Quantitative Finance

Prof. Raghu Nandan Sengupta

Department of Industrial and Management Engineering

Indian Institute of Technology, Kanpur

Module - 05

Lecture – 30

So, welcome back continuing our discussion in the pictorial sense that, how you combine the different above forward and options. So, in the last class we have seen that, we have been able to combine the forward and the option means; such a way that your main motivation was that the prices r or n, decreasing trend and you want to reduce the price. So, let us now consider the other way round. Now, those were all long forwards.

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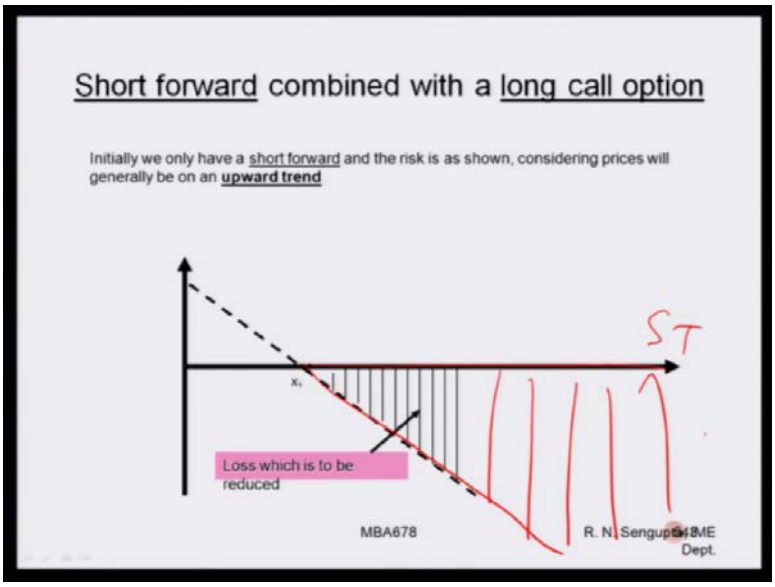

Now, you have basically a short forward and the prices are increasing trends. So, just concentrate on in this pure short forward. So, in the case this is ST, I am not mark in the graphs, but definitely we all know this is ST and along the y-axis we have the profits; cumulative profit or the net profit.

So, if you consider the price of ST is greater than X1; obviously, there is a loss. So, the more the ST prices more than X1; obviously, the loss increases. So, this is the overall loss which you have. Is continues. Now you have main question is that, that if their on and you want to combine short forward in the option. How would we do, such that the overall is reduced, pictorially again. So, let us see how it is done.

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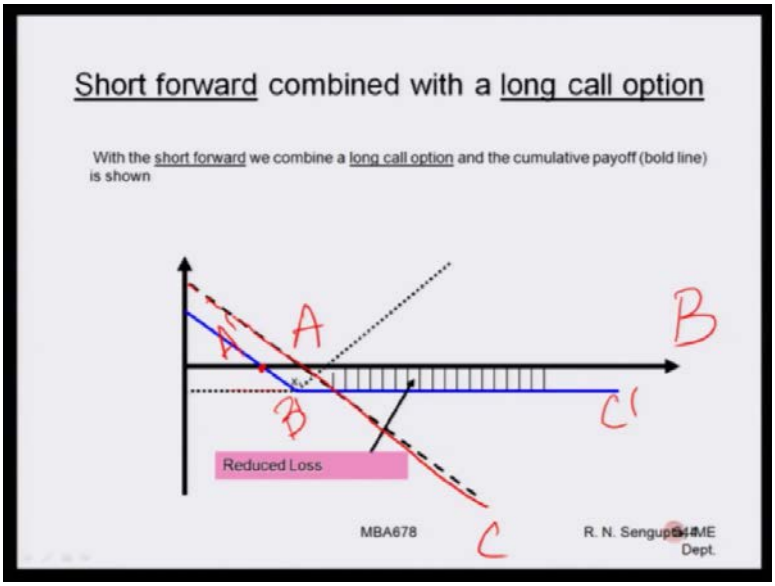

Now you combine a short forward position along with the long call option. So, initially it was a short forward where the prices are on a increasing trend, you would have phased a loss. Now you combine with the call option. So, the bigger hash lines, the red one which I am now marking is basically the initial position short forward. Now you have the small dotted one; which you have marked is basically the long call option and once you combine then the blue one which you see is the combined loss. So, initially loss was A and considering it is going towards B, some points obviously; And C. So, the graph was basically expanding triangle which is A B C. Now what we have been able to do is that? We have been able to reduce the loss by A. Considering the point A is the same thing, or let us it will be more explicit. Consider the overall loss as A1, then B1 and it continues. So, say for example, C1 is somewhere down the line. So, if you see the overall loss with respect to the diagram it has definitely reduced considering the prices are a increasing trend. So now, what you have done? For increasing trend price initially whether short forward position, now we have basically combined with the long call option. Next diagram.

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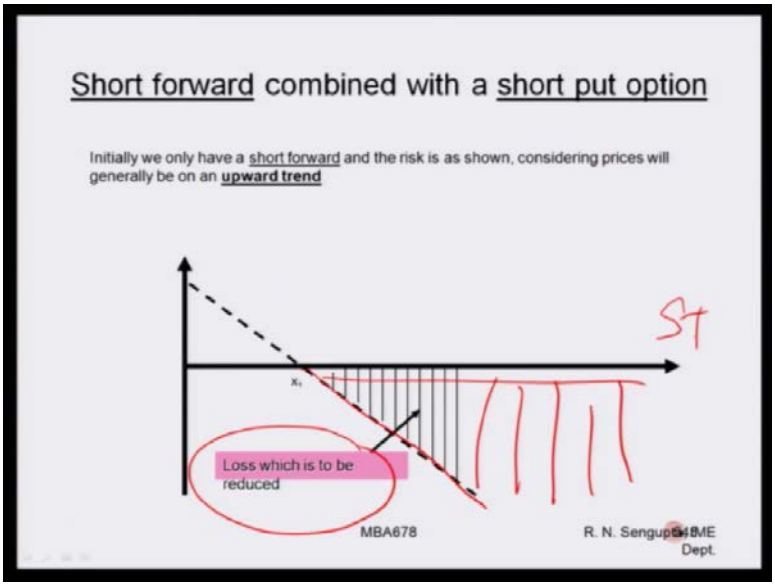

Again the same thing. We have a short forward position thinking other the next the bullet points I am just mentioning. You think to the prices on a upward trend, you basically combined with the short option. So now, you have basically put options. So initially it was a call or it is a put. So, you want to reduce this overall risks; again this is this is increasing triangle, which you have already shown. It keeps increasing and overall loss increases as ST which is here along the x-axis keeps increasing more than X1. Combine that the short forward is the short put position, what do you have?

