose value has not yet been observed. In these problems, we use the **conditional PMF** of X given Y. The conditional PMF of X given Y is defined as