

Probability & Statistics

- Refresher (Basic definitions)
- Conditional Prob
- Bayes Theorem ✓
- Descriptive statistics
- Gaussian Distribution
- CLT
- Confidence Interval
- Binomial / Geometric
- combinatorics

Sample Space (SS)

Experiments

- Tossing a coin
- Rolling a die
- Watch netflix or not

:

SS → is the set of all possible outcomes
or results of that exp.

Eg 1: Rolling a die

1 2 3 4 5 6 7 8

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

Eg 2 - flip a coin

$$ss = \{ n, T \}$$

Ex 3 - A person appearing for interview
.....?

SS — { success, failure }

Eg: Rolling 2 dice.

SS - 36

2 coins \rightarrow SS $\leftarrow \{HH, TH, HT, TT\}$

Dui^{z-1}

Rolling a die

Tossing a coin

$$\left\{ \begin{array}{c} 2 \\ 3 \\ 4 \\ 5 \\ 6 \end{array} \right\} \times \left\{ \begin{array}{c} T \\ H \end{array} \right\}_2$$

$\frac{6 \times 2 = 12}{=}$

$$\begin{array}{llllll} H - & (1, H) & (2, H) & (3, H) & (4, H) & (5, H), (6, H) \\ T - & \underline{(1, T)} & (2, T) & & & \underline{(6, T)} \end{array}$$

(12)

Event

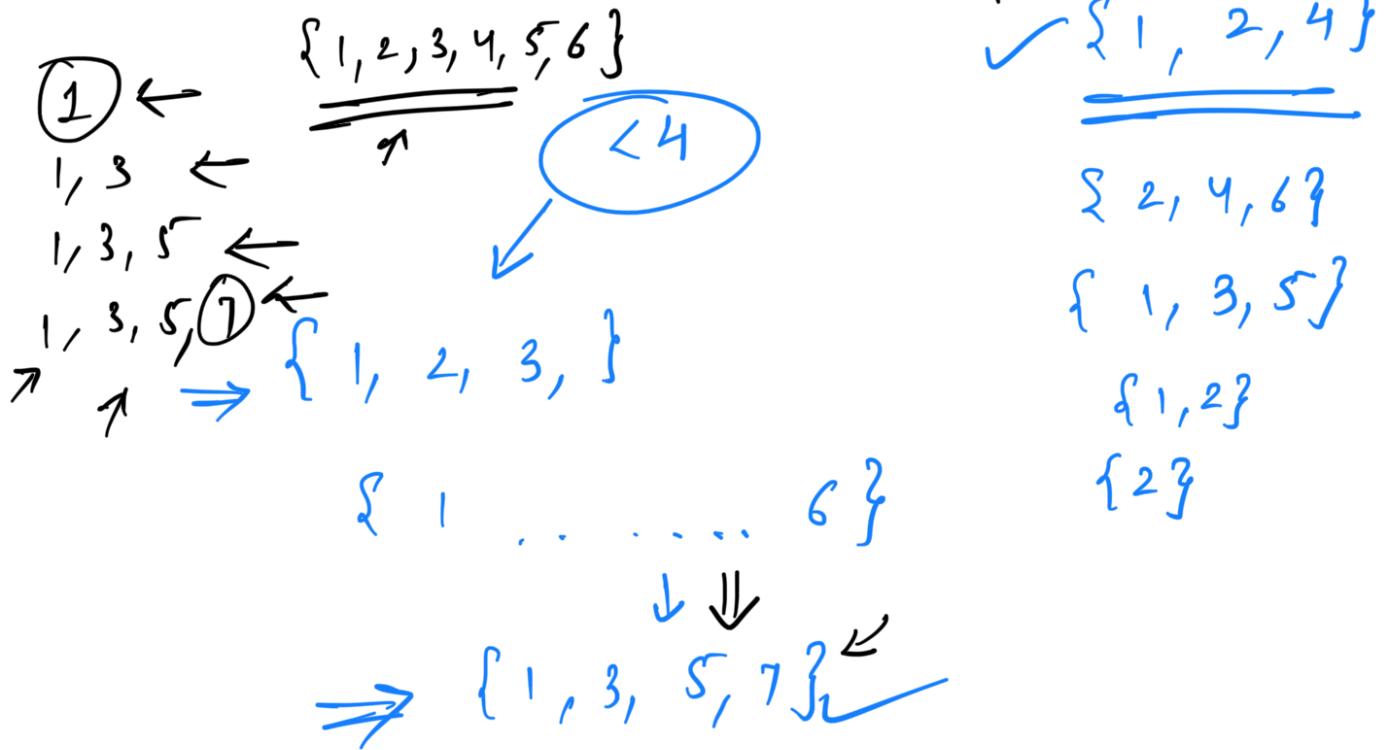
→ An event is ANY subset of a ss.