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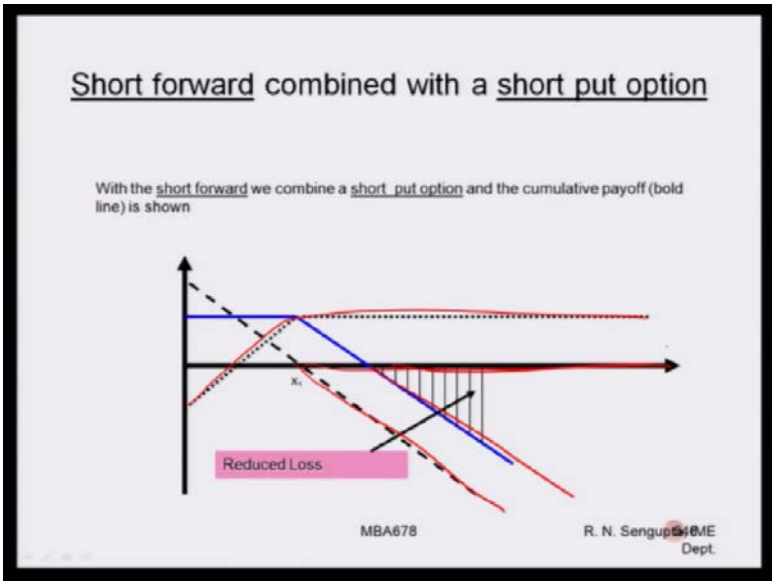

You combine this, this is the short put position. As you combine you see the overall loss which was this triangle, has now been reduce to this triangle. So obviously, it seems that

the; obviously, the loss is definitely there, but you have been able to combined and reduce the loss to a maximum for some extend. That initially the short forward has been combined with basically the call and the put or with different combination of that, such that in the long run. The overall position does give you a picture, that the overall risk is reduce to maximum possible extend.

So now, initially we are consider two examples; where the prices you think if the event on downward trend you face a loss, then you consider the prices are going on upward trend. You face a loss and then you saw that how combining different type of forwards along with the option pictorially we can reduce the overall risk. So; obviously, with this pictorial is true, you can make very simple and nice matrices to understand how this works.

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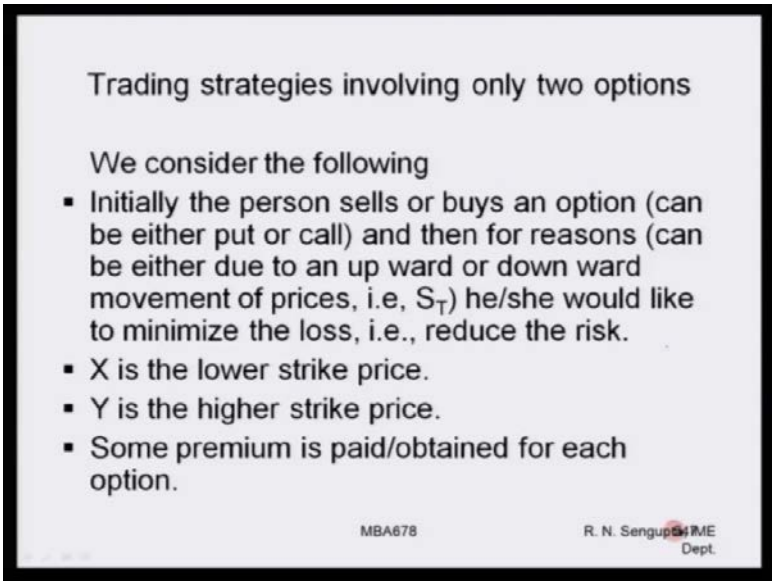

Trading strategies involving two options. So, we will consider the following; again we may have done it. But now I am again repeating, please follow the diagram explicitly such that make things much clear for you. So, if you are able to understand the diagrams was the first go immediately solve the problem using the matrices. But I will strongly argue that understand pictorial one first, and then for any new examples we; which you have taking out, follow the other root. First in a matrix and then make the diagram, because if you basically would make all the matrices very explicitly a very simple in excel sheet. Then using the first column which is the domain of ST and the last column would be the cumulative profit, net profit. Using these two columns you can make the diagrams for the pay of matrix for different combinations of forward, options and so

analysis was very easy.

So, as continuing, we consider the following thing. Initially the persons sells or buys an option can be either put or call; and then for reasons can either due to an upward trend or downward trend of the prices. He assured like to minimize the overall loss or reduce the risk. So, here we are changing the notion. Initially if you remember we use X as a strike price, but now we will use two different variables or two different symbols. Where X is the lowest strike price, Y is the higher strike price some premium is paid obtain for each option. And now we will consider that if it is the put option we will consider the price is a small p; it is a call option will consider the price as small c. We are not going to consider, again I am repeating we are not going to consider any American options all would be in European one.

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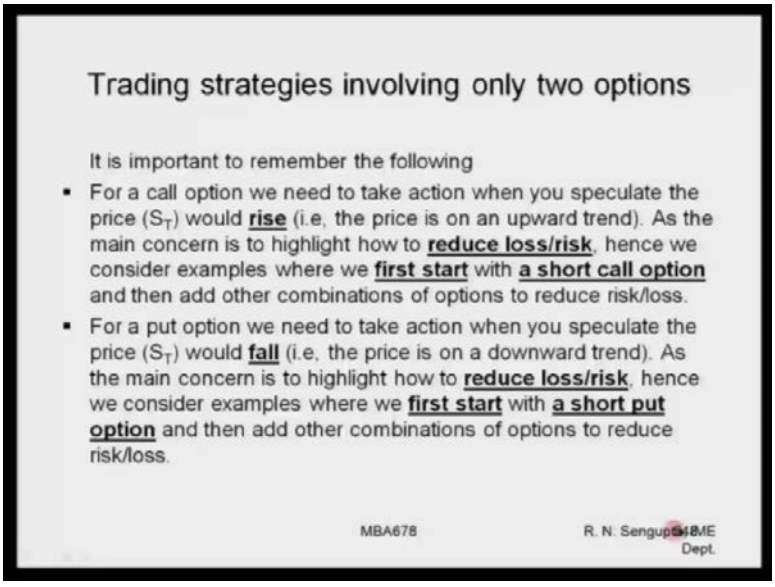

It is important to remember the following. For a call option, we need to take the action when you speculate the price ST would raise. That is the price is an upward trend, as the main concern is to highlight how to reduce the loss or the risk. Hence we consider examples, where the first where we first start with the short call and then add another combination option to reduce the risk. Now many come to the put option; for a put option we need to take action when we speculate the prices are on a following trend or a decreasing trend. As are main concern is to highlight how to reduce the loss and risk, hence we consider examples where we first start with the short put and basically combine it accordingly. So, in both the cases where is a call option, we think it the prices would be on a increasing trend and the second case of the put we think, it will be on a

decreasing trend.

