

# PROBABILITY

## BASIC DEFINITIONS

Say you will learn AI, nobody panics



But say you will learn probability and statistics, then everybody loses their minds

- ① Prob Stats ↗ ↘
- ② fundamental ↗
- ③ Maths for ML ↗

w.r.t → Context

of  
data  
Science

1

2

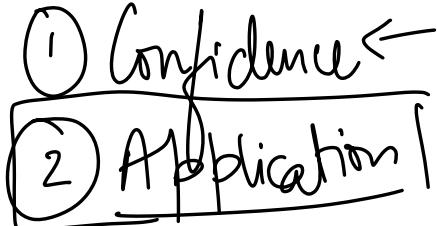
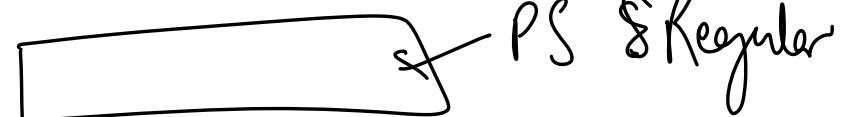
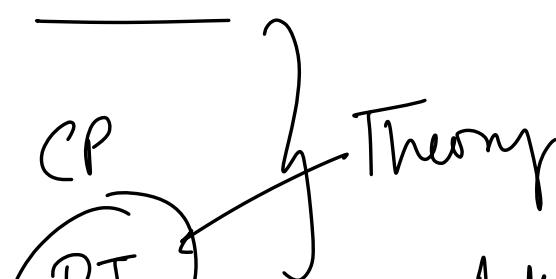
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11





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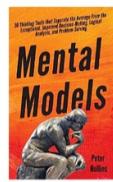
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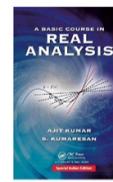
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## My List



Top Picks for Nikhil



English Movies



ML 2 → Recommender System

## Basic Terminologies :

⇒ Experiment:

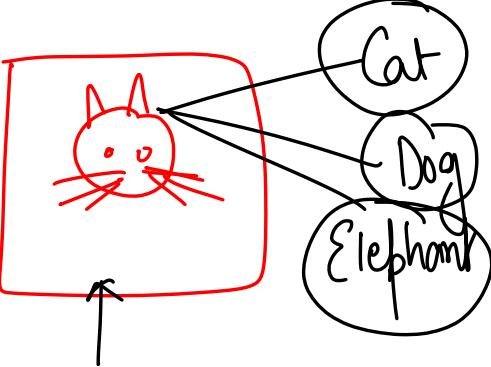


“deterministic experiments”

- ⇒
- ① Rolling a die → 1 to 6
  - ② Deck → 52
  - ③ Match → Win/Loss
  - ④ Stocks → Profit/Loss
  - ⑤ Coin flip → Heads/Tails

Probabilistic  
Experiment

Uncertainty involved.



Experiment

Outcomes

Sample Space

Events

Rolling A dice

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



Sample Space :  $\{1, 2, 3, 4, 5, 6\}$   
Colled<sup>n</sup> of all possible outcomes

Events : "Any Subset of Sample space is an event"

A =  $\{2, 4, 6\}$  ✓ Dice showing even no.s

B =  $\{1, 3, 5\}$  ✓ .. .. odd no.s

C =  $\{1, 2, 3, 4\}$  ✓ → less than 5, at most 4, Not more than 4

D =  $\{1, 2, 3, 7\}$  ✗ → Not in SS.

Experiment

Coin tossing

Outcomes :

$$\{\{H\}, \{T\}\}$$

SS :

$$\{H, T\}$$

Events :

$$A = \{H\}$$

$$B = \{T\}$$

$$C = \{H, T\}$$

$$D = \{\emptyset\}$$

Outcomes

Sample Space

Events

$$\{\{H\}, \{T\}, \{H, T\}, \{\emptyset\}\}$$

$$2^N$$

$$\rightarrow 2^2 = 4$$

"Neither H nor T"

