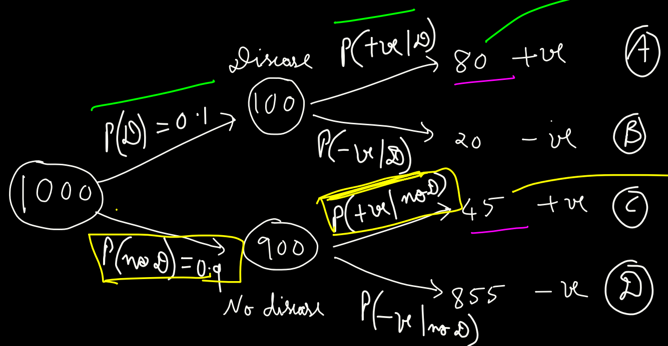
A disease affects 10% of the population.
Among those who have the disease, 80% get “positive” test result
Among those who don’t have the disease, 5% get “positive” test result

Overall, what percentage of people tested “positive”? $80 + 45 = 125$

$12.5\%$

$P(+ve \mid \text{Disease}) = 0.8$

$P(+ve \mid \text{no disease}) = 0.05$




$P(+ve \cap D) = P(+ve \mid D)\, P(D)$
$= (0.8)(0.1)$
$= 0.08$

$P(+ve \cap \text{no Dis})$
$= P(+ve \mid \text{no Dis})\, P(\text{no } D)$
$= (0.05)(0.9)$
$= 0.045$

$P(+ve) = P(+ve \cap D) + P(+ve \cap \text{no dis})$
$= 0.08 + 0.045$
$= 0.125$

$P(+ve) = P(+ve \mid D)\, P(D) + P(+ve \mid \text{no } D)\, P(\text{no } D)$
$= (0.8)(0.1) + (0.05)(0.9) = 0.125$

Total Probability

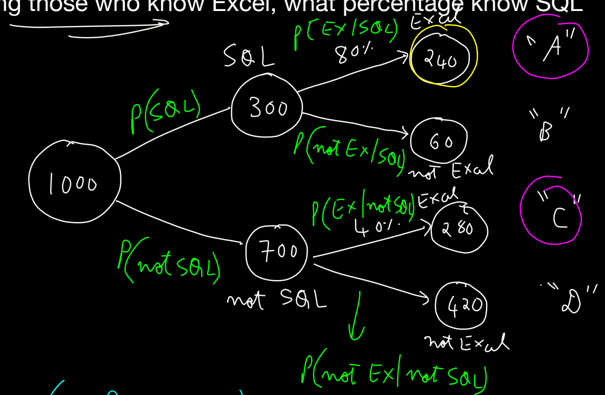
You test positive: What is the probability that you actually have the disease?

(A) & (C) are +ve $\longrightarrow$ $80 + 45 = 125$ are +ve

Among these 125, 80 people have the disease

$$P(D \mid +ve) = \frac{80}{125} = 0.64$$

For a new cohort in DSML, we have the following information
30% of the people know SQL.
80% of the people who know SQL also know Excel.
40% of the people who do not know SQL, also know Excel.
Among those who know Excel, what percentage know SQL




$P(Ex \cap \text{not } SQL) = 0.28$

$P(Ex | \text{not } SQL) \, P(\text{not } SQL)$

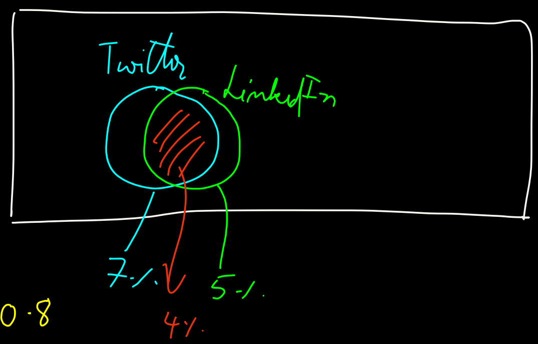
$P[Ex \cap SQL] = 0.24$

$(0.3)(0.8)$

$$\frac{240}{240 + 280} = 0.46$$

Those who know Excel

In a city, 7% people are on Twitter
5% people are on LinkedIn
4% people are on both LinkedIn and Twitter




$P[T] = 0.07$

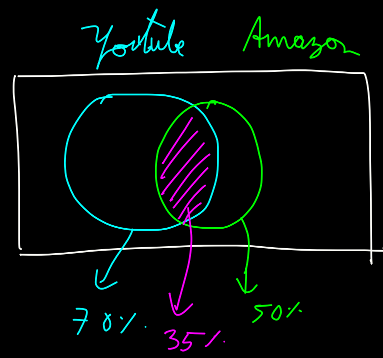
$P[T \mid L] = \dfrac{P[T \cap L]}{P[L]} = \dfrac{0.04}{0.05} = 0.8$