→ Rolling a dic

Events : → Getting an even no.
 → " " prime no.
 → " " no. < 4

D: $\{1, 2, 2\} \times \left\{ \begin{array}{c} 1, 2, 3, 4, 5, 6 \end{array} \right\}$

Aus: NO, it is NOT an event.



Set Operations

- 1 Union
2. Intersect
3. Complement

Rolling a die $\rightarrow \{1, 2, 3, 4, 5, 6\}$

M \rightarrow 1, 3, or 5 $\rightarrow \{\underline{1}, \underline{3}, \underline{5}\}$

S \rightarrow 1, 5, or 6 $\rightarrow \{\underline{1}, \underline{5}, \underline{6}\}$

When both will win!

Intersection $\rightarrow \{1, 5\}$

$$M \cap S \rightarrow \{1, 5\}$$

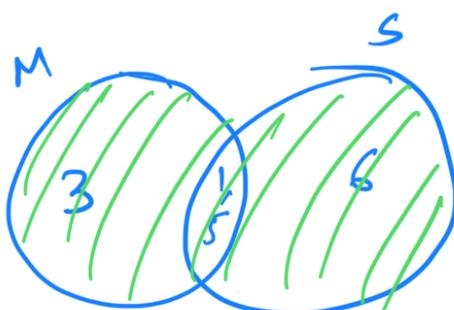
→ When will either one of them win?

$$M \rightarrow \{1, 3, 5\}$$

$$S \rightarrow \{1, 5, 6\}$$

$$\Rightarrow \{1, 3, 5, 6\} \leftarrow \text{Either one will win}$$

$$M \cup S \Rightarrow \{1, 3, 5, 6\}$$



Union \rightarrow Entire region

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

When will Milandep lose?

$$M \rightarrow \{1, 3, 5\}$$

∴ .

- Milandeep lorry → $M' \rightarrow \{2, 4, 6\}$
 Complement $\overbrace{\hspace{10em}}$
- Swraj losing $S' \rightarrow \{2, 3, 4\}$
 $\overbrace{\hspace{10em}}$

Q: When will both lose?
 $\overbrace{\hspace{10em}}$

$$\rightarrow M' \cap S' \rightarrow \begin{cases} \{2, 4, 6\} \\ \{2, 3, 4\} \end{cases} \Rightarrow \underline{\{2, 4\}} \leftarrow$$

Q. Milandeep wins, Swraj loses
 $\overbrace{\hspace{10em}}$.

$$M \cap S' \rightarrow \begin{cases} \{1, \cancel{3}, 5\} \\ \{2, \cancel{3}, 4\} \end{cases}$$