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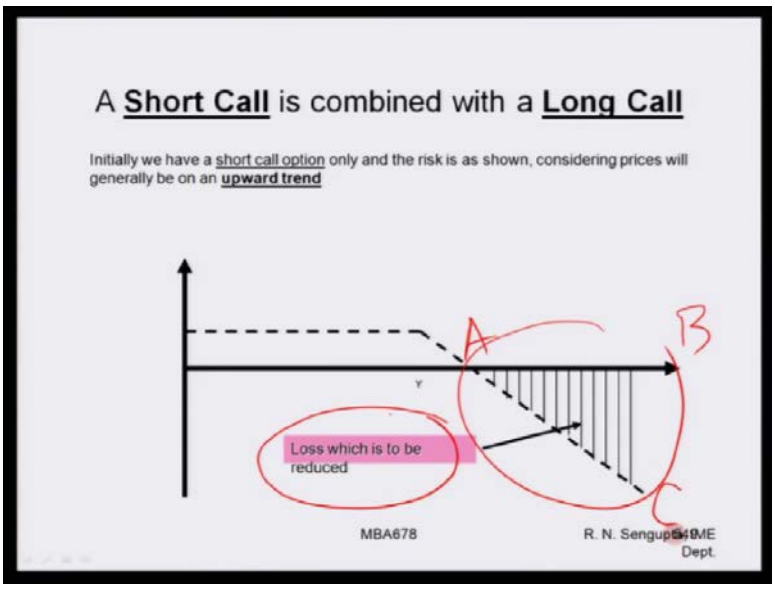

So now, consider here. We have a short call is combined with the long call. So, if you consider only this diagram has been shown, you have basically a short call and the overall loss is the hash one which is shown here. So; obviously, it would be triangle A B somewhere there, C some where there. There is a increasing triangle. So, now the price is given as Y remembers that. So, there are now 2 or 3 or 4 different type of strike prices depending on how the problem has been formulated. So, the pink line area which shows is the loss which has to be reduced.

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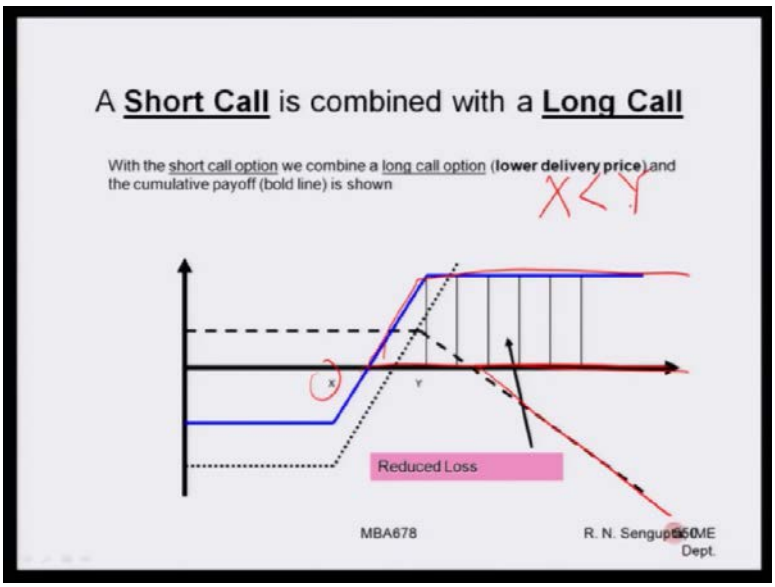

Now, we combine that, with the short call position has been combined with the long call position but remember that the prices was different. Initially, it was X for 1 short call option, now for a long call option the prices is basically delivery prices X. X is lower; remember that it is lower. It did not be higher. If it is higher obviously the diagram would change.

So, with the short call option we combine and long call option, lower delivery price and the cumulative pay off bold blue line is shown. So, if you see, the overall loss initially was this triangle. Now the overall loss is basically the hash line, which rather than loss is a profit. So, this is just notion on concept. It could have been on the lower side also. This blue could have been a lower side also, but be rest sure the overall loss would definitely be reduce. The movement you combine a short call option with a long call option, but remember the long call option would basically have a lower delivery price. Which is X and will always consider X is less then Y.

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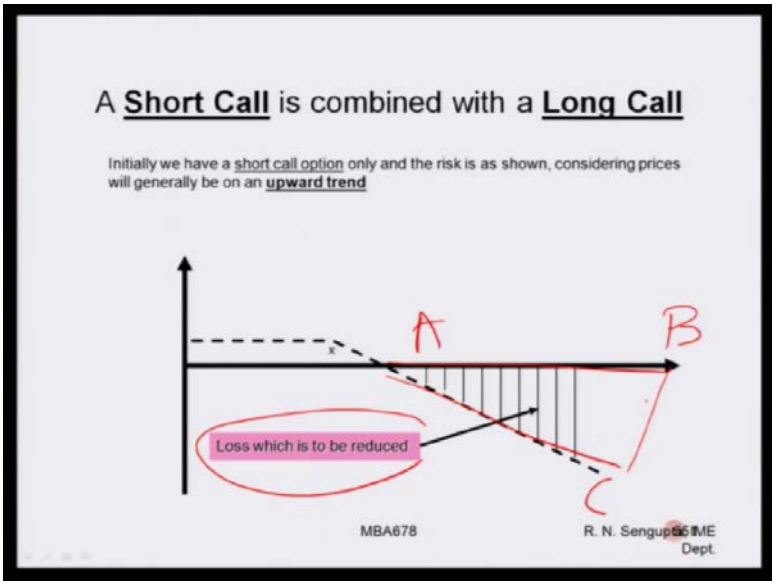

Now, we have basically short call option and considering the prices will be on a upward trend. Again the same thing, we have considered here. Again the remember, this is a certain difference. In initial case, of the first problem we consider that the strike price was Y, but now we are considering this strike price is X. So, we will combine in this way, very simply. First will have basically option whether delivery price was higher and will try to combine with an option later on whether delivery price is lower. In the next instance which switch it. In the sense that we have some option when the delivery price is whatever it is, but now will combine with the option when the delivery price is higher.

Only to make our understanding very simple, we have always consider Y is greater than X. Hence we will say that label price if it is lower will always denoted by X, if the delivery price is higher will always denote by Y.

So, here it what is being shown? This is the loss which is to be reduce and the overall loss is basically given this triangle A B somewhere C. So, this A, B and C I am just denoting in order to make you understand. So, initially we have the short call option only on the risk is as shown considering prices will generally be on an upward trend.