Empty Set or Null Set  
is a valid Subset

Experiment      Outcomes      Sample Space      Events  
 Tossing 2 Coins Simultaneously

$$\text{Outcomes} = \{ HH, HT, TH, TT \}$$

$$2^N = 2^4 = 16$$

SS      = { HH, TT, HT, TH }

Events     $\Rightarrow A = \{ HH, HT, TH \}$

either is head  
 almost 1 tail ( $\leq 1$ )  
 atleast 1 head ( $\geq 1$ )  
 No TT

$$B = \{ HH, TT \}$$

Both are Same

$\{HH, HT, TH, TT\}$

Subsets -

①  $\{HH\}$

③  $\{HH, HT\}$

⑧  $\{HT, TH\}$

⑩  $\{HH, HT, TH\}$

②  $\{HT\}$

⑥  $\{HH, TH\}$

⑨  $\{HT, TT\}$

⑫  $\{HT, TH, TT\}$

③  $\{TH\}$

⑦  $\{HH, TT\}$

⑯  $\{TH, TT\}$

⑮  $\{HH, TH, TT\}$

④  $\{TT\}$

⑯  $\{HH, HT, TH, TT\}$  whole

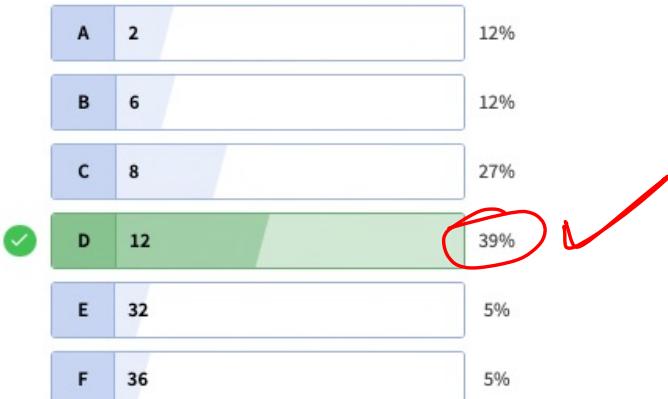
⑯  $\{\}$  empty

## Quiz time!

⌚ TIME LEFT: 1 Secs

We are tossing a coin followed by a dice. How many elements will be there in the sample space?

66 users have participated



[End Quiz Now](#)

Experiment	Outcomes	Sample Space	Events
------------	----------	--------------	--------

Tossing coin followed  
by dice

Outcomes:

$\{H1\}, \{H2\}, \{H3\}, \{H4\}, \dots$	$\{H6\}$
$\{T1\}, \{T2\}, \{T3\}, \dots$	$\{T6\}$

Sample Space :  $\{H1, H2, \dots, H6, T1, T2, \dots, T6\}$  (12)

Events:

:  $\{H1, H3, H5\}$

→ Head & odd nos.  
→ Head & no even  
no tail & odd nos.

Experiment  
Dice Roll.

$$A = \{1, 3, 5\}$$

$$B = \{1, 5, 6\}$$

$$C = \{2, 4, 6\}$$

$$A^c = U - A$$

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

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

Events  
Universe, Universal Set

Intersection

$$A \cap B = \{1, 5\}$$
 "members belonging to both A AND B"

Union

$$A \cup B = \{1, 3, 5, 6\}$$
 "members belonging to either A OR B"

Compliment

$$A^c / A' = \{2, 4, 6\}$$
 "members belonging to Universal Sets which are NOT IN A"

$$B^c / B' = \{2, 3, 4\}$$

$$C^c / C' = \{1, 3, 5\}$$

$$\Rightarrow A^c = \{1, 2, 3, 4, 5, 6\} - \{1, 3, 5\}$$

$$A^c = \{2, 4, 6\}$$

$$A \cup A^c = U$$

$$A \cap A^c = \{\} = \emptyset$$

$A \cap C = \{\}\Rightarrow$  Mutually Exclusive Events.  
Disjoint Sets

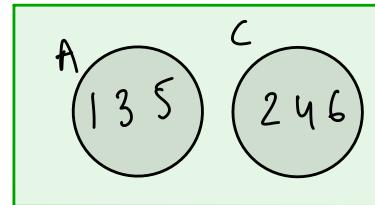
Probability : Prob. that event A occurs :

$$= \frac{\# \text{ outcomes in Set } A}{\# \text{ outcomes in Set } S}$$

$$\text{Coin toss} = \{H, T\}$$

$$P(H) = 1/2$$

$$P(T) = 1/2$$



Experiment	Outcomes	Sample Space	Events
Coin toss	$\{1\} \{2\} \{3\} \{4\} \{5\} \{6\}$	$\{1, 2, 3, 4, 5, 6\}$	

