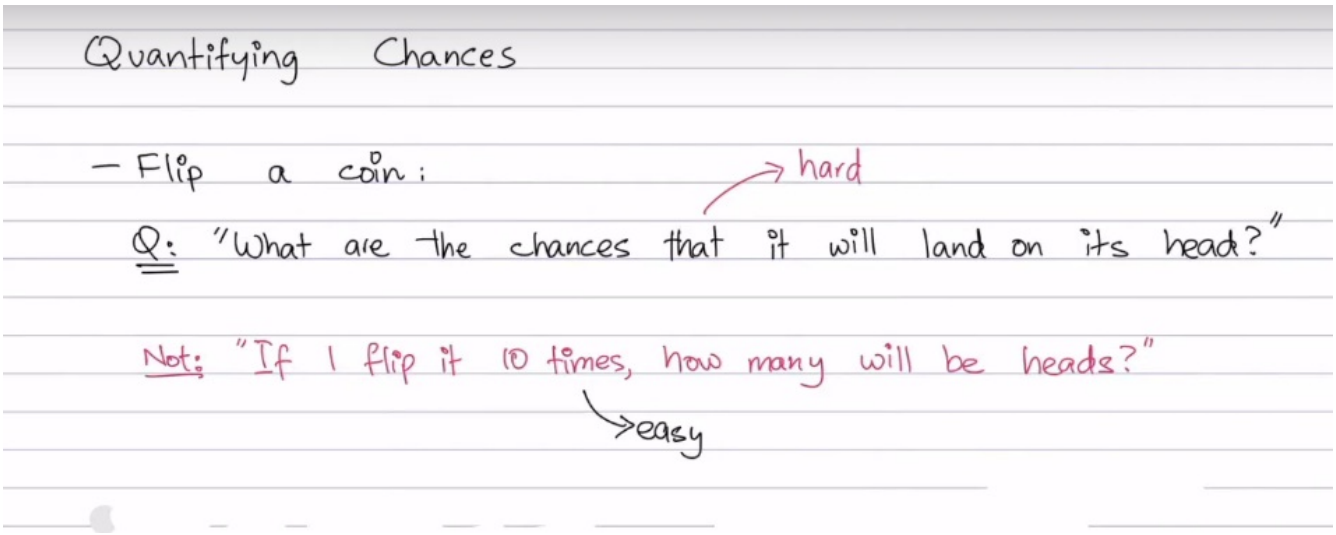
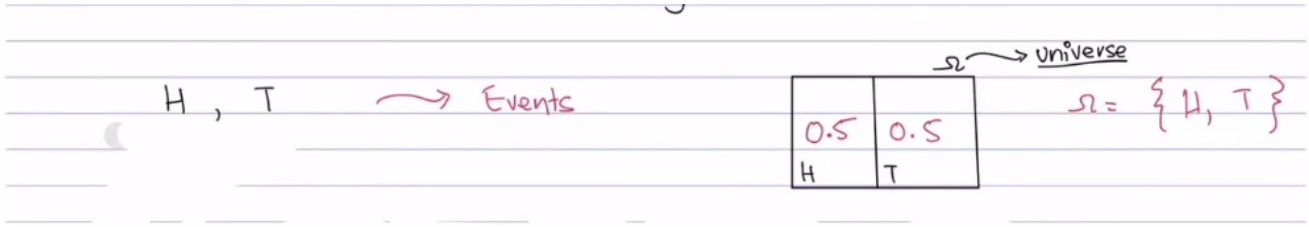
Lecture 8 :

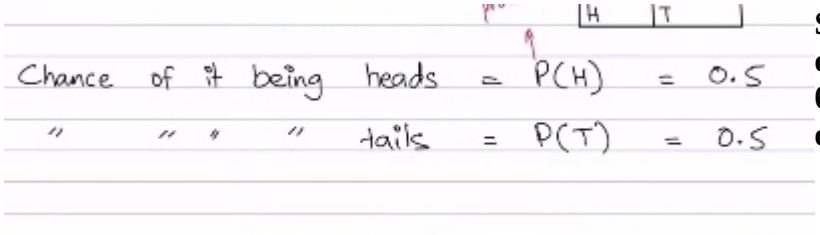


Here are two questions first one is hard and the second one is easy
- first one is hard because u do one flip and before the event occur u have to guess either it will be head or tail
- second one is easy because u have to count how many heads will occur if u flip a coin 10 times(u just have to count)

Event: An event is **an outcome or set of outcomes resulting from an experiment**.
Mutually Exclusive: two or more events that cannot occur at the same time.