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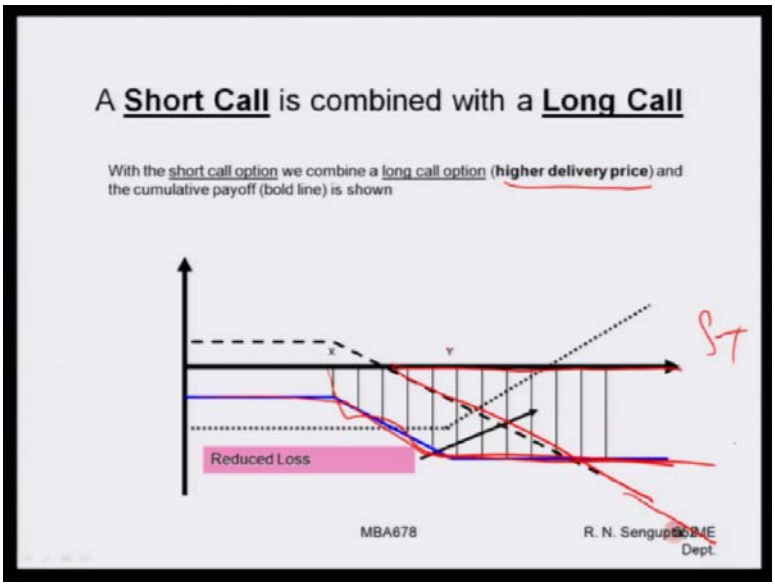

Now, we combine that with the long call option, but remember this. This highlighted points are important, that delivery prices higher, which is Y. So, initially if you see that your overall loss was this, now combine that we have been able to reduce the overall loss to maximum possible extend. Because if you go more down to the line, where ST is keeps increasing the overall loss in the first instant expires. But now we have been able to basically keep it within the bank such that the loss would be reduce the maximum possible extend.

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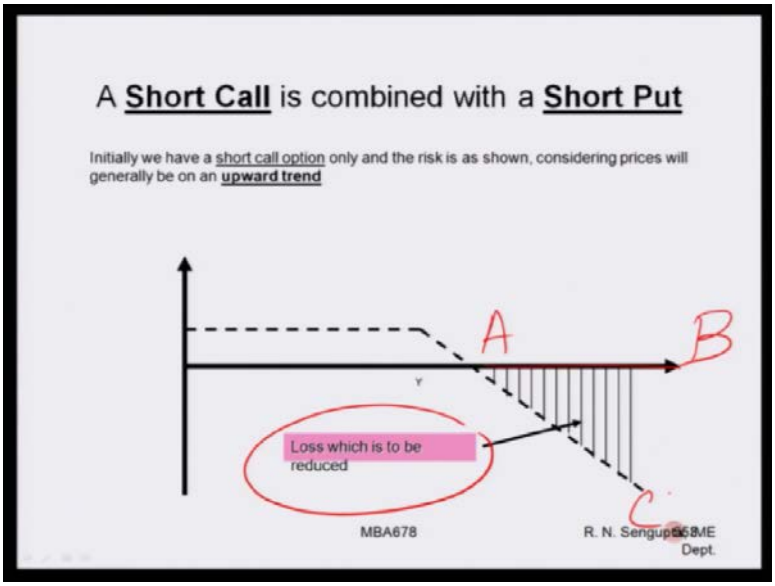

Now again a short call is combine with the short put, initially again will consider that the loss as shown in the pink one. And remember the strike prices Y, which means that now it should give you hint. That will now combine with the short put with the actual price of the second one option would be X would be less than Y. Because Y is always as for the assumption, if you remember in the first slide which you mention before you started a discussing. We said that Y was greater than X. So, initially we have short call option only on the risk is a shown considering prices will generally be on a upward trend, we have basically risk as given A B some point down the line, C is some point down the line.

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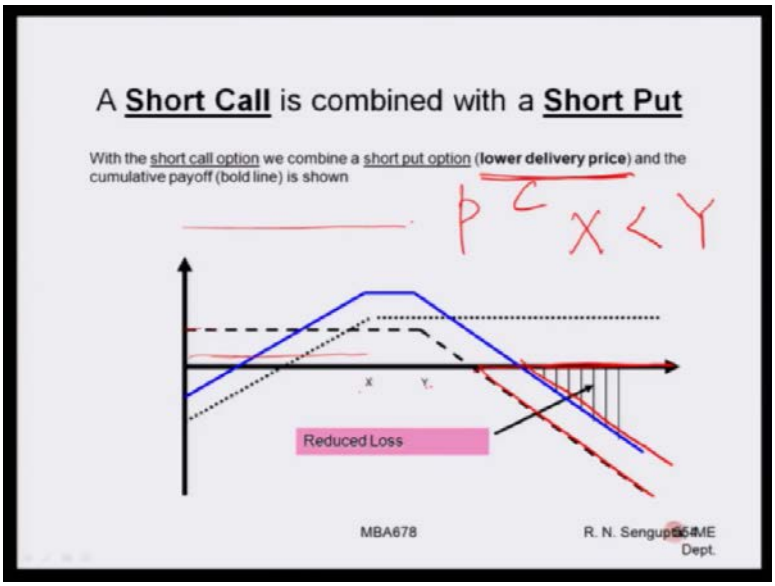

Combine with the short put option, but now lower the delivery price; that means, it will

be X. So, initially it was Y, now it is X; remember again, I am again repeating it; Y is greater than X. And when you combine it the cumulative profit is known as a bold blue line and if you see the overall loss was this. Now the loss has been reduce. So, what is should understand, the X and Y are just a notional concept in order to make you understand weather. When we are trying to combine an option with the lower delivery price or higher delivery price; point number 1. Point number 2 the P's and C's which we have combined that is the P or the C or the put on the call values, they have been taken arbitrarily.

So, if you see the big hash one could have been here also or the big hash one could be here also. So; that means, the over depending on where P and C are your overall whole blue line which is being shown here are the cumulative P of would change its position. But intrinsically if you draw it with the initial position, you will definitely see there is a reduction in the overall loss. If you see from the pictorial point of view and obviously, that may not be very evident when you draw the matrix. So, that is why I am saying that when you draw the matrix and then draw to the diagram things would be much clearer to you.

