CONDITIONAL PROBABILITY

what do you see in these images ?

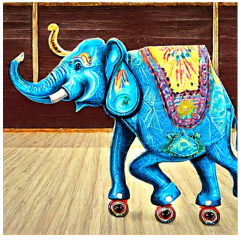
Images

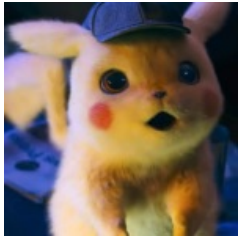
Labels

Computer Generated

"Pink golfball"

"Blue elephant roller skating"





"detchiv Pikachu"

Whatsapp

How are → you ?
→ the ?
→ things ?

X_1 X_2 X_3

Given X_1 = "How" and X_2 = "are", what is the probability that X_3 = "you"
X_3 = "the"
X_3 = "things" ... ?

} lots of computation

Experiment: Sum of 2 dice throws

D_1+D_2	D_2 = 1	2	3	4	5	6
D_1 = 1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

$$P[D_1 = 2] = \frac{6}{36}, \quad P[D_1 + D_2 \leq 5] = \frac{10}{36}$$

$$P[D_1 = 2 \cap D_1 + D_2 \leq 5] = \frac{3}{36}$$

$$P[D_1 = 2 \mid D_1 + D_2 \leq 5] = \frac{3}{10}$$

"given"

$$P[D_1 = 2 \mid D_1 + D_2 \leq 5] = \frac{P[(D_1 = 2) \cap (D_1 + D_2 \leq 5)]}{P[D_1 + D_2 \leq 5]} = \frac{3/36}{10/36} = \frac{3}{10}$$

$$P[A|B] = \frac{P[A \cap B]}{P[B]}$$

$$P[D_1+D_2 \le 5 \mid D_1 = 2] = \frac{P[D_1+D_2 \le 5 \cap D_1 = 2]}{P[D_1 = 2]} = \frac{3/36}{6/36} = \frac{3}{6}$$

Experiment : Sachin Tendulkar's Stat .

Won century	False LOST	True WON	All
False (No Century)	160	154	314
True (Century)	16	30	46
All	176	184	360

$P[W] = \frac{184}{360}$ $P[C] = \frac{46}{360}$

$P[W \cap C] = \frac{30}{360}$ $P[C \cap W] = \frac{30}{360}$

$P[W/C] = \frac{30}{46}$ $P[C/W] = \frac{30}{184}$

$$P[W/C] = \frac{P[W \cap C]}{P[C]} = \frac{30/360}{46/360} = \frac{30}{46}$$

$$P[C/W] = \frac{P[C \cap W]}{P[W]} = \frac{30/360}{184/360} = \frac{30}{184}$$

WC 30	16 CW'
WC' 154	160 $C'W'$

$$P[A/B] = \frac{P[A \cap B]}{P[B]}$$

Conditionally probability

$$P[A \cap B] = P[A/B] \cdot P[B]$$

Multiplication Rule.

$$P[B/A] = \frac{P[B \cap A]}{P[A]}$$

$$P[B \cap A] = P[B/A] \cdot P[A]$$

$$P[A/B] \cdot P[B] = P[B/A] \cdot P[A]$$

$$P[B/A] = \frac{P[A/B] \cdot P[B]}{P[A]}$$

BAYES THEOREM

① "images" → "labels" Easy $P[\text{label} / \text{images}]$

"labels" → "images" Difficult.

$$P[B/A] = \frac{P[A/B] \cdot P[B]}{P[A]}$$

D

$$P[\text{images} / \text{labels}] = \frac{P[\text{labels} / \text{images}] \cdot P[\text{images}]}{P[\text{labels}]}$$

E E E

It is known that 60% people use Swiggy, 50% use Zomato. 20% people use both.
Among those who use Zomato, what fraction also use Swiggy?

Quiz time!

TIME LEFT: 0 Secs

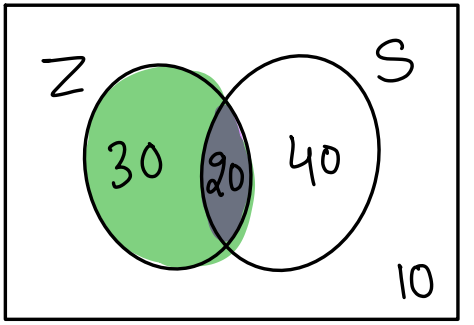
1. It is known that 60% people use Swiggy, 50% use Zomato. 20% people use both.

