Agenda

* Baye's theorem
* Dependent Events
* Independent Events

** Assignments

Sample space
Event
probability

→ Conditional probability

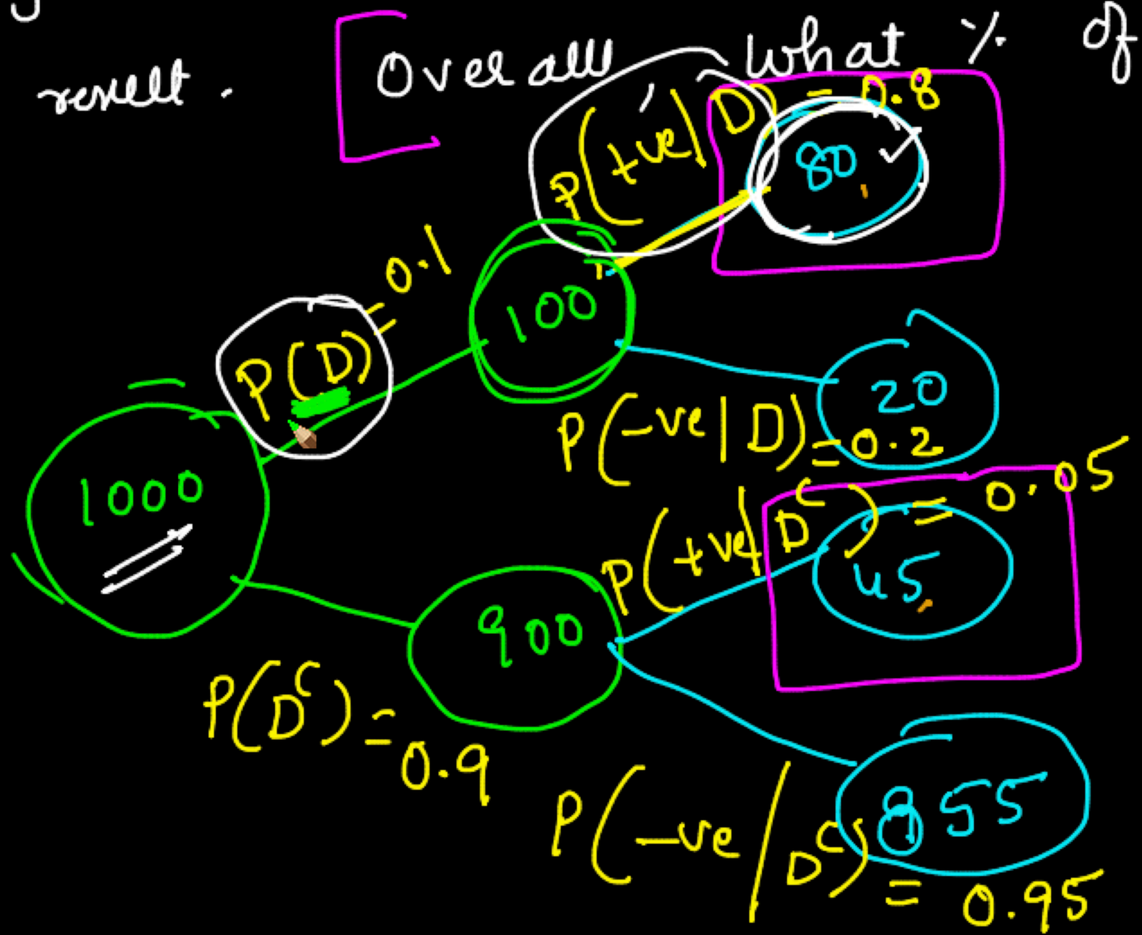
→ total law of probability

Mutually Exclusive

Quiz #1

A disease affects 10% of the population. Among those who have the disease, 90% get "positive" test result. Among those who don't have the disease, 5% get "positive" test result.

[Overall, what % of people tested "positive"?



$\Rightarrow \frac{125}{1000}$

$\Rightarrow$ 12.5 %

Quiz #2

what is $P(+ve \mid Disease)$?