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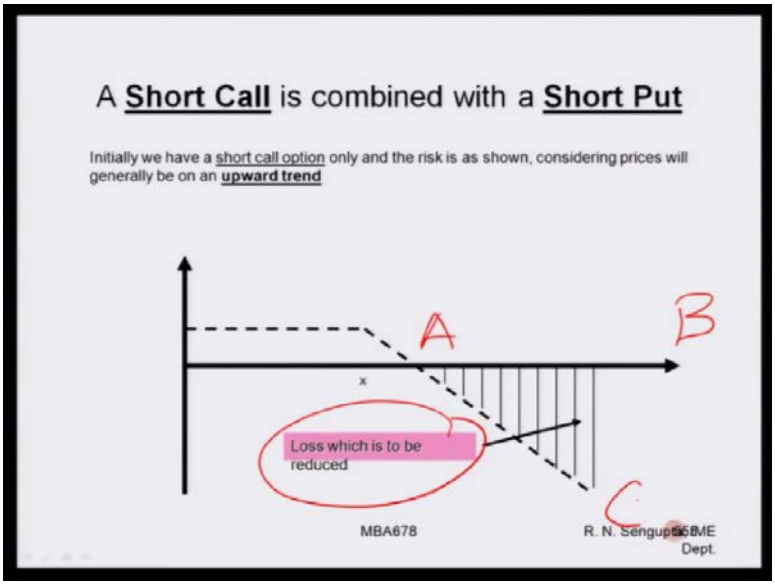

Initially, where short call option only and the risk is as shown, considering prices would be again on upward trend. So, this is the overall loss; consider this is A, this is B, somewhere points, C the somewhere point it expands as ST is greater than equal to X. X is again remember the lower price.

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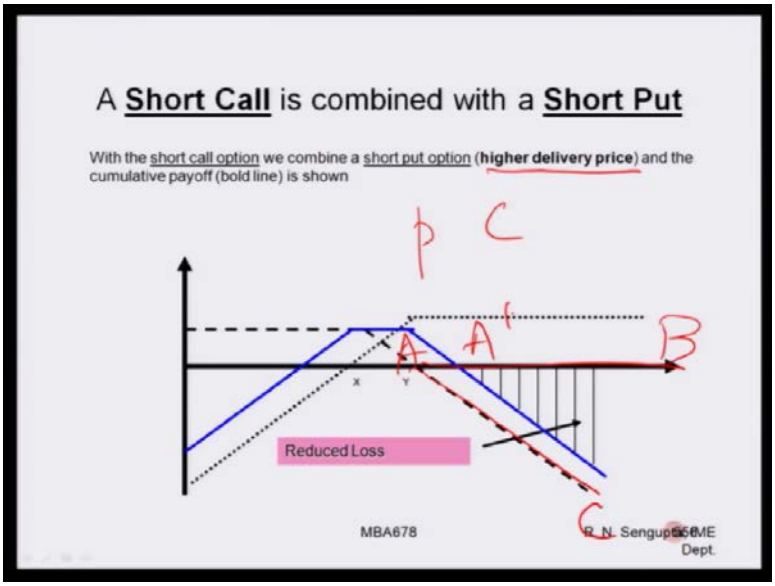

Combine with an short put option; that means, short call option have been combined with the short put option, with the higher delivery price and the higher delivery price is Y. So, and the cumulative profit is on by the bold blue lines; so initially again same thing. P and C can be any positions, I do not know. I have just drawn it arbitrarily. So, this was the initial loss; A B C. Now the overall loss would be some A1, B and C; that means, you are able to reduce the loss to a possible extend.

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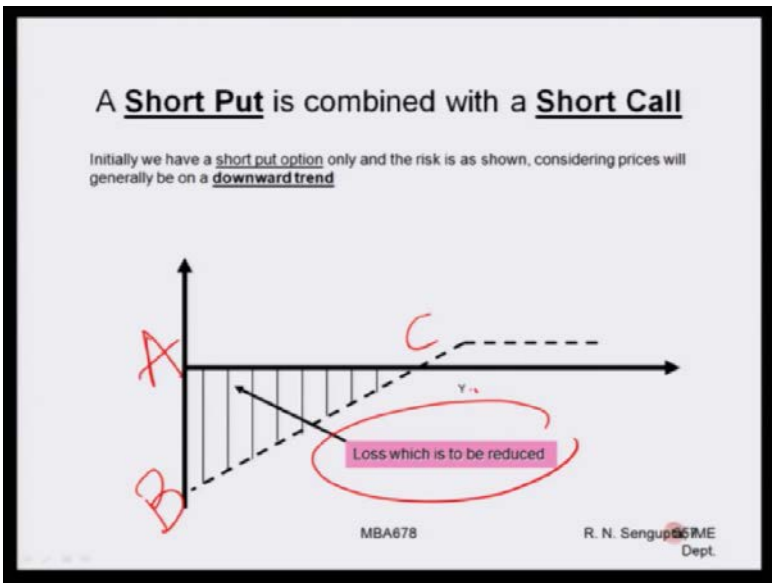

Now we consider the short put is combined with the short call. Initially we have short put and considering he prices. So, now, they are basically initially we consider higher and lower movement, considering the initially the forwards. Then we combine the options.

Now we start itself my option then combine another options; only that those they are call and put and the delivery prices have been marked in such a way, that they are X and Y where Y is greater than X. So, we consider they are on the downward trends. So, this is the overall loss which we have face or you would face to consider these points are A, B, C. This Y is the delivery price. For a price where which will always on the on the higher side.

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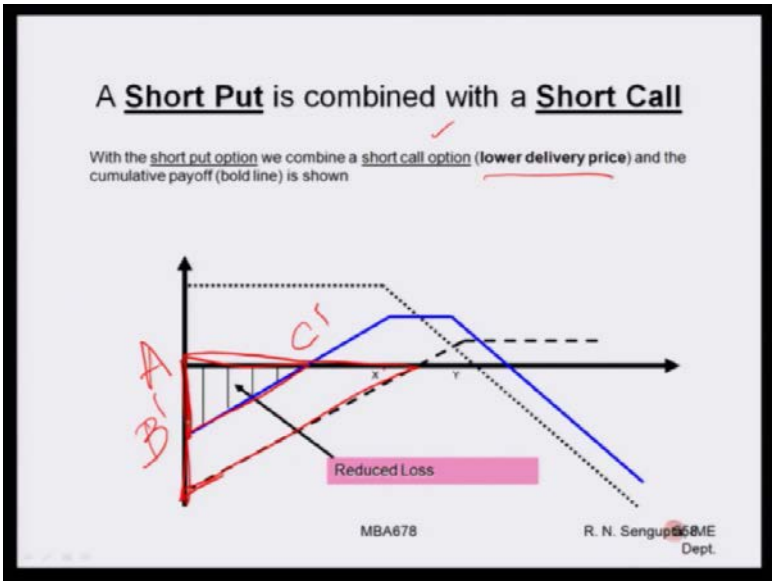

Combine that with the short call option with the lower delivery price which is X. So, here overall now risk has been reduce to A, B1, C1. So, overall loss initially was this triangle which was A, B, C. Now it is being reduce to A, B1, C1; which is definite that means, thinking that they are on a downward trend.