Among those who use Zomato, what fraction also use Swiggy?

34 users have participated

A	0.20	18%
B	0.50	15%
C	0.40	59%
D	0.33	9%

End Quiz Now



20/50

$$P[S/Z] = \frac{P[S \cap Z]}{P[Z]}$$

$= 20/50 = 0.4$

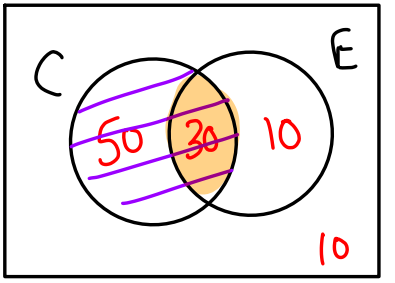
Quiz time!

Quiz Ended!

It is known that 80% people like cappuccino, 40% people like espresso, and 30% like both. Among the people who like cappuccino, what fraction of people like espresso?

62 users have participated

A	0.3	5%
✓ B	30/80	74%
C	30/40	16%
D	0.8	5%



$$P[E/C] = \frac{P[E \cap C]}{P[C]} \quad (30/80)$$

$$= \frac{30/100}{80/100} = \frac{30}{80}$$

Quiz time!

Quiz Ended!

hich of these probabilities represent the following statement: Among the people who like cappuccino, what fraction of people like espresso?

58 users have participated

A	P[Espresso | Cappuccino]	90%
B	P[Espresso U Cappuccino]	2%
C	P[Cappuccino | Cappuccino]	5%
D	P[Cappuccino ∩ Cappuccino]	3%

P[E | C]

LinkedIn → Premium User → Seeking Jobs
Non Premium → Not Seeking

Quiz time!

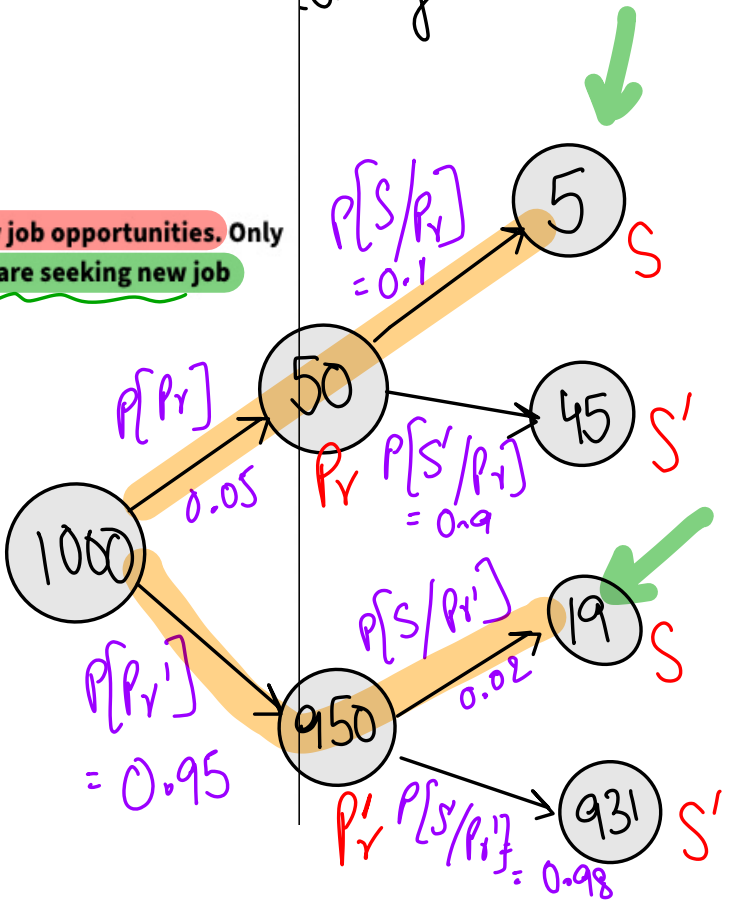
Quiz Ended!

5% of all LinkedIn users are premium users. 10% of premium users are seeking new job opportunities. Only 2% of non-premium users are seeking job. Overall, what percentage of people are seeking new job opportunities?