$P(+ve \mid Disease) = 0.8$

0 to 1

0 100%

Quiz #3

$$P(+ve \mid \text{No Disease})$$

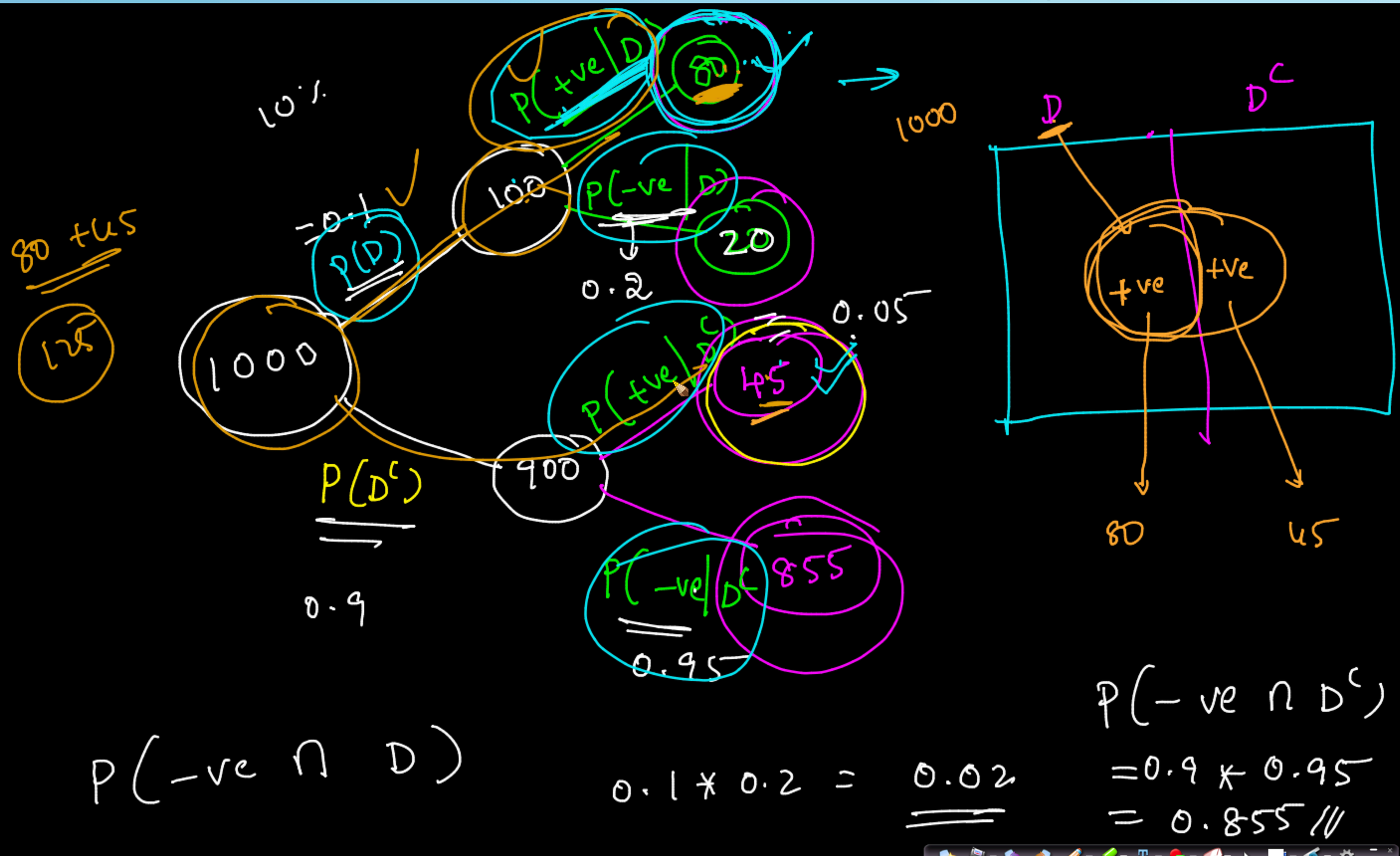
Quiz #4

$$P(+ve \cap \text{Disease})$$

$$= P(D) * P(+ve \mid D)$$

$$= 0.1 * 0.8$$

$$= 0.08 * 1000 \Rightarrow 80$$



$P(-ve \cap D)$

$0.1 * 0.2 = 0.02$

$P(-ve \cap D^C)$

$= 0.9 * 0.95$

$= 0.855$ //

$$P(\text{+ve} \cap \text{No Disease})$$

$$= P(D^c) * P(\text{+ve} \mid D^c)$$

$$= 0.9 * 0.05$$

$$= 0.045$$

$P(-ve \cap D\text{f's cause})$

=> Suppose you are tested positive. what is the probability that you have disease.