This is an universe in which only two events occurs either head or tail
it is represented by omega.
now it is given that the **both events are equally likely** → so it answers the question the chance of getting the head or tail is **50%.**
The chances of its lying on head is 0.5 and its lying on tail is 0.5.
either it will head or it will tail nothing else → looks like the binary number either 1 or 0
So flipping a single coin equals to 1 bit of information.

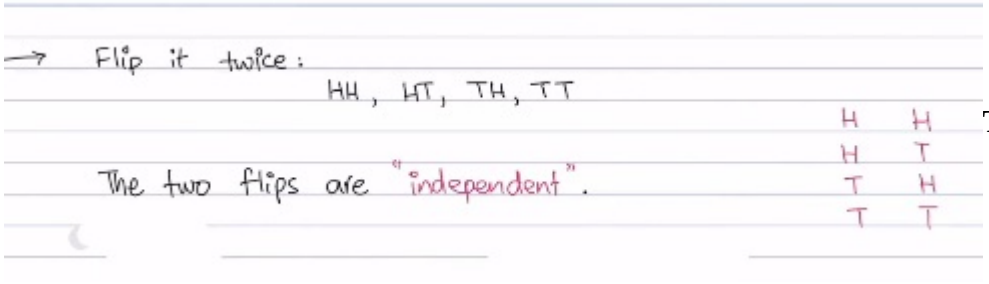


So chance of being heads or probability of heads is 0.5 .Similarly probability of tail is 0.5.

Axiom: Something u can't prove but u agree to it because it makes sense.
In probability there are ***two*** axioms((which we can't prove but everyone agrees to it because they are very rational).

1. Probability of an event must lies between 0 and 1.
0 → it is definite that it will not occur.
1 → it is definite that it will occur.
(we are talking about chance so yeah what will be greater than if u know that something will definitely occur)
2. Sum of all events must be 1. (suppose take the example of coin so we already believe its in definition that there will be only two events head or tail so there both probability will be equals to 1 because what else is there we already say that there are only two events).