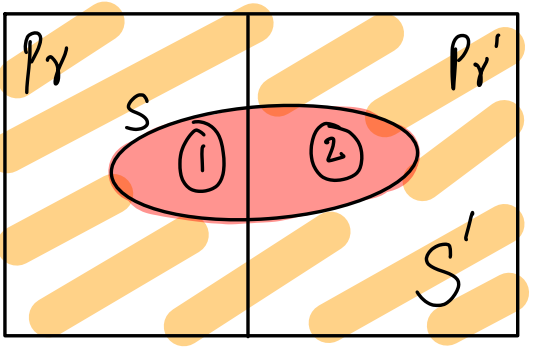
45 users have participated

A	2%	11%
✓ B	2.4%	62%
C	3.7%	13%
D	5%	13%

$P[S] = (5+19)/1000$



$P[S] = \underline{2.4\%}$



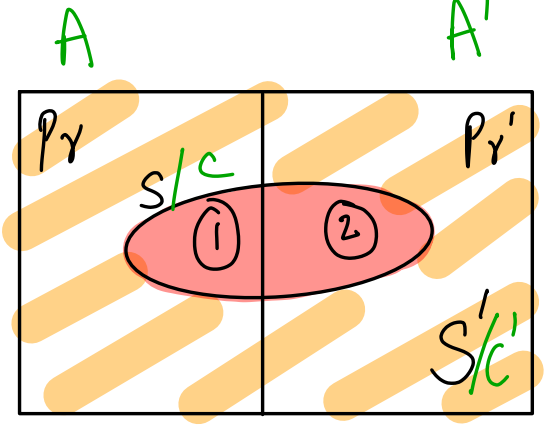
$P[S] =$ (1) + (2)

$= P[S \cap P_Y] + P[S \cap P_{Y'}]$

$= P[S/P_Y] \cdot P[P_Y] + P[S/P_{Y'}]\, P[P_{Y'}]$

$= 0.1 \times 0.05 + 0.02 \times 0.95$

$= 0.005 + 0.019 = 0.024 \Rightarrow 2.4\%$

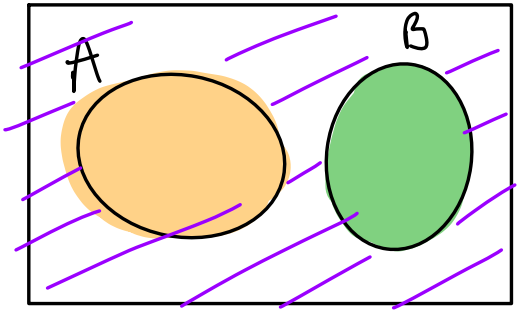


$$C = (A \cap C) \cup (A' \cap C)$$

(1) (2)

$A \cap A' = \{\}$ "Mutually Exclusive"

$A \cup A' = S/U$ "Mutually Exhaustive"



1. MExc and M Exh
2. MExc
3. MExh
4. Mexc' and Mexh'

$A \cap B = \{\}$ "Mutually exclusive"

$A \cup B \neq S$ ~~"Mutually Exhaustive"~~

Quiz time!

Quiz Ended!

It is known that 30% of emails are spam, and 70% are not spam. The word "purchase" occurs in 80% of spam emails. It also occurs in 10% of non-spam emails. Overall, in what percentage of emails would we see the word "purchase"?

