

② Counting Approach

Coin
4 toss

Event $A \rightarrow 3$ heads

enumerate

$$S = \left\{ \begin{array}{l} \text{HHHH, } \underline{\text{HHHT}}, \underline{\text{HHTH}}, \underline{\text{HTHH}}, \\ \underline{\text{THHH}}, \text{HHTT, HTHT, THTT,} \\ \text{TTTH, THTH, HTTH, TTTT,} \\ \underline{\text{TTHT}}, \underline{\text{THTT}}, \underline{\text{HTTT}}, \underline{\text{TTTT}} \end{array} \right\}$$

$$P(3H \text{ in } 4 \text{ tosses}) = \frac{\# \text{ elements in } A}{\# \text{ elements in } S} = \frac{4}{16} = 0.25$$

- ✓ No experiment performed.
- X Does not always work.



$$\frac{1}{16} + \frac{1}{16} + \frac{1}{16} + \frac{1}{16} = \frac{4}{16}$$

Axioms of Probability

جس کو سچ ماننے کا حق ملتا ہے Axiom

$P(\text{event})$ = likelihood of event

① $0 \leq P(A) \leq 1$ ✓

② $p(S) = 1$

③ For disjoint sets A, B, C , with probabilities $P(A), P(B), P(C)$, a new event

A ∪ B ∪ C will have event

$$P(\underbrace{A \cup B \cup C}_{P(\text{Union})}) = \underbrace{P(A)} + \underbrace{P(B)} + \underbrace{P(C)} \quad \checkmark$$

2 trial? $\rightarrow$ 4 Experiment $\rightarrow$ record 34?
Empirical

Empirical
4 tosses - 3 heads

$$P(3 \text{ heads in } 4 \text{ tosses}) = ?$$

Empirical?

Empirical?

$n=1$ $n=2$

$\downarrow$ $\downarrow$

$\frac{0}{1}, \frac{0}{2}, \dots$

$\frac{0}{1}, \frac{0}{2}$

4 tosses

$\downarrow$

$\frac{3H}{0,1}$

4 tosses

$\downarrow$

$\frac{3H}{0,1} \dots$

$n \rightarrow \infty$

$$P(34 \text{ in } 4000) = \frac{17}{5}$$

$\lim_{n \rightarrow \infty} f(n)$

his s.

$$0 \leq P(A) \leq 2$$

$$P = 2 \left(\lim_{n \rightarrow \infty} \frac{\# \text{event}}{n} \right)$$

$$P = 2 \frac{\# A}{\# S}$$

S



5



Not disjoint

S



Disjoint