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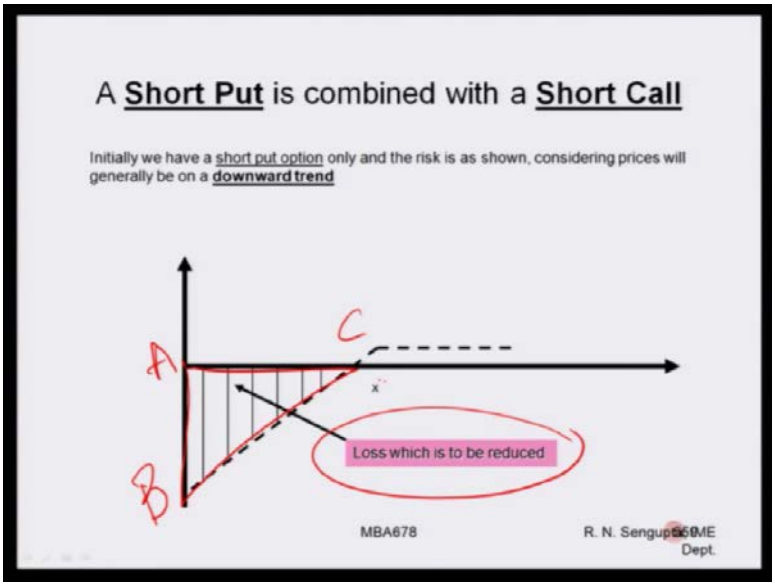

Again different combinations are short put with the short call. It is on a downward trend overall loss is given by this pinked area, which is A B C. This is A, this is B, this is C and they are considering X is the delivery price.

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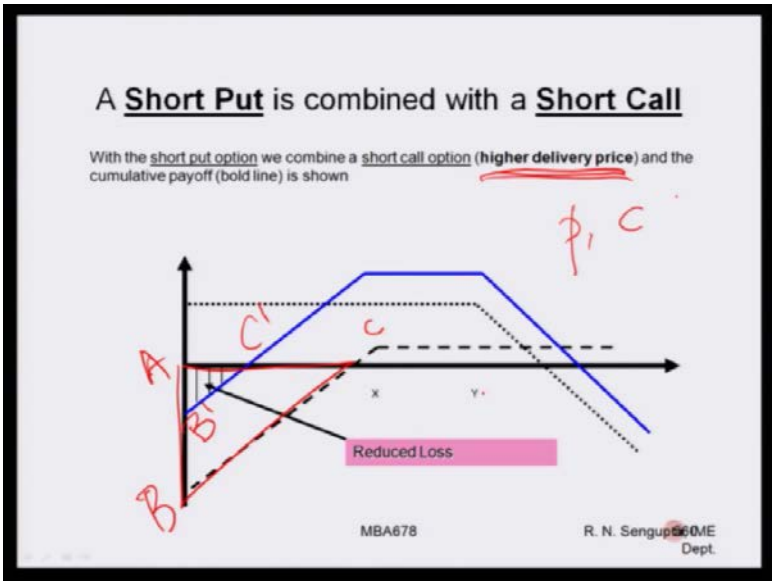

Now, we will combine that with the short call option with the higher delivery price. So, what we are doing is? If you notice, we are combining different calls and puts, but considering the put position delivery price is lower, in first instance; then in the next instance is higher and vice versa. So, we are trying to take different combinations of put and put and call and trying to see that whatever you do. Thinking very rationally and combine them combining them considering different values of X and Y, would definitely

gives you a reduce a loss.

So now, the overall loss has again been reduced considering delivery price is Y. T was basically A, B, C. Now it is basically A, B1 and C1. And again remember I am repeating it, but please bear with me. That the value of P and C which is the call price and the put price would be dictated depending on what type of option you buy. So, these are just pictorial one in order to make you understand. That how pictorially the overall risk reduce.

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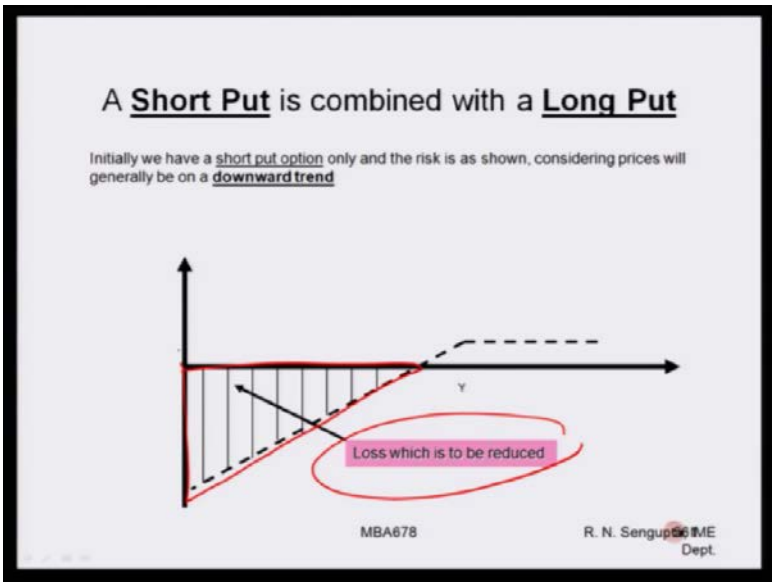

So, again the same thing. I am continuing the same thing with different combinations. So, we have a short put option and you think this is a downward trend. So, this is the overall loss again A B C would this area triangle.

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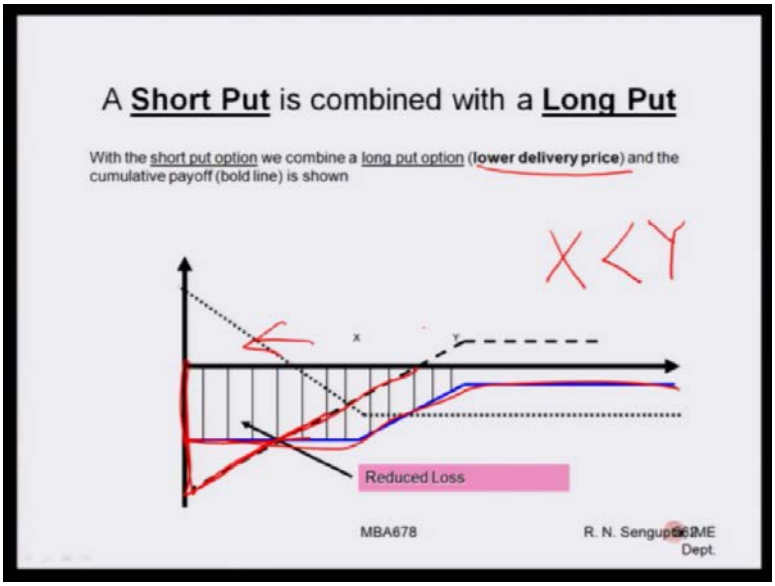

Then you combine with a long put option, but with lower delivery price. So now, you will see the overall risk, which was this triangle may has been reduce. Now you may be thinking that it does not look to the reduction. So, what I am thinking? I am saying is that, the person initially thought that it was on more going to on a downward trend. So, if is considering the downward trend which is in this area; obviously, we will see this area is less than this triangle. So, in the general sense for downward trend you definitely see reduction in the loss.