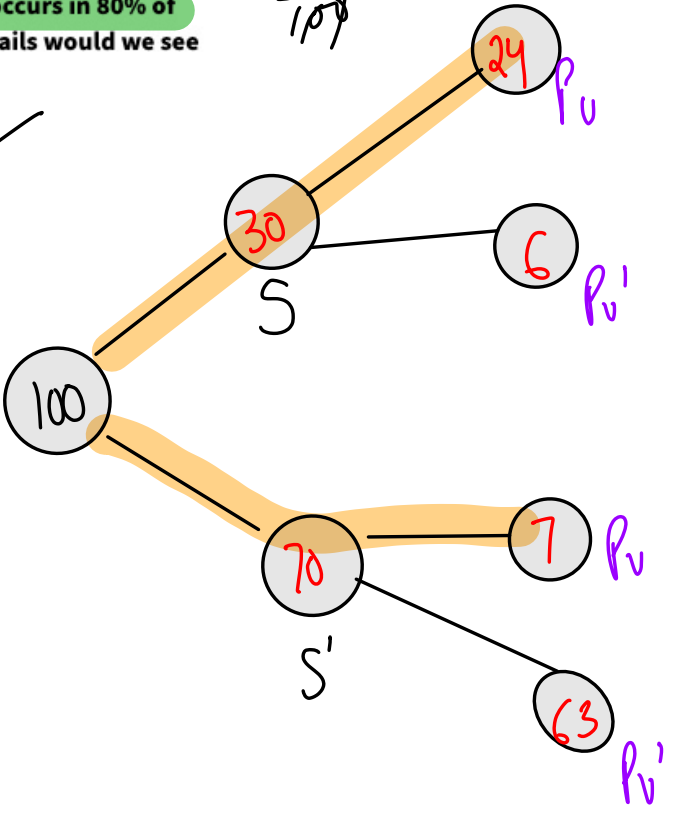
41 users have participated

A	45%	2%
B	10%	7%
C ✓	31%	90%
D	71%	0%

24+7 = 31%

80% x 30

80/100 x 30 = 24



Quiz time!

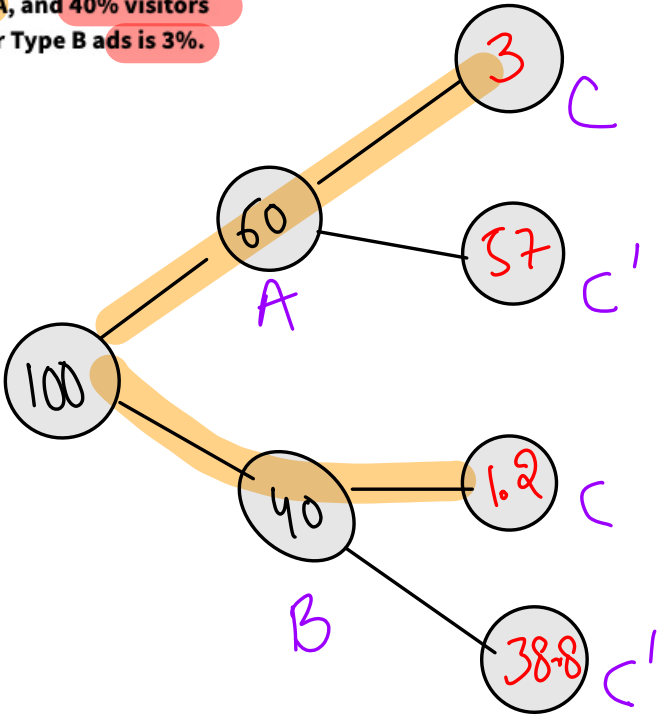
Quiz Ended!

An e-commerce website shows two types of ads: A and B. 60% of the visitors see Type A, and 40% visitors see Type B. The click-through rate for Type A ads is 5%, while the click-through rate for Type B ads is 3%. What is the overall click through rate?

47 users have participated

A	3	0%
B	4	6%
C	4.2	8%
D	8	11%

$3 + 1.2 = 4.2$%



NPS

Quiz time!

Quiz Ended!

In an NPS survey, it is seen that 70% are promoters, 20% are neutral, 10% are detractors. 90% of promoters, 40% of neutral, and 5% of detractors recommend the product to a friend. What is the overall percentalge of people who recommend the product?

