Section 1.1

Sample spaces and probabilities

Sample space

Definitions illustrated with simple example: Roll two 4-sided dice

<u>Definitions:</u>

Sample point = possible outcome, usually denoted ω.

E.g., $\omega =$_____

Sample space = the set of all sample points, denoted Ω

E.g, $\Omega = \{(1,1), (1,2), (1,3), (1,4),$ _____,…(3,4), (4,4)$\}$

$\#\Omega$ = cardinality of Ω. E.g, $\#\Omega =$ _____

Definitions continued

Event ≔ subset of Ω.

It can often be described with words.

E.g., $A =$ {The dice show the same number} = {_____}

$F =$ {all possible events} = all subsets of Ω

$\#F =$ _____

Probability measure: $P: F \to [0,1]$

- *For event* $A \in F$, $P(A) =$ *"probability Event A occurs"*
- In our example, $P(\{(1,3)\}) = P\{(1,3)\} =$ _____ $= P\{\omega\}$ for any $\omega \in \Omega$, and

$P\{(1,1),(2,2),(3,3),(4,4)\} =$_____

and $P(A) =$ _____

Definitions continued

P satisfies:

- $0 \leq P(A) \leq$ ___, for any $A \in F$
- $P(\emptyset) =$ ___, $P(\Omega) =$ _____
- If $A_1, A_2, A_3, \ldots$ are pairwise disjoint, $P(\bigcup_{i=1}^{\infty} A_i) =$ _____

This implies $P(\bigcup_{i=1}^{n} A_i) =$ _____

E.g., $P(\text{First die role equals 1 or 2}) =$ _____

The triple, (Ω, F, P), is called a *probability space.*

Q: Flip 3 coins. What is the corresponding probability space?

(Need to define Ω and P)