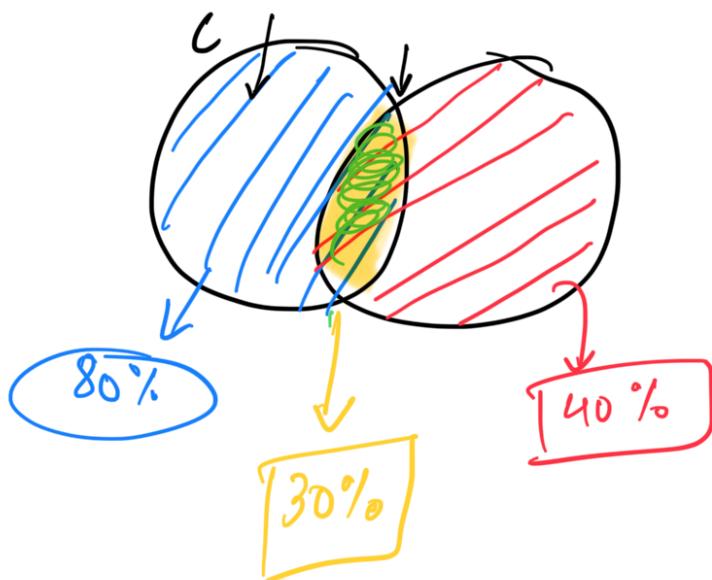
Ans. $\rightarrow \{3\}$

80% — Cappu

40% — Esp

$$\rightarrow \boxed{80\%} - \boxed{\text{Both}} \leftarrow$$

100



C - 80

E - 40

$$\boxed{\text{B} - 30}$$

(10)