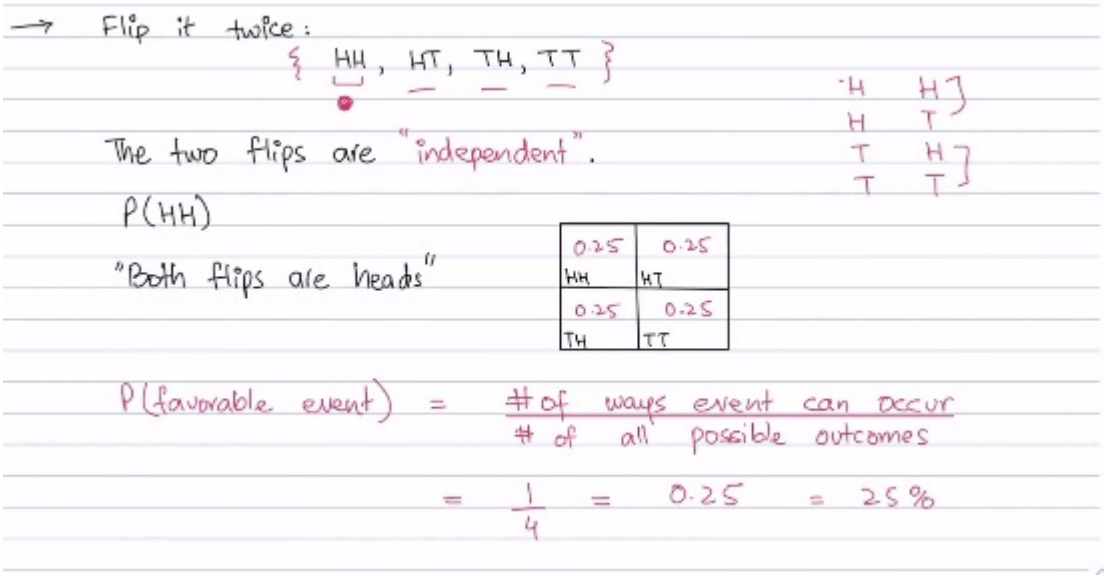
Now take the example of two coins



TRUTH TABLE

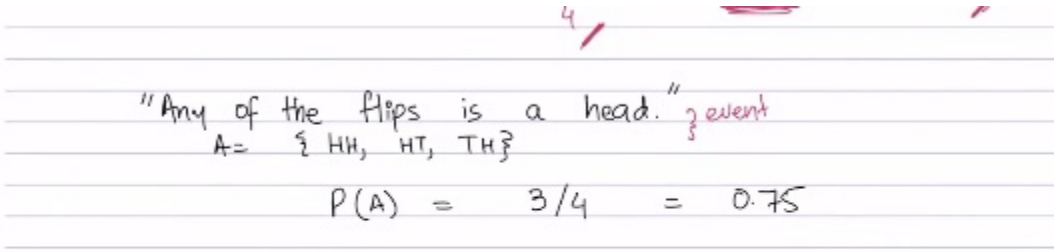
flip it twice now there are ***four*** possibilities.
Two events are independent means that the second event will not be effected by the first one .

- ***Now if we want to find an event that the both flips are head.***
- ***As we now that sum of all will be equal to one and the no of possible outcomes is 4 so***

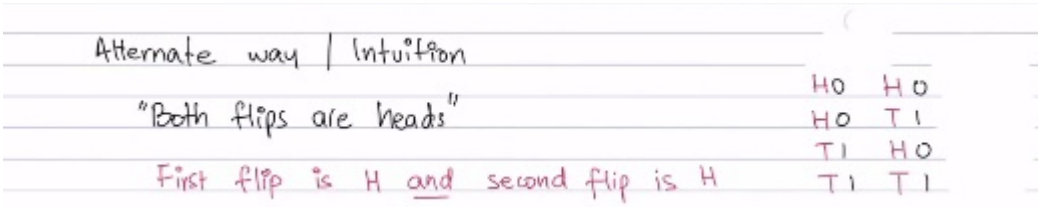


probability will be ¼ as there is only one event in which both head occurs and all the four events are equally likely.

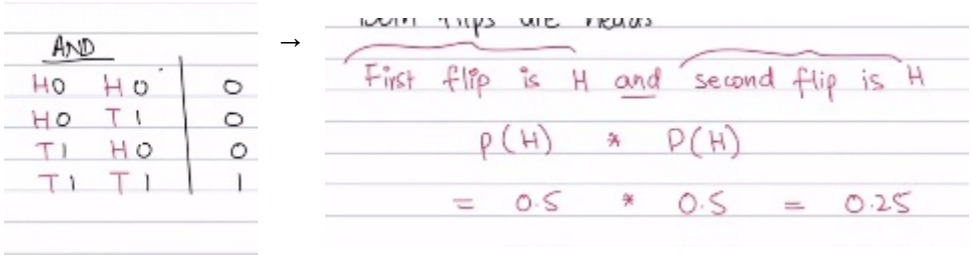
If we want to find any of the flip is head. So there are three events in which at least one head occurs so → ¾