$P(D \mid +ve)$

=

(i) $P(D)$

(ii) $P(+ve \mid D)$

(iii) $P(D \mid +ve)$

(iv) $P(D \cap +ve)$

=> If you

⇒ If you are tested +ve, then you belong (80+45)

125

Among those 125 how many have disease.

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

$P(+ve \mid D)$ = 0.64

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

$$P(D \mid +ve) = \frac{P(D \cap +ve)}{P(+ve)}$$

Bayes Theorem

$$P(D \mid +ve) = \frac{P(D) * P(+ve \mid D)}{P(+ve)}$$

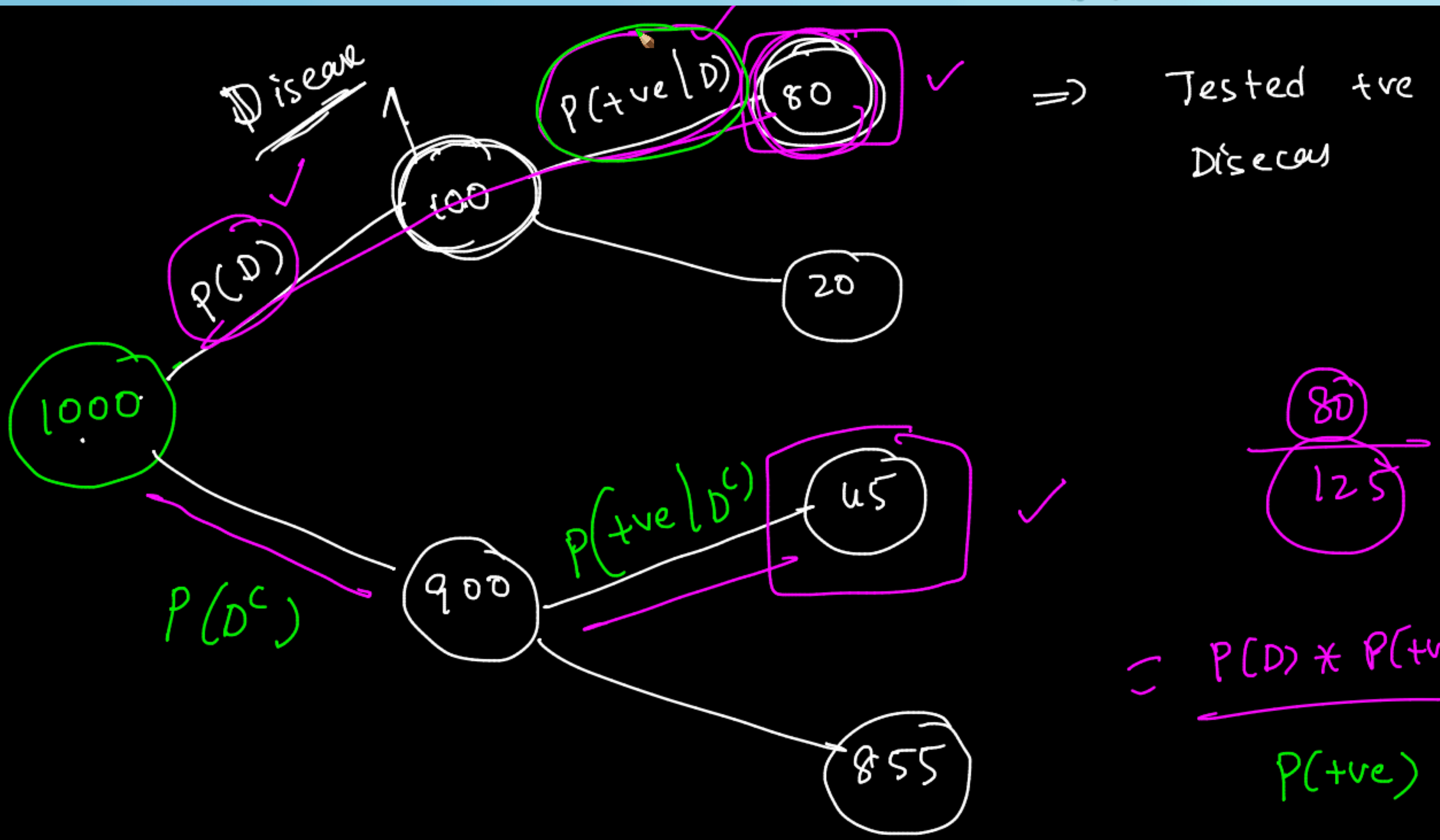
$$P(+ve) = P(D) * P(+ve \mid D) + P(D^c) * P(+ve \mid D^c)$$

