IIT Madras

ONLINE DEGREE

Statistics for Data Science – 1
Professor Usha Mohan
Department of Management Studies
Indian Institute of Technology, Madras
Week 6 - Tutorial 5

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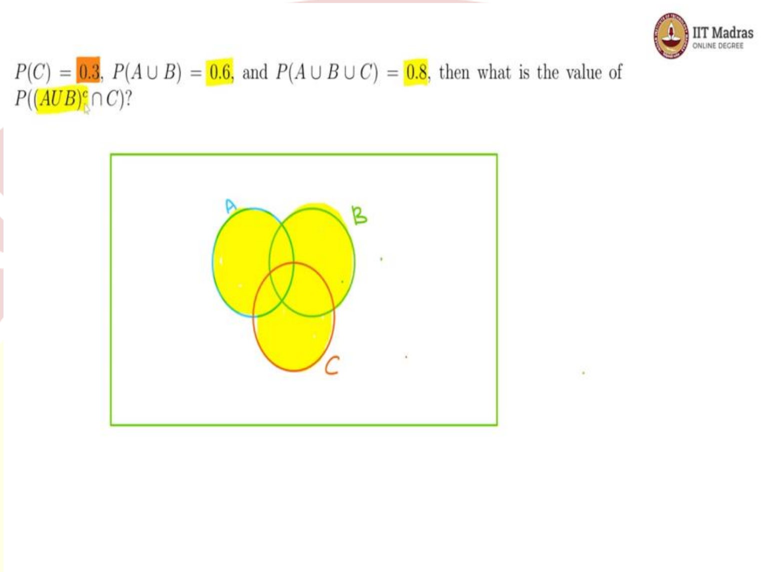