This extra info about the person changed the prob of being on Twitter

T & L are "dependent"

$P[L] = 0.05$ $\qquad$ $P[L \mid T] = \dfrac{0.04}{0.07} = 0.57$

A website showing ads on Youtube and Amazon have noticed the following stats.
70% of those who saw the ad, saw it on Youtube.
50% of those who saw the ad, saw it on Amazon.
35% of those who saw the ad, saw it on both.




$$P[Y] = 0.7$$

$$P[Y \mid A] = \frac{P[Y \cap A]}{P[A]} = \frac{0.35}{0.5} = 0.7$$

$$P[A] = 0.5$$

$$P[A \mid Y] = \frac{P[Y \cap A]}{P[Y]} = \frac{0.35}{0.7} = 0.5$$

$P[Y \cap A] = P[Y]\,P[A]$ (1) here

A and Y are independent if

$$\begin{cases} P[Y \mid A] = P[Y] & (2) \\ P[A \mid Y] = P[A] & (3) \end{cases}$$

$$P[Y \mid A] = \frac{P[Y \cap A]}{P[A]} = \frac{P[Y]\cancel{P[A]}}{\cancel{P[A]}} = P(Y)$$

A and B are two independent events, where it is known that P(AUB) = 0.5 and P(A) = 0.3
What is P(B)?

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

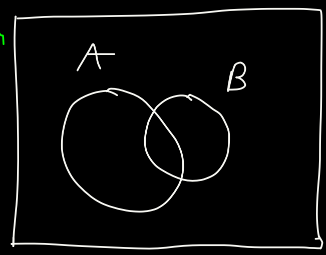
independent

$$0.5 = 0.3 + P(B) - P(A)\,P(B)$$

$$0.5 = 0.3 + P(B) - (0.3)\,P(B)$$

$$0.2 = 0.7\,P(B)$$

$$P(B) = \frac{2}{7}$$




Independence

$$P(A|B) = P(A)$$

$$\frac{P(A \cap B)}{P(B)} = P(A)$$

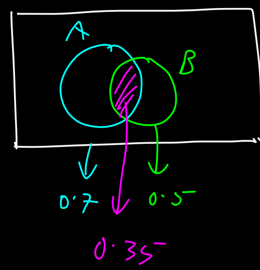
$$P(A \cap B) = P(A)\,P(B)$$

Amit can solve a math problem 0.7, and Bharath can solve it with probability 0.5. Both of them attempt this problem independently.

What is the probability that both solve it? $P(A \cap B) = P(A)\,P(B)$

What is the probability that neither solve it?

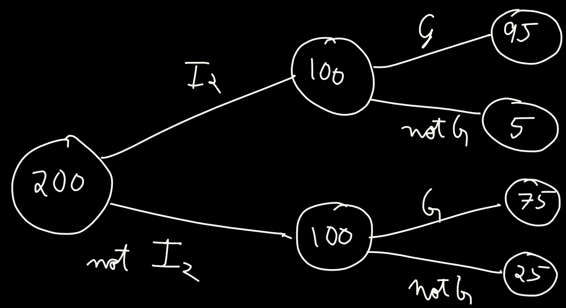
$$1 - P(A \cup B) = 1 - 0.85 = 0.15$$




$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
$$= 0.7 + 0.5 - 0.35$$
$$= 0.85$$

50% of the people who gave the first round were called for the second round
95% of the people who got invited for the second round felt that they had a good first round
75% of the people who did not get invited for the second round also felt that they had a good first round

Given that a person felt good about the first round, what is the probability that he cleared the first round?




$$\frac{95}{95+75}$$

$P[I_2 | G]$ is asked

$P[I_2] = 0.5$

$P[G | I_2] = 0.95$

$P[G | \text{not } I_2] = 0.75$

$P(I_2) = 0.5$

$$P[I_2 | G] = \frac{P[I_2 \wedge G]}{P(G)} = \frac{P[G | I_2]\, P(I_2)}{P[G | I_2]\, P[I_2] + P[G | \text{not } I_2]\, P[\text{not } I_2]}$$

$$= \frac{(0.95)\cancel{(0.5)}}{(0.95)\cancel{(0.5)} + (0.75)\cancel{(0.5)}} = \frac{0.95}{0.95 + 0.75} = 0.58$$