Alternate way :-



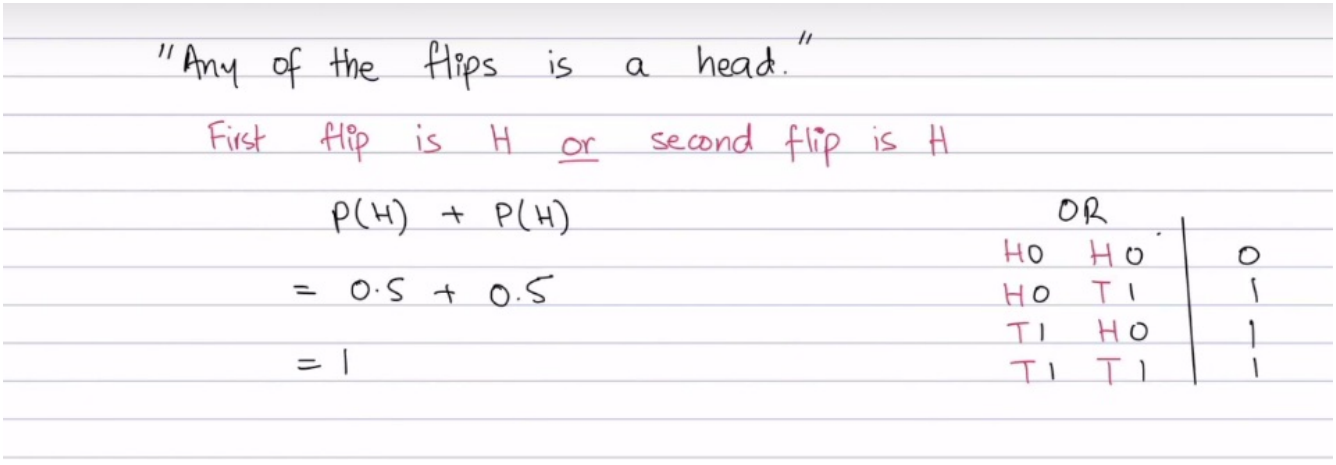
As we say that truth table is similar to it and also in the statement and is used so if we apply the and truth table to get to the answer



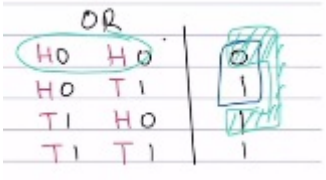
As *AND* is used and we *multiply* in *AND table* so if I multiply the probability of first event with the second and yeah we got the correct answer.

Two combine event probability will be less than the events independently.

Let's try to use this intuition for the second question

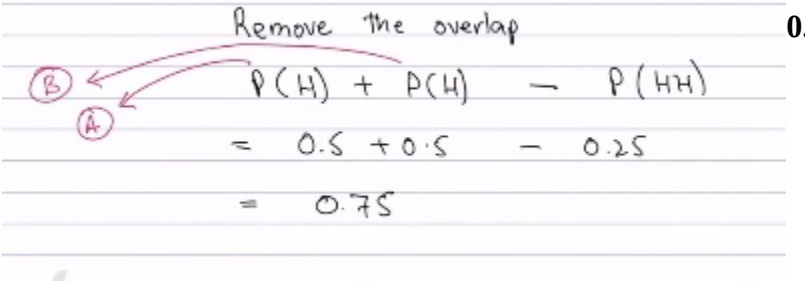


As OR is used so we add but we got the wrong answer ,Intuition here failed.



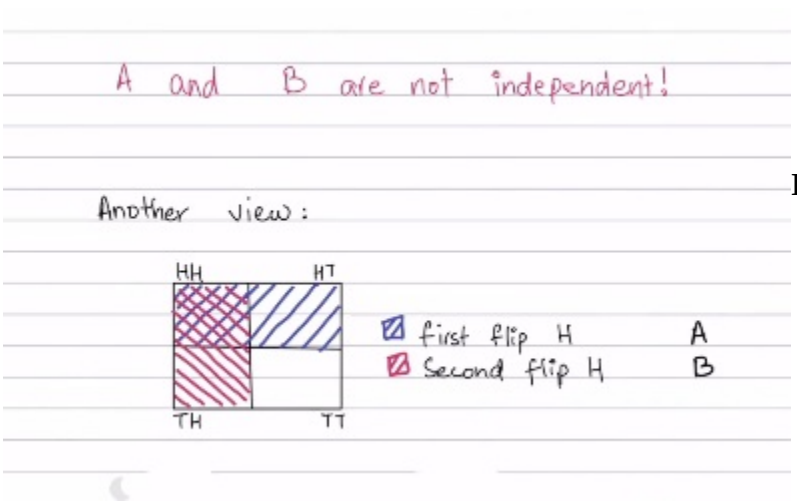
We are counting the HH two times
for first flip is head → HH,HT
for second second flip is head → HH , TH

