

# Sample Spaces

- A complete list of all possible outcomes of a random experiment is called **sample space** or possibility space and is denoted by  $\mathcal{S}$ .
- A sample space is a set or collection of outcome of a particular random experiment.
- For example, imagine a dart board. You are trying to find the probability of getting a bullseye. The dart board is the sample space. The probability of a dart hitting the dart board is 1.0.
- For another example, imagine rolling a six sided die. The sample space is  $\{1, 2, 3, 4, 5, 6\}$ .

# Sample Spaces

- The following list consists of sample spaces of examples of random experiments and their respective outcomes.
- The tossing of a coin, sample space is  $\{Heads, Tails\}$ .
- The roll of a die, sample space is 1, 2, 3, 4, 5, 6
- The selection of a numbered ball (1-50) in an urn, sample space is  $\{1, 2, 3, 4, 5, \dots, 50\}$

# Sample Spaces

- Percentage of calls dropped due to errors over a particular time period, sample space is  $\{2\%, 14\%, 23\%, \dots\}$
- The time difference between two messages arriving at a message centre, sample space is  $0, \dots, \text{infinity}$
- The time difference between two different voice calls over a particular network, sample space is  $0, \dots, \text{infinity}$

## Sample Spaces

Consider couple that have two children. Treating the gender of the children as an *ordered pair* outcome of a random experiment, the sample space is

$$S = \{(b, b), (b, g), (g, b), (g, g)\}.$$

Let us assume that each sample point is *equiprobable*, with probability 0.25 for each sample point.

Find the probability that both children are girls if it is known that:

- (a) at least one of the children is a girl,
- (b) the older child is a girl.

## Part a

Find the probability that both children are girls if it is known that at least one of the children is a girl.

$$S = \{(b, b), (b, g), (g, b), (g, g)\}.$$

## Part b

Find the probability that both children are girls if it is known that the older child is a girl.

$$S = \{(b, b), (b, g), (g, b), (g, g)\}.$$