\Rightarrow Like Cappuccino ! Espresso

$$\overline{\boxed{\% \text{ cappu}} - \boxed{\% \text{ both}}}$$

80 - 30

$$\boxed{50\%} \leftarrow$$

Probabilities

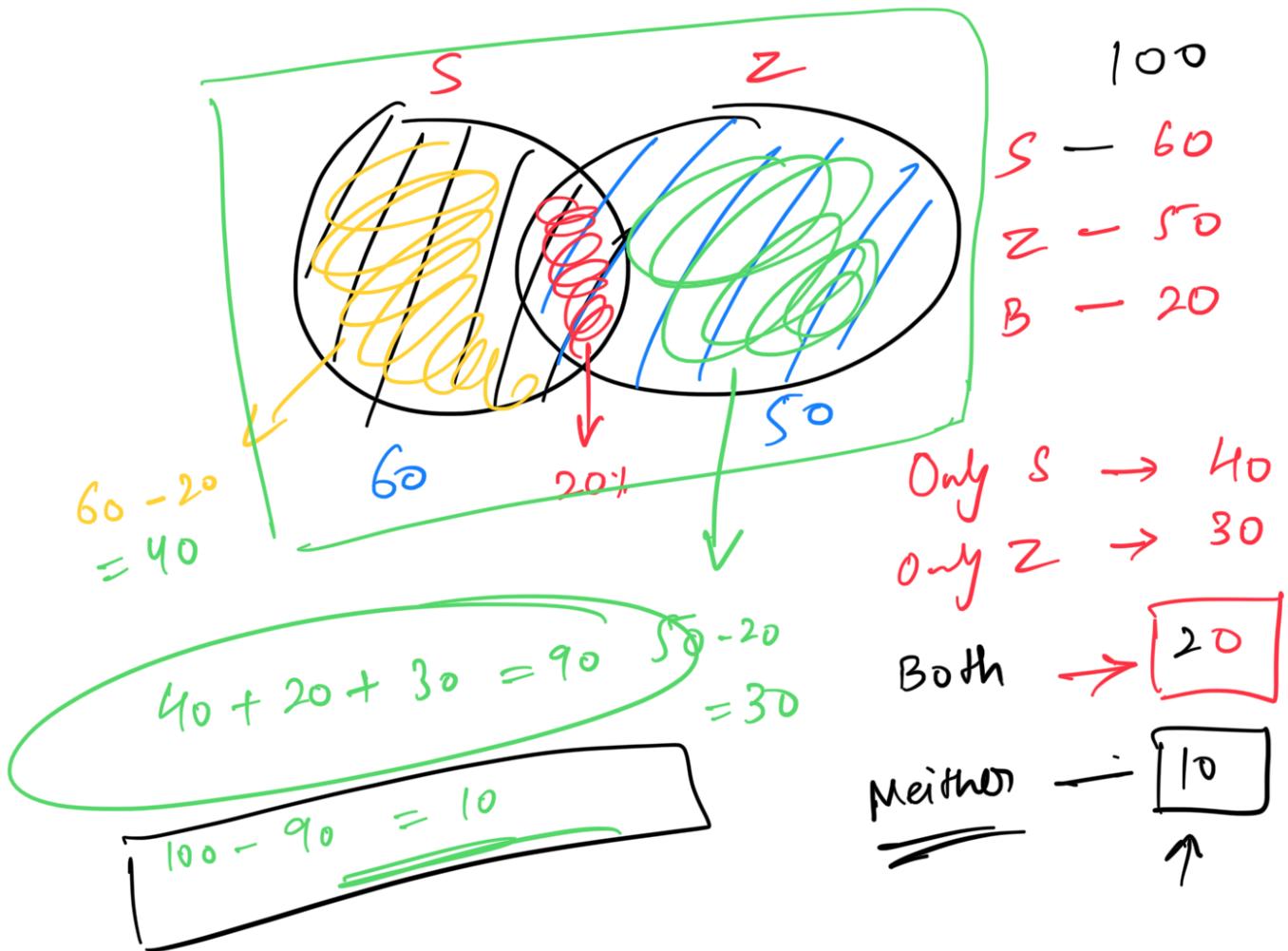
0.8

0.4

0.3

$$60 - 20 \rightarrow \boxed{40\%}$$

\uparrow
Swingsy Not rounded.



$$\left. \begin{array}{l} \text{Amazon} = 70\% \\ \text{Flipkart} = 50\% \\ \text{Both} = 30\% \end{array} \right\}$$

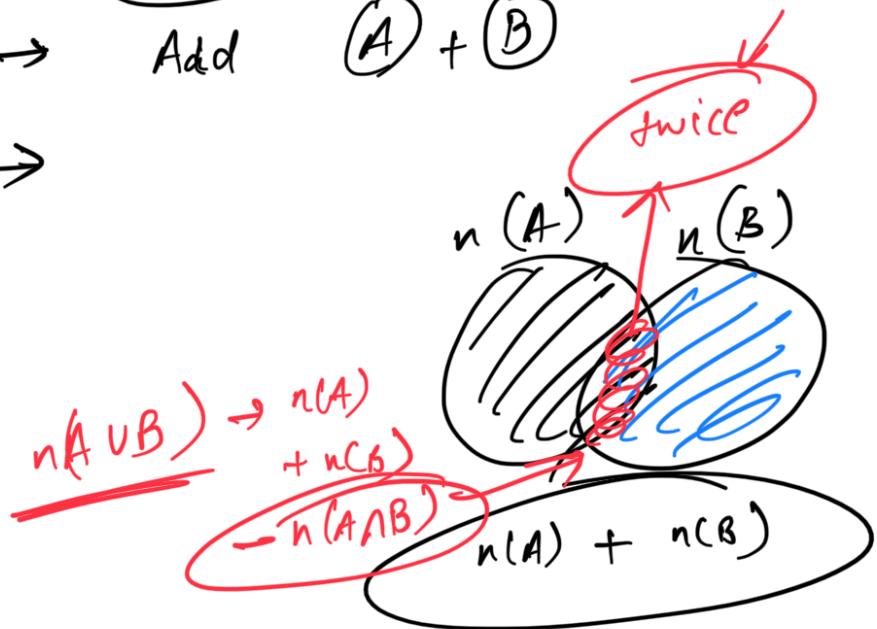
Only Amazon $\rightarrow 70 - 30 = 40$
 Only Flipkart $\rightarrow 50 - 30 = 20$

= 30% ↓

Neither A nor f → $\underline{\underline{100}} - \underline{\underline{90}} = \underline{\underline{10}} \overline{n}$

$n(A \cup B) = n(A) + n(B) - \underline{\underline{n(A \cap B)}}$

Logic : $A \cup B \leftarrow$
 \rightarrow Add $\circled{A} + \circled{B}$



$n(\text{Neither A nor f})$

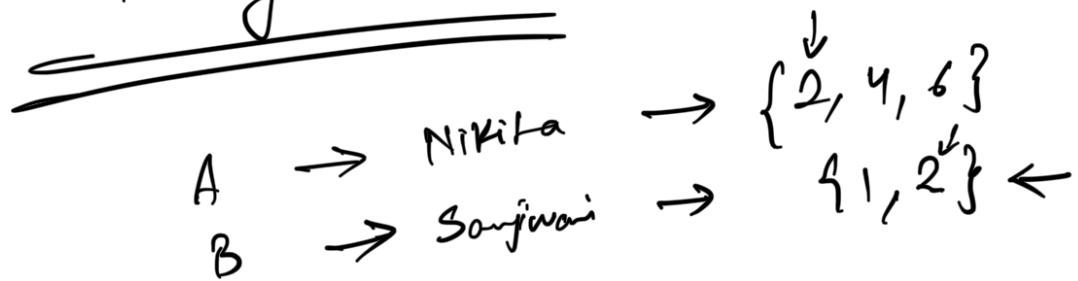
$$\underline{\underline{100}} - \underline{\underline{n(A \cup F)}}$$

