Random Variable

$X = \{x_1, x_2, \ldots, x_n\}$

① Start date

$x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5$

S^n possible $= \binom{5}{3}$

$\{1, 3, 5\}, \{1, 3, 4\}, \ldots$ 10 steps

Taking time.

$\binom{5}{3}$ possible ways of taking 3 $\rightarrow \frac{5!}{3!(5-3)!}$

$\binom{n}{r}$ possible $\longrightarrow \frac{n!}{r!(n-r)!}$

$\{1, 3, 5\}$

$[\text{Prob}] = S^n$ Possible

Benefit.

Idea → Prior possible things $\rightarrow q_1 = q_2$

$[\text{Prob}] = 2^{n-1}$

Frequency

Die Symbols

x_1	1
x_2	2
x_3	3
x_4	4
x_5	5
x_6	6

Value

Table → Symbols

Idea Based Outcome Scenario.

$X = \{x_1, x_2, x_3, \ldots, x_n\}$

q_1

q_2

$\text{Idea} \rightarrow q_1 = q_2$

Frequency.

lower range. $q_1 = 1/2000 \rightarrow$ Bad

upper range. $q_2 = 1/200 \rightarrow q_2 > q_1$

$[1, 2, 3, 4]$

Probability

Frequently

Experiment → { choosing one cup / choosing a person / Die roll / Coin toss } $\{E\}$

$\{H, T\}$ $\{\frac{1}{2}, \frac{1}{2}\}$

Long n not be exactly long

$\{1, 2, 3, 4, 5, 6\}$

Sample space $\{H, H, H, H, H, \ldots\}$ $\{H\}$

Coin : Fair Coin, one side Head, other T $\{\frac{1}{2}, \frac{1}{2}\}$

Fair to Unfair Probability

$P(E) = \frac{n(E)}{n(S)}$ → no of desired outcome / total possible outcome.

$E \Rightarrow$ $\{1\}, \{2\}, \{3\}, \{4\}, \{5\}, \{6\}$ $n(E) = 1$

$n(S) = 6$

$E \Rightarrow$ getting odd number

$E = \{1, 3, 5\}$ $n(E) = \frac{3}{6} = \frac{1}{2}$

- $0 \le P(E) \le 1$
- $P(E) = 1 \Rightarrow$ Certain

$P(E) = \frac{n(E)}{n(S)}$

Coin → Tossing $\{H, T\}$ $\{\frac{1}{2}, \frac{1}{2}\}$

$P(H) = \frac{1}{2}$

$P(T) = \frac{1}{2}$

$\frac{1}{2} + \frac{1}{2} = 1$

Sum $n(E)$ / Sum $n(S)$ $\rightarrow 1$

$P(E) = 1$

Marginal Probability

Probability

$P(E)$ only one event happen

$P(\text{not event}) = \frac{n(\text{not } E)}{n(S)}$

Conditional Probability

Joint Probability $\{P(A \cap B)\}$

Bowl A → Cost 2 red, 1 white

Bowl B → Cost 1 red, 3 white

$P(A \cap B)$

$A \cap B \rightarrow$ 2 red, 3 white

$(S) = \frac{5}{8}$ $\Rightarrow$ $P(A \cap B) = \frac{5}{8} = \frac{5}{8}$

Conditional Probability

Cost 1

$\frac{1}{2}$

Bowl A

Bowl B

Red, red, White, White

$\frac{1}{2}$

$\frac{1}{2}$

$\frac{1}{2}$