Law of Total probability

$$= 0.1 * 0.8 + 0.9 * 0.05$$

$$= 0.08 + 0.045$$

$$= 0.0125 \Rightarrow 12.5\%$$



$\Rightarrow$ Tested +ve and Disease

$= \frac{P(D) * P(+ve|D)}{P(+ve)}$

$\Rightarrow$ $\Rightarrow$ 10% affects disease

Among those who have the disease, 80% get +ve.

Among those who doesn't the disease, 5% get +ve

(i) $P(D) = 0.1$

(ii) $P(+ve \mid D) = 0.8$

(iii) $P(+ve \mid D^c) = 0.05$

$P(D \mid +ve)$

$=$

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

$$= P\left(\frac{D \cap +ve}{P(+ve)}\right)$$

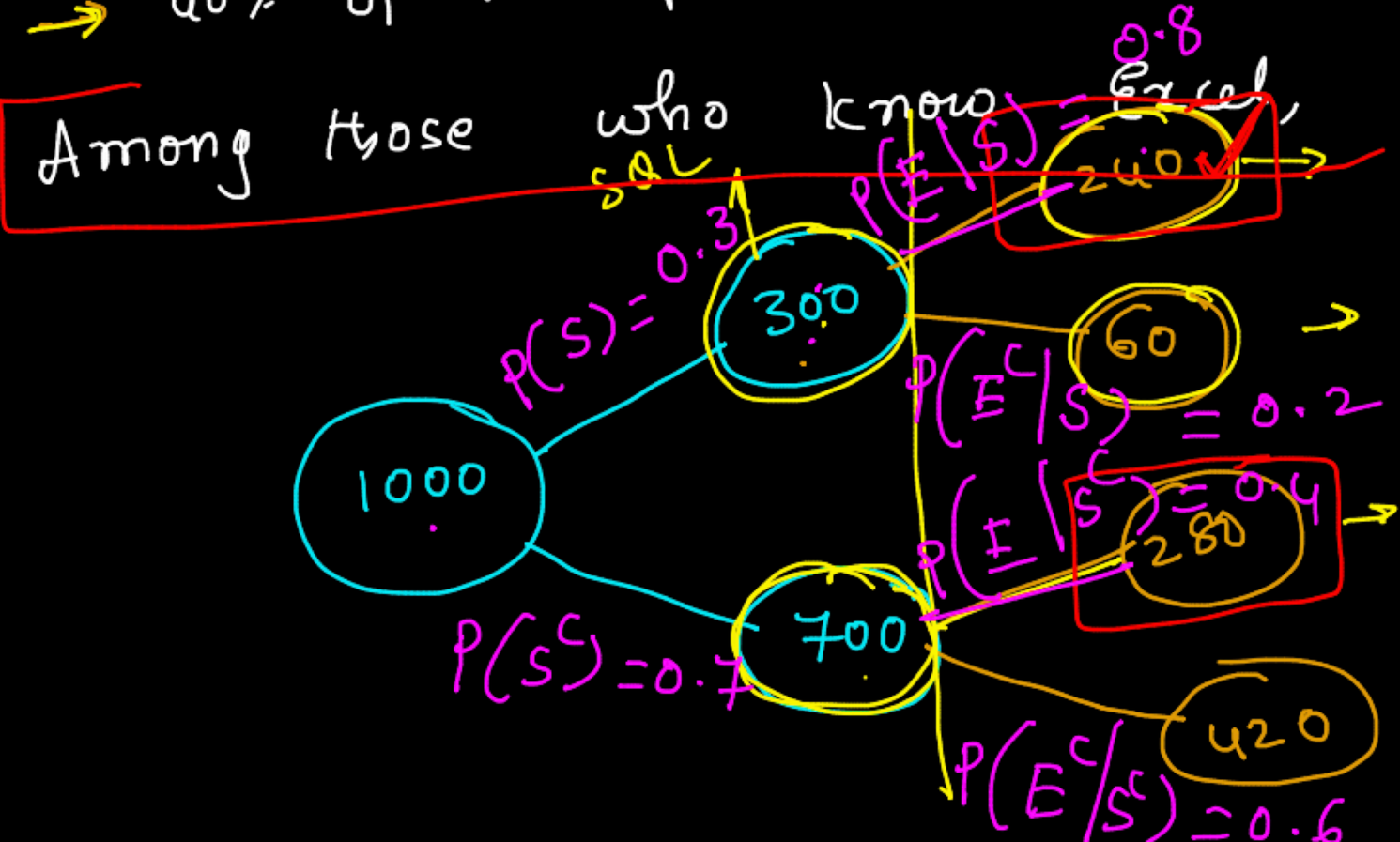
$$= \frac{P(D) * P(+ve|D)}{P(+ve)}$$

May 23

Quiz For a new cohort in DSML, we have the following inf.

- 30% of the people know SQL.
- 80% of the people who know SQL also know Excel.
- 40% of the people who donot know SQL also know Excel

Among those who know SQL, what is Probability that they know Excel?