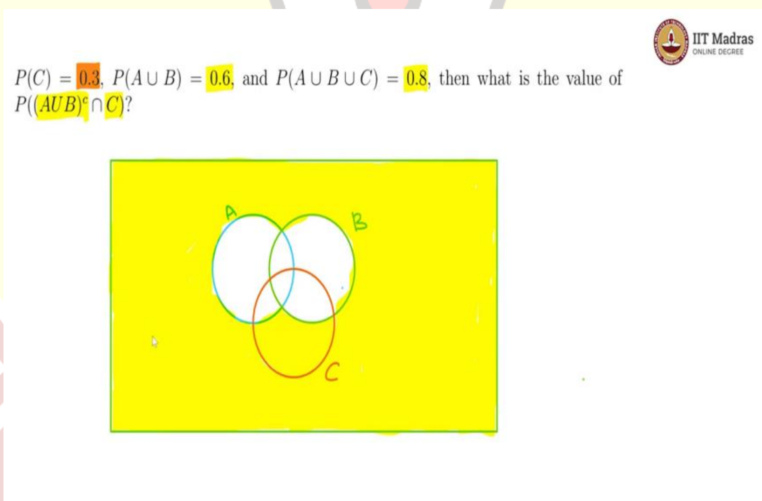

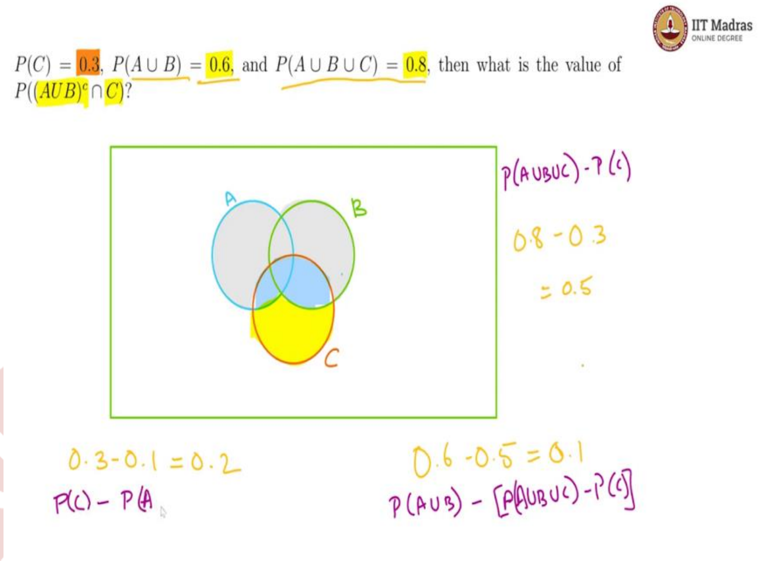

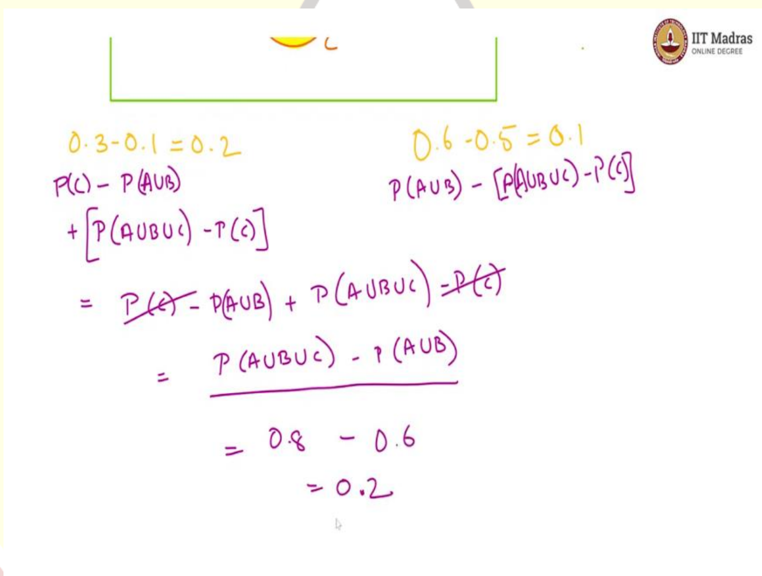

In this problem we are looking at some sets, the probability of set C is 0.3, so for this let us try to draw the Venn diagram. So, let this be the universal set, so this would be the sample space and within this we have three sets C and A and B, let this be set A and this is set B and this is set C. So, this 0.3 indicates that this area which is the set C's area is 0.3 of the total area that is 30% of the total area.

And then this 0.6 is the union of A and B which is roughly this, so that is 60% of the total sample space and lastly they are saying that 0.8 is for A∪B∪C, so the union of all of this is 0.8. So, now they are asking what is the value of $(A\cup B)^C \cap C$, so $(A\cup B)^C$ is everything outside of A∪B which is all of this.

And you want the intersection with C, so we only look at the part where C is also involved which is essentially this portion. So, we want this one's area we know that totally C is 0.3 and we know that totally $A \cup B \cup C$ is 0.8. So, if we remove C from $A \cup B \cup C$, we will be looking at this portion which is then $0.8 - 0.3$. So, this gray portion is 0.5.

And further we know that $A \cup B$ is 0.6 so this blue region here that is going to be $A \cup B$ minus the grey region which is $0.6 - 0.5$ is equal to 0.1 and we know that this yellow region is essentially all of C minus the blue region so that is $0.3 - 0.1$ which is equal to 0.2. So, here we are saying $P(A \cup B \cup C) - P(C)$ is 0.5 and here we are saying $P(A \cup B)$ minus this 0.5 which is $P(A \cup B \cup C) - P(C)$.

And lastly here we are saying it is P(C) minus whatever this whole thing is. So, if we applied that we will get $P(C) - P(A \cup B) + P(A \cup B \cup C) - P(C)$. So, this gives us $P(C) - P(A \cup B) + P(A \cup B \cup C) - P(C)$, so P(C) is getting cancelled here.

So, we are effectively left with $P(A \cup B \cup C) - P(A \cup B)$ which also makes full sense because this yellow region is essentially the union of the 3 minus the union of A and B. So, yeah if we substituted that directly here also we would get $P(A \cup B \cup C)$ is 0.8 minus $P(A \cup B)$ is 0.6. So, we get 0.2.