$$100 - (n(A) + n(B) - n(A \cap B))$$

$$100 - (\underline{\underline{70 + 50}} - \underline{\underline{30}}) \quad \text{No/L.}$$

$$100 - 40 = \underline{\underline{60}}$$

Rolling a die



What is the prob. of Nikita winning the bet?

$$SS \rightarrow 6$$

$$P(N) = \frac{3}{6} = \frac{1}{2}$$

$$P(N') = 1 - \frac{3}{6} = \left(\frac{3}{6} \right) = \frac{1}{2}$$

Q. What is the prob. of Sanjivani winning?

$$P(S) = 2/6$$

$$P(S') = 1 - \frac{2}{6} = \frac{4}{6}$$

Prob. of both winning? $N \cap S \Rightarrow \underline{\underline{\{2\}}}$

$$\underline{\underline{P(N \cap S)}} = \underline{\underline{1/6}}$$

Prob of either one winning?

$$NVS = \{1, 2, 4, 6\}$$

$$P(NVS) = \frac{4}{6}$$



Mutually Exclusive

A

B

Two events A & B are mutually exclusive if they have no outcomes in common.

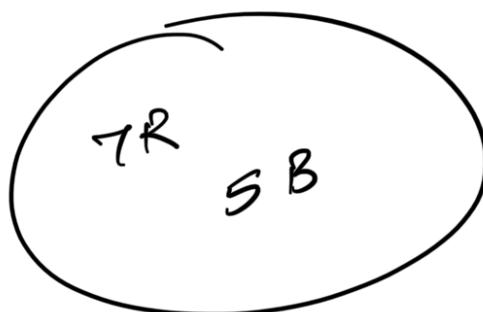
→ $A \cap B$

→ if A occurs, then B cannot occur

→ if B " "

A " "

Eg:



Ball

$$P(A \cap B) = 0$$

$Y \text{ or } B$

0	0	0
0	0	0
0	0	0
0	0	0

$$\cancel{4+6+2=12}$$

$$n(Y \cup B) = n(B) + n(Y) = 6+2 = \cancel{8}$$

$$6+2 = \frac{\cancel{8}}{12} \leftarrow$$

$$P(Y \cup B) = \frac{\cancel{8}}{12}$$

$$P(Y \cap B) = 0$$

$$P(Y \cup B \cup G) = \cancel{\frac{1}{2}}$$

NPS

Detractor $\rightarrow \{1, 2, 3, 4, 5, 6\}$
 . . . < 7 & 2

Neutral $\rightarrow \{q\}$
 Promoters $\rightarrow \{q, 10\}$



$$\begin{array}{c}
 \textcircled{90\%} \rightarrow \overbrace{\text{P} + \text{N}}^{\text{P+N}} \rightarrow 100 - 90 \Rightarrow 10\% \text{ are detrac} \\
 \hline
 30\% \rightarrow \boxed{\text{N} + \text{D}}
 \end{array}$$

$100 - 30 \Rightarrow 70\%$
Promoter

$$100 - 10 - 70 = \textcircled{20}$$

$$100\% - (\text{P} + \text{N}) \Rightarrow ?$$

Detractor

100 %
~~P + N + D~~

Prom \swarrow
 \searrow

N

$$(\text{P} + \text{N}) + (\text{N} + \text{D})$$

$\dots \curvearrowright$

$$P + 2N + V$$

$$\frac{(P+N+D) + N}{100 + \textcircled{N} - 100}$$

↓
 \textcircled{N}

→ Naked statistics

→ How to lie with
statistics?

→ Book?
Z.