$$A = \{2, 4, 6\} \rightarrow P(A) = \frac{3}{6}$$

$$B = \{1, 2\} \rightarrow P(B) = \frac{2}{6}$$

$$C = \{1, 4, 5, 6\} \rightarrow P(C) = \frac{4}{6}$$

$$P(A \cup B) = \frac{\#\{1, 2, 4, 6\}}{\#\{1, \dots, 6\}} = \frac{4}{6}$$

$$P(A \cap B) = \frac{\#\{2\}}{\#\{1, \dots, 6\}} = \frac{1}{6}$$

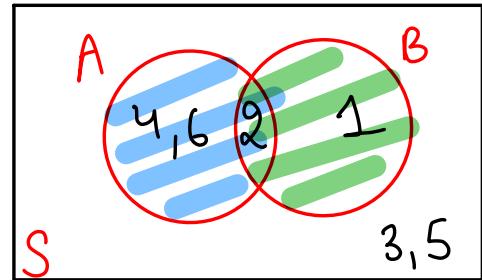
$$P(A \cap A^c) = \frac{\#\{\}}{\#\{1, \dots, 6\}} = \frac{0}{6}$$

$$P(A \cap C^c) = \frac{\#\{2\}}{\#\{1, \dots, 6\}} = \frac{1}{6}$$

$$A = \{2, 4, 6\}$$

$$B = \{1, 2\}$$

$$P(A) = \frac{\#\{2, 4, 6\}}{\#\{1, \dots, 6\}}$$
$$= 3/6$$



$$P(B) = \frac{\#\{1, 2\}}{\#\{1, \dots, 6\}} = \frac{2}{6}$$

$$P(A \cup B) = \frac{\#\{1, 2, 4, 6\}}{\#\{1, \dots, 6\}} = \frac{4}{6}$$

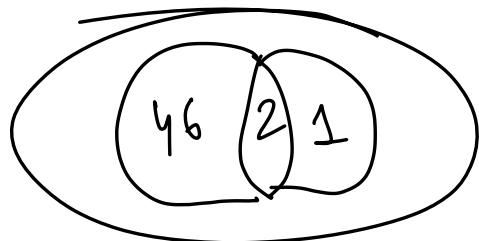
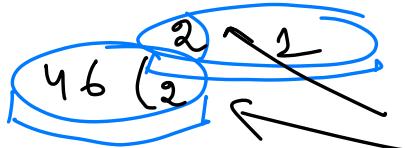
$$P(A \cap B) = \frac{\#\{2\}}{\#\{1, \dots, 6\}} = \frac{1}{6}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

## Quiz time!

Quiz Ended!

There are 4 green balls, 6 yellow balls, and 2 blue balls in a bag. A random ball is chosen. Find the probability that a yellow or blue ball is chosen

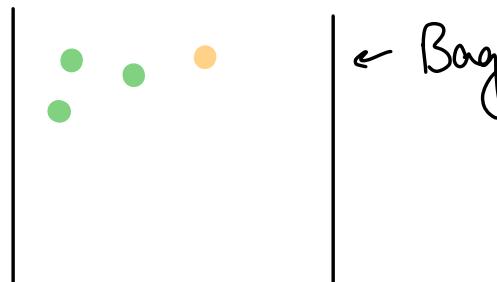


$$P(G) = \frac{4}{12} \quad P(Y \cup B) = \frac{8}{12}$$

$$P(Y) = \frac{6}{12}$$

$$P(B) = \frac{2}{12}$$

$$P(Y \cup B) = P(Y) + P(B) - P(Y \cap B)$$



$$P(Y \cup B) ? = 6/12 + 2/12 - 0/12$$

$$= 8/12$$

# Quiz time!

TIME LEFT: 37 Secs

Which of the following represent mutually exclusive sets?

59 users have participated

- |   |  |     |
|---|--|-----|
| A | Youtube premium Vs Non-premium users                 | 75% |
| B | People who like <u>Cappuccino</u> Vs <u>Espresso</u> | 19% |
| C | Users of <u>Swiggy</u> Vs <u>Zomato</u>              | 2%  |
| D | Users of <u>Amazon</u> Vs <u>Flipkart</u>            | 5%  |



[End Quiz Now](#)

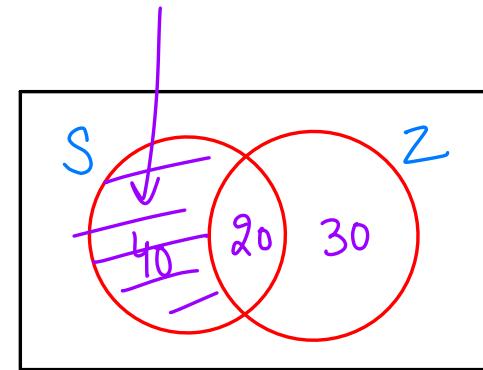
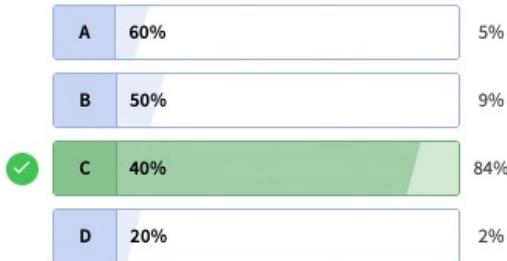
## Quiz time!