So, again remember with recitation I am saying, X is less than Y. And this X and Y are basically the delivery price of different type of options which you where a put or a call whether is on a long position or a short position.

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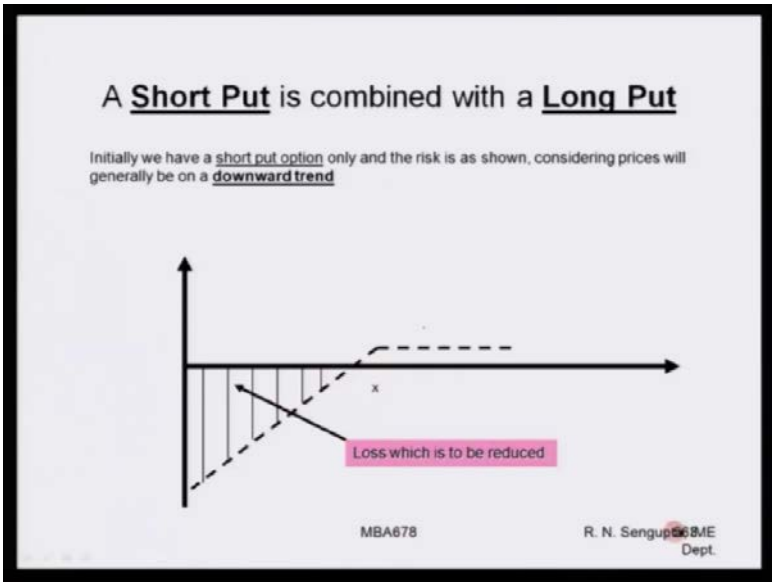

A short put position on a downward trend the loss is given, X is the delete price.

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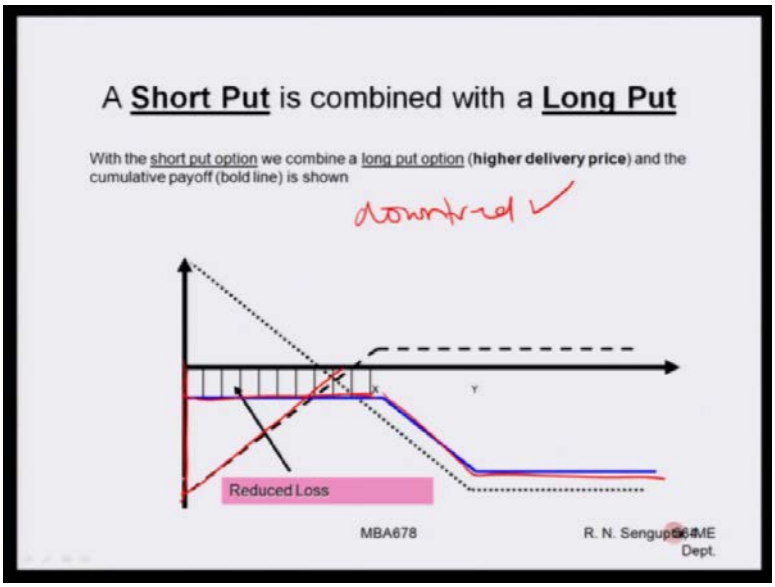

So, you basically combined with the long put position. The delivery price is higher, initially you had basically the triangle as the loss. Now it is basic with this the rectangle one; obviously, the loss increases, but remember again one thing. That are mean concern was on a downward trend. So, if the downward trend is true then; obviously, we will see the loss which is given by the bold blue lines, is less than the case when we had basically the triangle one.

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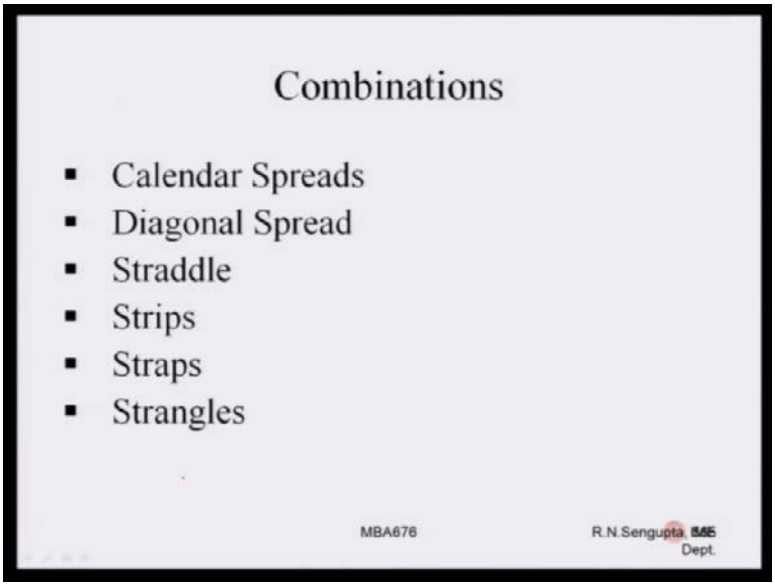

Now, we will combine, consider the different combinations of Calendar spreads, Diagonal spreads, Straddle, Strips, Straps and strangles.

