Probability and Stochastics for finance-II
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Lecture - 20
Final Lecture

So, this is the last talk of this course a 10 or course of the part two of probability and stochastic for finance it is a very, very broad subject broad subject matter it needs a lot of understanding lot of work, I myself need to study much more deeper the mathematical finance is very, very big area, what I am going to show you.

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Now, is it how do you calculate this delta t that you are at every time t how do you know how much talk to by which is which was very simple in the case of the two period modal now. So, the title of this lecture is final lecture these are relaxed by ten hours schedule or this is just bonus. So, here the K 2 finding this is done by using something called a martingale representation theory. So, what is the martingale representation theory? So, martingale representation theory I am says give me any martingale right which is adapted to a filtration associated without Brownian emotions.

So, you will have the Brownian emotions you have the filtration associated with the Brownian emotions and also you have MT adapted to the filtration FT and is a martingale. So, how martingale representation theorem says how do I represent the martingale? So, it says the there would exist and adapted process is adapted to the filtration tau u or exist and adapted process tau u such that. So, this is the delta this is very important this quantity, as that MT is equal to M0 plus 0 to t tau u d w u. So, this is call a martingale representation process every marks what does it says it says every martingale can be represented that is the whole thing. So, a martingale representation theorem every martingale can be represented as a e to integral.

Now once is this done easy to figure out how to do that it does not matter. If you have a martingale under the Brownian emotion under p tilde you will have the similar sought of representation theorem. So, I am not getting into the details of this. So, if I look at our process or our new risk neutral valuation. So, this is something we have all ready seen this formula is now known to us. So, this martingale this this is known to us because these all x t and this is capital X t which is v t even prove. In fact, sorry in the risk neutral measure you can prove this is a martingale. When I do not want to prove it is; obviously, you can understand it is the same thing that, we have done already now if this is the martingale then it must have a representation. So, there must be some gamma u. So, I am doing the representation with respect to the risk neutral measure d 0 is one that is why just you have v 0. Now we have also seen at d t x t we have also proved it earlier was x 0 plus 0 to t delta u sigma u s u d w u we have seen this we have prove the martingale the fact that this martingale why is using the fact that these e to integral in martingale.

Now, sorry there is x 0 now what we know we know that v t must be equal to x t and v 0 is equal to x 0 that is what we know. So, in order that these two are same these two integrals must also co inside these can be done if we choose delta t sigma t s t is equal to tau u see by choose this tau u or tau tilde u does not matter. So, delta t, there must be some process with respect to each this is the delta t that is enough our course this is just on. So, we have done a large amount of work here, we started with the very basic notions of interest rates then yield of curves then optimization modals in finance then we went to portfolio optimization for which we may details study then, a brief over kind of the capital asset price you modeled then we did the option price seeing in the discreet time an option price seeing in the continuous times. So, in this 10 hours time a huge amount of material has been packed in. So, you need to also consult books you need to consult the net be careful when you take things from the net.

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I was also shown books for example, these book which have to show again and again shown in the part one that these two books, have stochastic calculus for finance by volume one and volume the fact one is volume two which is for continuous time and volume one is for discreet time they should be a must you know, if are anybody working in finance anybody who likes finance paralegal finance should have these two book, with these I hope that here we enjoyed the course you can give the feedback my tears would come back if there are questions, if the question I what the teaching with horology, but I would again retread that please do not put in personally emails to me stating that oh you should have thought us Lebesgue integral I knew some people might's you must might should have discuss ethos formula before you do it all these things, but again and again I am telling it was formula is all ready if done in detail in part 1. So, cannot be done here now this is the part two our course of which is good if you have look at the part 1.

We are expecting a lot of things from the students that of in finance there is the lot of pressure on the quant's the guys who work in continental finance is that there were to have a hold on lot of aspects of mathematics is not just then, you have to more some probability and then, the can just go of or some stochastic process they have to have hold a lot of aspects of mathematics and these actually puts in humans pressure on them. So, here I am expecting that the students would have a lot of my some basic knowledge of probability some basic knowledge of stochastic process they would know what a normal distribution is etcetera, etcetera, etcetera there a sudden assumptions under which have working it is not a very basic or introductory course our Lebesgue integration. So, I had a student riding to me that oh you did not bother of teaching Lebesgue integration in details, but possibly they do not know that Lebesgue integration is complete course mathematics is a deep think mathematics is what about solving some complicated problems where algebraic manipulations, so what deep ideas.

So, this I also tell you that this is as the beginning of finance you had in the complete market real market is incomplete how would you handle things in incomplete market is a very, very fundamentally show research now what it is this new ideas call indifference pricing etcetera which has come into the market that is a lot of things which had been started in the theory of risk using convex analysis for example. So, that lot of things can be studied. So, that the mathematical finance has in deeded a very broad area it involves very good math deep mathematics, but is not always the they that things that we do here is practically viable these thing this modals are built under very ideal condition just in physics you will modals on the ideal assumptions which may not exactly be replicated in nature here also things there we do your may not be exactly we replicated in the market may not be exactly market may not be exactly as that, but these modals helps us just like in physics to understand some aspects of how financial markets behave.

So, financial markets also have this human aspect in do it which we were not going to do it call behavior finance, but here it is mathematical models which actually helps us to do some pricing which helps us to gage what should Bhima investment. So, your mathematics does play a very important role. So, I hope that a large part of view large number of view who have enjoyed the course and I am sorry, if they someone who is being left out in from the old discussion not finding it comfortable we our tears my tears would be very happy to help them.

So, thank you thank you once again I wish some of you in who has done both the part of this course would actually become, a quant and take a mathematical finance in the future

Thank you.