→ know SQL & Excel

→ know SQL & don't know Excel

→ don't know SQL & know Excel

→ don't know SQL & don't know Excel

$$= \frac{240}{520}$$

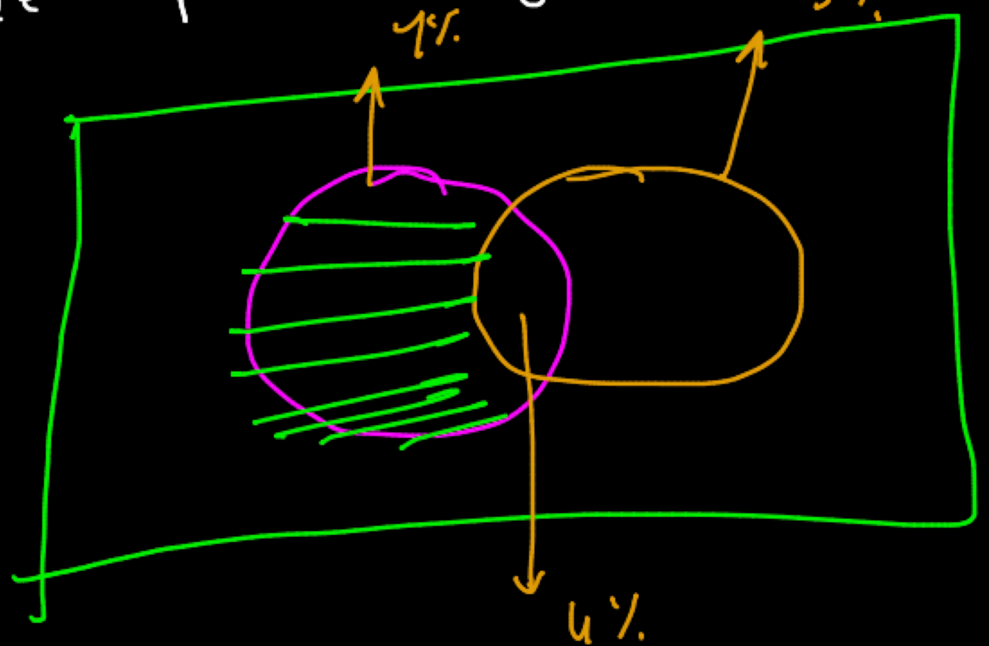
$$P(SQL \mid Excel) = 0.46$$

$$= \frac{P(SQL) * P(Excel \mid SQL)}{P(Excel)}$$