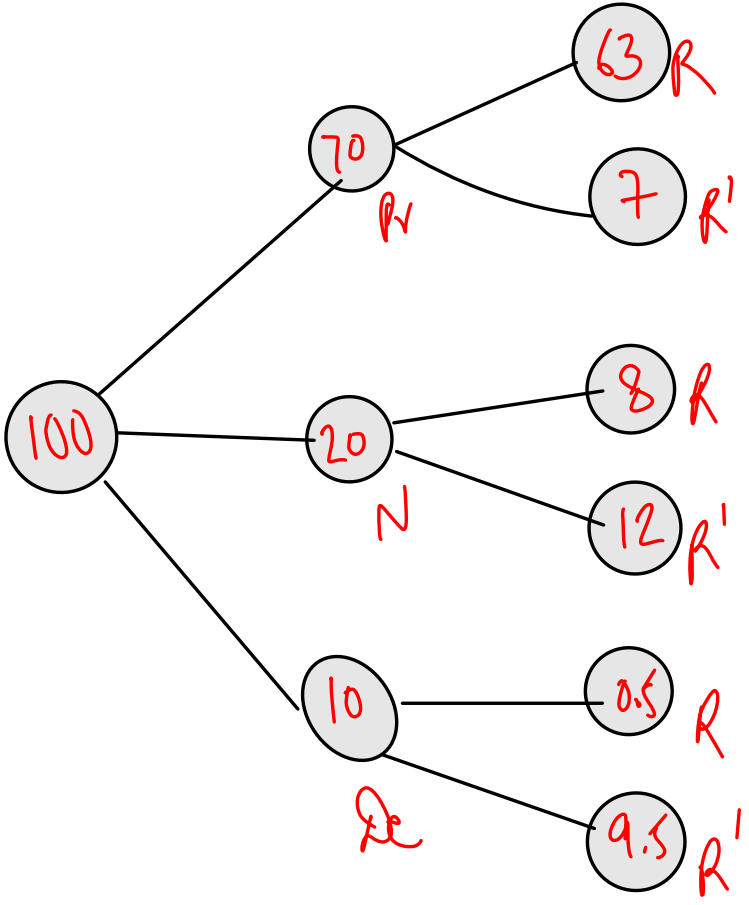
46 users have participated

A	50%	2%	✗
B	65.7%	13%	✗
C ✓	71.5%	80%	
D	82.9%	4%	✗

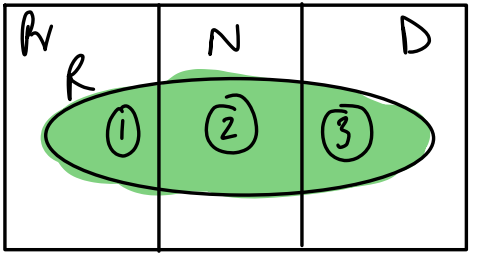
	Pr	Ne	De
R	63	8	0.5
NR	7	12	9.5
	70	20	10

$63 + 8 + 0.5$

$= 71.5\%$



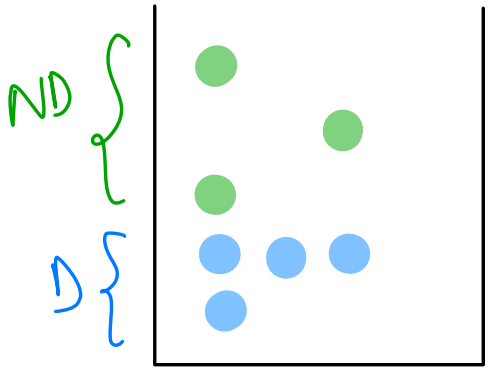
$$P[R] = \textcircled{1} + \textcircled{2} + \textcircled{3}$$



$P[\text{Raining} / H]$

$P[\text{Raining} | T]$

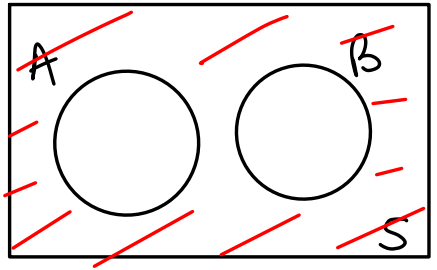
Recap
1. Conditional Prob.
2. Multiplication Rule
3. Bayes Theorem.



$\frac{6}{15} = \frac{2}{5}$

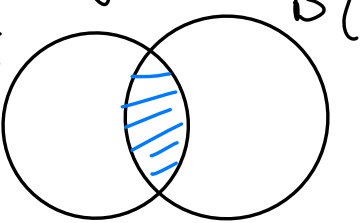
$= \frac{2}{5}$

① Mutually Exclusive ↻ Only
A & B

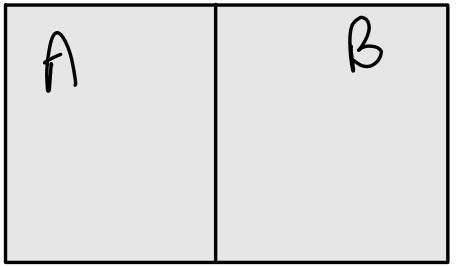


② Mutually Exhaustive Only

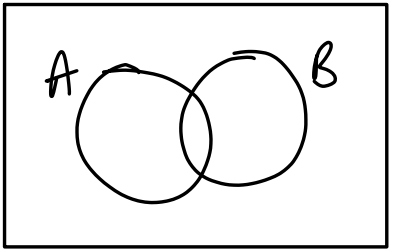
(C) A B (E)



③ M cah & M cadv.



④



M cadv ✗

M cah ✗

① Prime v/s non prime

② Divisible by 3 Divisible by 5