so remove the one HH
as we calculate above the probability of HH is 0.25
so

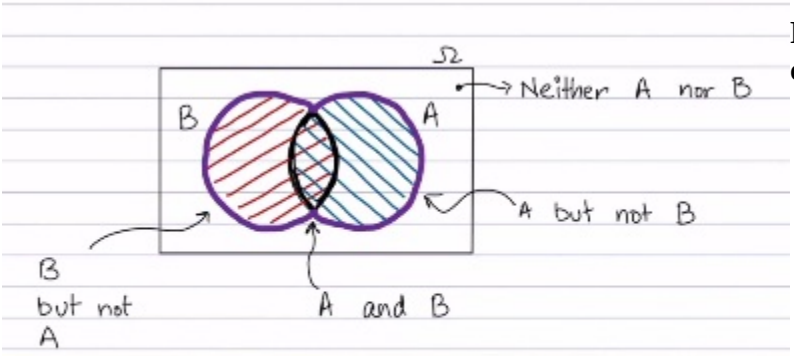


0.75 the correct answer.

Now these two events are no longer independent .

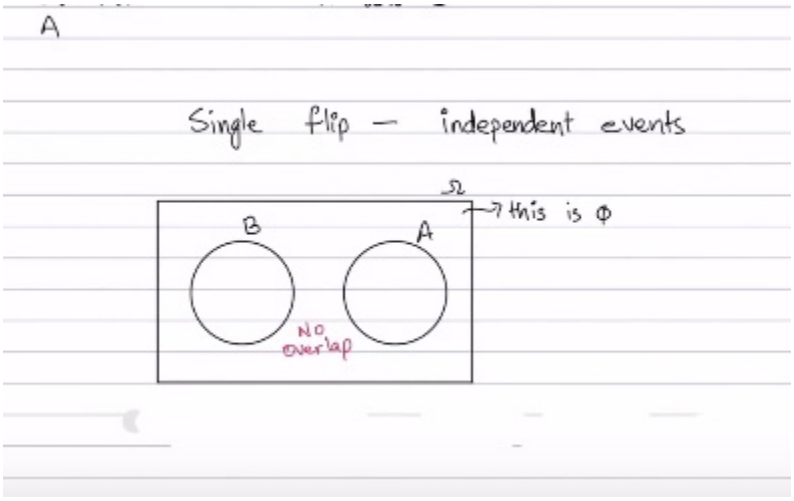


Blue area is first flip is head
Red area second flip is head
HH area is overlapping



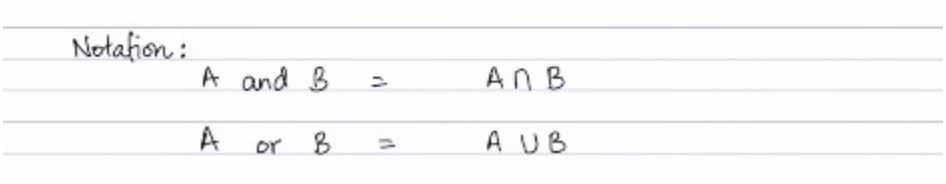
Represent above diagram in circles

independent events → no overlap



so formula will be

P(A or B) = P(A) + P(B) – P(A and B) *subtracting the overlap area*



Overview of the lecture:

- ***defining a problem in which we see that quantifying the chance is necessary.***
- ***Uncertainty.***
- ***Example of flipping a single coin which looks like binary number.***
- ***Chance is probability.***
- ***Two axioms of probability.1 → probability lies btw 0 and 1 2. → sum of all events must be 1.***
- ***Two flips example.***
- ***Compound Events . Example : Both flips are head. Formula → # of ways an event can occur/ # of all possible outcomes → n/N***
- ***Alternate way using truth table.***
- ***Overlap problem in OR case → we are counting HH two times.***
- ***Venn diagram.***