$$= \frac{0.3 * 0.8}{0.3 * 0.8 + 0.7 * 0.4} = \frac{0.24}{0.52} = 0.46$$

Dependent Events

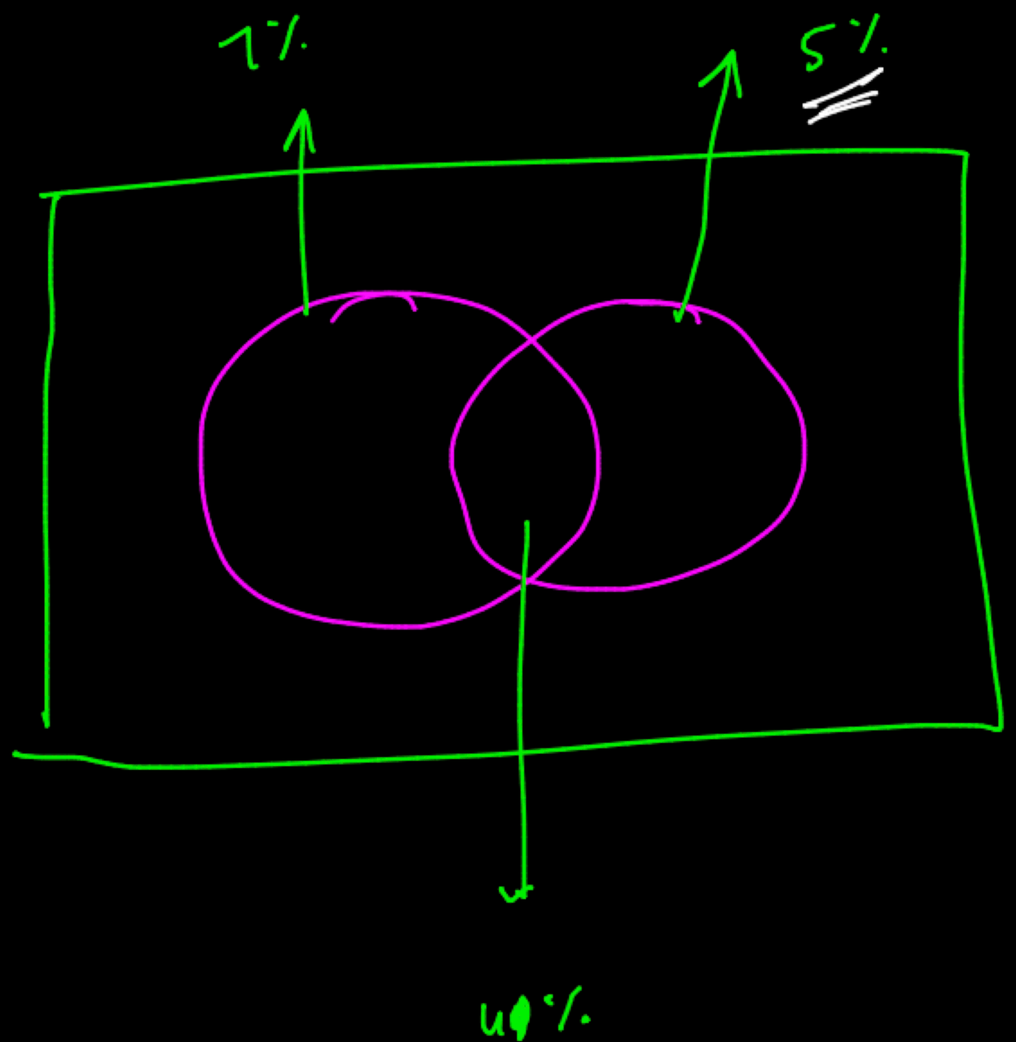
⇒ In a city, 7% of people are on Twitter. 5% of people are on LinkedIn. u% of people are on both LinkedIn and twitter. A random person is choosen. What is the probability that he is on twitter?