Quiz Ended!

It is known that 60% people use Swiggy, 50% use Zomato. 20% people use both.

What percentage use Swiggy, but do not use Zomato?

56 users have participated



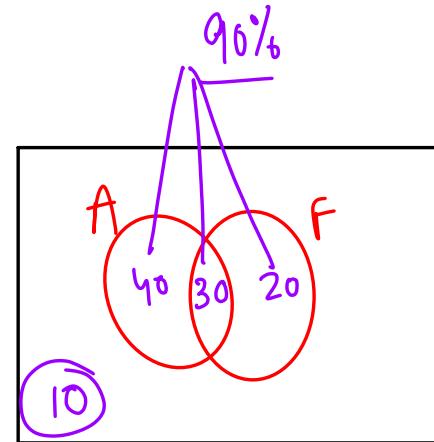
## Quiz time!

Quiz Ended!

It is known that 70% people use Amazon, 50% use Flipkart. 30% people use both.

What percentage of people use neither Amazon, nor Flipkart?

56 users have participated

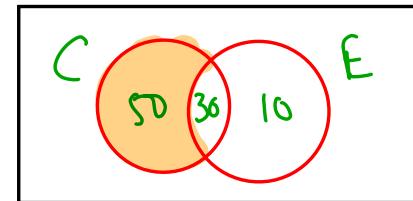


## Quiz time!

Quiz Ended!

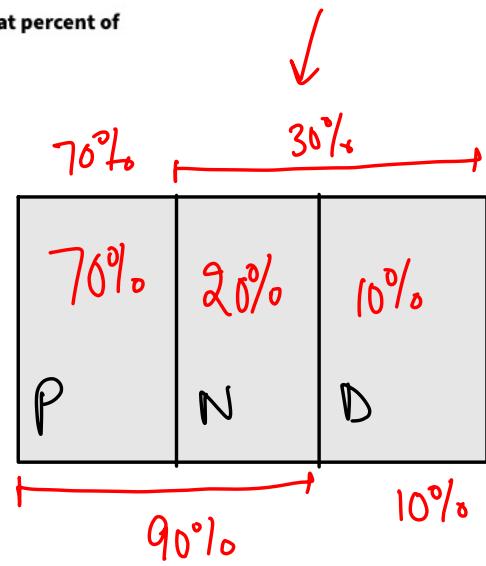
It is known that 80% people like cappuccino, 40% people like espresso, and 30% like both. What percentage of the people like cappuccino, but do not like espresso?

57 users have participated



Quiz Ended!

In an NPS survey, it is seen that 90% are either promoters or neutral. 30% percent are neutral or detractor. What percent of people are neutral?



① Saturday Sunday

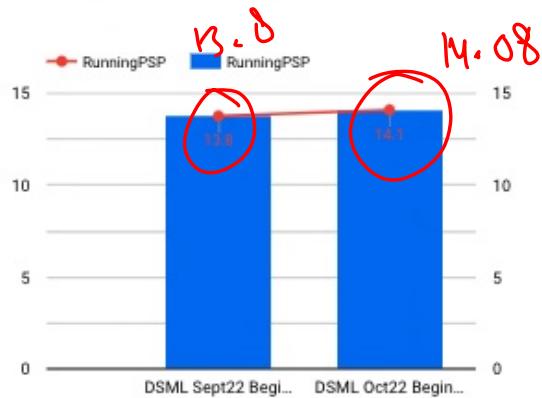
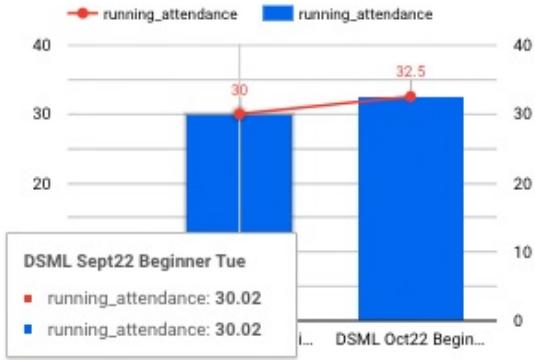
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DV]

9035852260

Numpy  
Pandas

Syllabus

$\hookrightarrow N_p + l_d$



Lunday  
Pandas

