Different ways to define a sample space. Examples with a series of coin flips.

Flip a coin repeatedly. Might want to, for instance, keep track of all the results on all of the flips. In that case, we would define the sample space

$$S = \{r_1 r_2 r_3 \ldots \,|\, r_j = T \text{ or } r_j = H\}$$

In that case, an example of an outcome is a sequence of T's and H's. For instance, the outcome might be $TTTHTHTTTHH\ldots$. Here, an event such as "the first two flips are H and then T, respectively, could be written as

$$A = \{HT r_3 r_4 \ldots \,|\, r_j = T \text{ or } r_j = H\}$$

.

We could (instead) write the sample space S in a completely different way, depending on our application. Suppose, for instance, we just really want to know how many flips are needed, to see the first H. In this case, it makes more sense to write the sample space as

$$S = \{\overbrace{TT\cdots T}^{j-1} H \mid j \geq 1\} \cup \{TTTTTTT\cdots\}$$

An example of an outcome in this setup looks like, for instance, $TTTTTTTTTH$. The event that at least 4 flips are needed to see the first head could be written as

$$A = \{\overbrace{TT\cdots T}^{j-1} H \mid j \geq 4\} \cup \{TTTTTTT\cdots\}$$