$P(T) = 0.07$

Quiz

A random linked in user is choosen. what is the probability that he is on twitter.



$$P(T \mid L) = \frac{P(T \cap L)}{P(L)}$$

$$= \frac{0.04}{0.05} = \frac{4}{5} = 0.8$$

$\Rightarrow$

The extra inf that a person is on linkedin, did this increase (or) decrease his probability being on twitter?

Dependent Events

Quiz

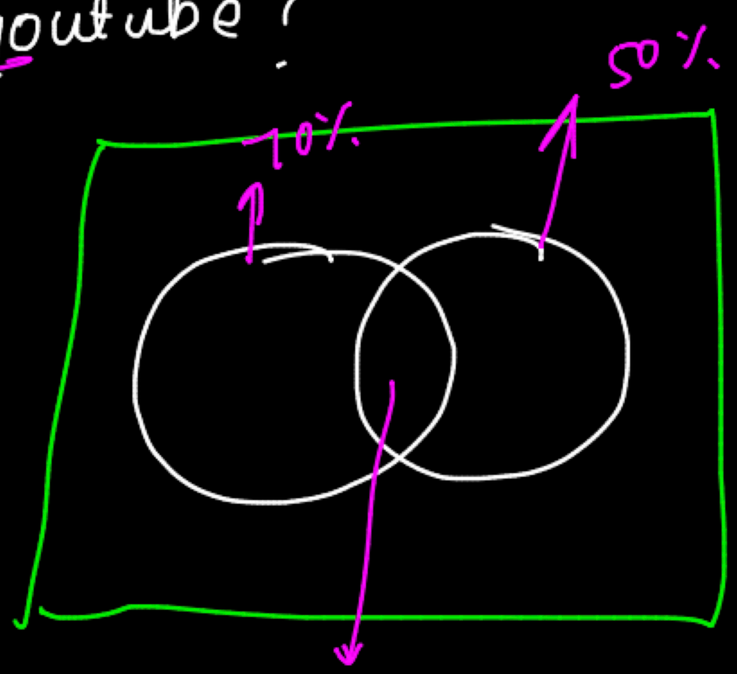
A website has noticed the following stats.

Among those who saw the ad, 70% saw it on youtub

50% saw it on Amazon, 35% saw it on both. A random

person is choosen. what is the probability that he saw Th

ad on youtube?



P(Y) = 0.7

=> Random person who saw the ad on amazon is choosen. what is the probability that he is also saw the ad on youtube ?

$$P(Y/A) = \frac{P(Y \cap A)}{P(A)}$$

$$= \frac{0.35}{0.5} = \frac{35}{50} = \frac{7}{10} = 0.7$$

$\Rightarrow$ A and B are independent Event

(1) $P(A \mid B) = P(A)$

$P(B \mid A) = P(B)$

(2) $\dfrac{P(A \cap B)}{P(B)} = P(A)$

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

=> If I toss a coin and throw a dice are these 2 events independent,

T2

$S = \{ H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6 \}$

A = coin is head

$\{ H1, H2, H3, H4, H5, H6 \}$

$P(A) = \frac{6}{12} = \frac{1}{2}$

B Dice is 3

$= \{ H3, T3 \}$

$P(B) = \frac{2}{12} = \frac{1}{6}$

$P(A \cap B) = 1/12$

$P(A \mid B) = P(A)$

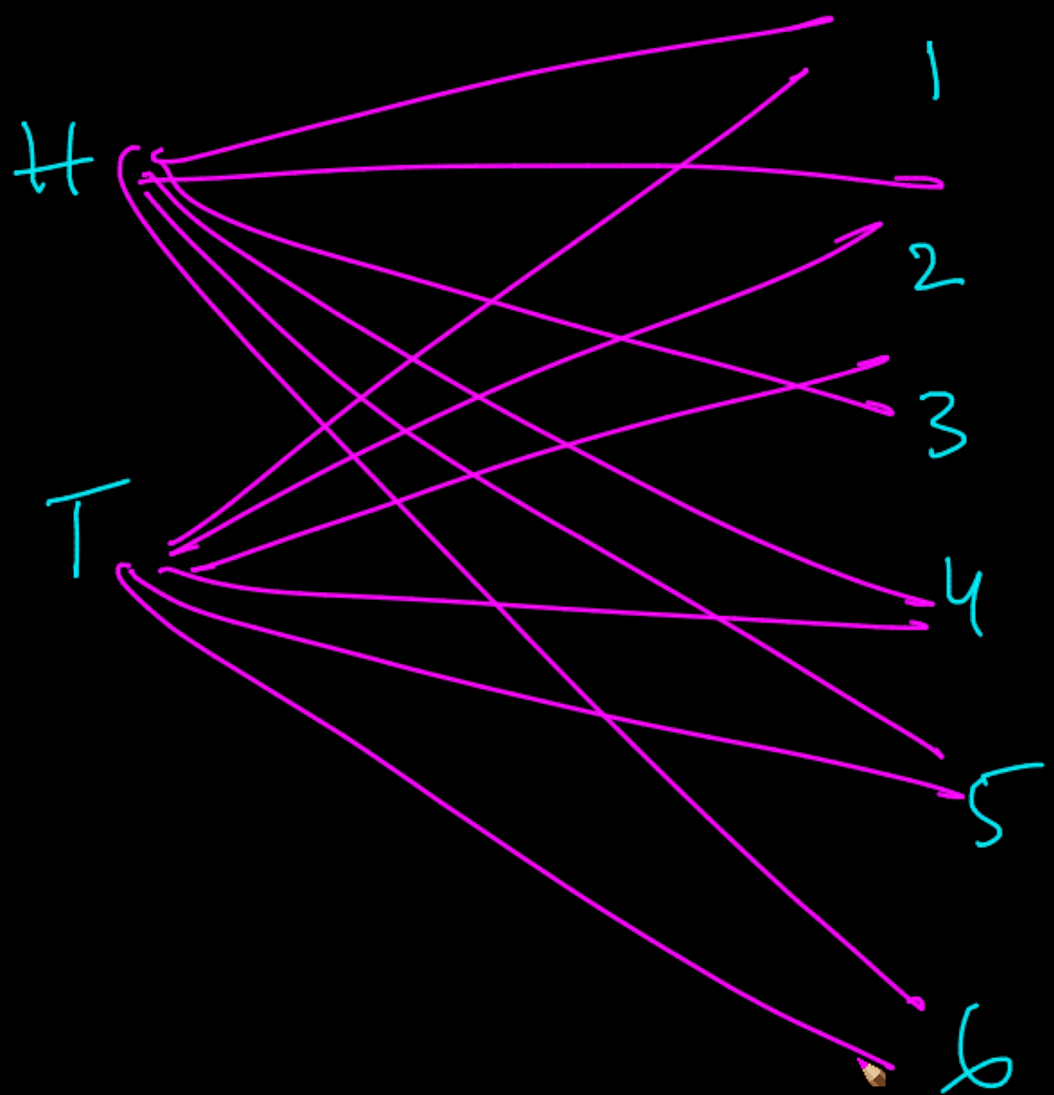
$1/2$

$\Rightarrow$ A & B

2 independent events

$$\frac{P(A \cap B)}{P(B)} = \frac{1/12}{1/6}$$

$$= 1/2$$


H
T
1
2
3
4
5
6

Microsoft

=> 50% of the people who gave the first round we 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 felt good about the first round. What is the probability that he cleared the first round.

$P(A \cup B) = 0.5$

$P(A) = 0.3$

$P(B)$?

A & B independent

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

$0.5 = 0.3 + P(B) - P(A) * P(B)$