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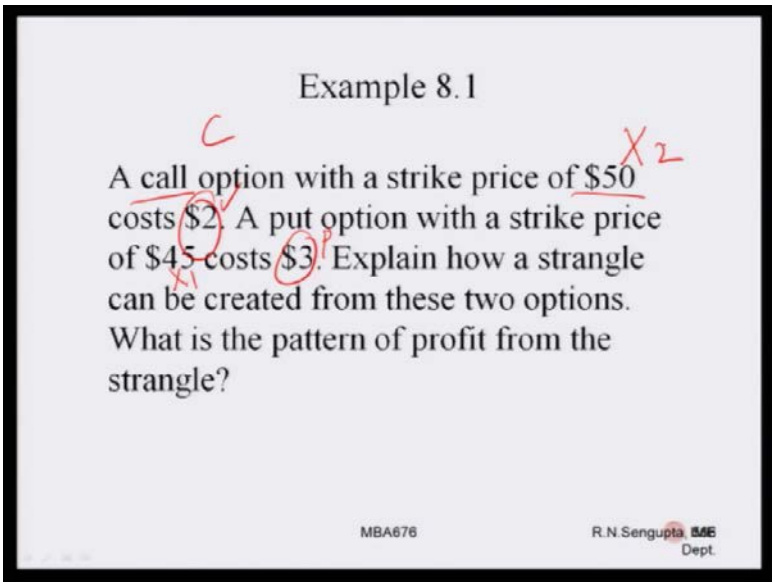

So, I will urge the students be to basically read the book in such a way, that once the overall combinations of forward and option, different types of options put and call are. Is available to them the understand conceptually; that means, first draw the matrix then draw the diagram. Then first draw the diagram and then understand the matrix, then combining them in a very simple fashion would definitely give you much better idea; that how the loss is reduce considering different combinations. The prices are on downward trend, prices on are upward trend, prices would be fluctuating with in this 2

bands so and so. So, you can combine a forward or on options or a cold call option or a put option, a long call, a short call, a long put, short put in different combinations. But remember the fact. That we will always consider the European option, point number one. We will also understand the delivery price obviously are same, but we will consider the delivery price. The time should be same, the delivery price of X, Y, K1, K2, K3 should be done in such a way; that the overall loss is reduced in the diagrams which we saw.

So, we have a call option with a Strike price of 50, cost is 2. So, this is basically the call option. So, this is the value of small c. The strike price is given and a put option is combined with the strike price of 45 and a price P of 3. So, explain how was triangle can be created. So, basically you know that where 50 and where 45 would be. So, if this is say for example X1 and this is say for example X2. So, you can face it a long of particular line and draw them using any matrices. Matrices means what I am talking about is using a excel sheet and then draw the diagram.

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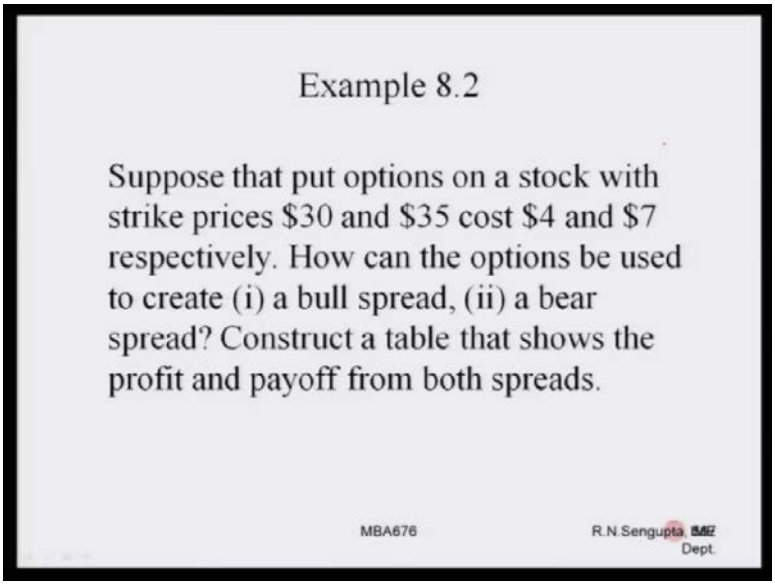

Suppose in a next example we have a put options. These are put options which strike price is 30 and 35, and P1 P2 which is the put prices are given 4 and 7. How can the option be use to create a Bull spread, Bear spread, construct a table accordingly and draw it accordingly.

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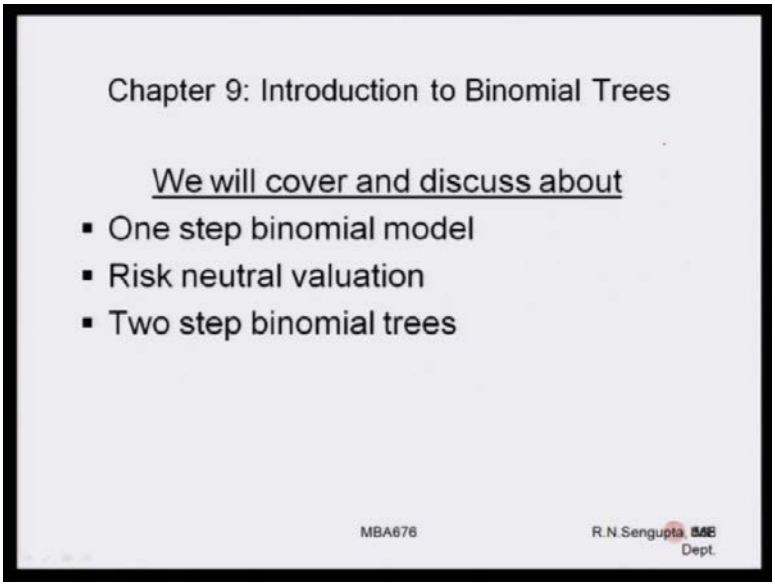

Now, we will start of the simple concept of Binomial trees. We will cover sand discuss very briefly one step binomial tree, the risk neutral valuation and the two step binomial tree; and how you proceed to do the calculation accordingly.

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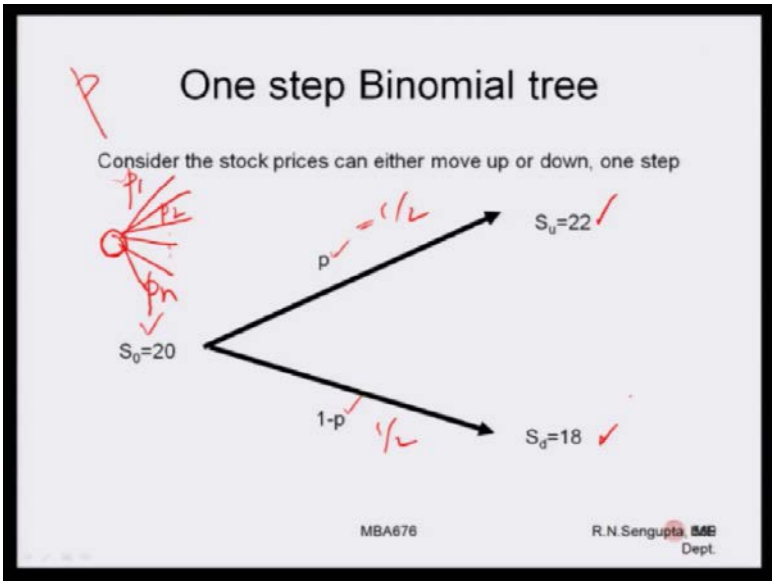

Now consider the simple example. We have a stock price, which can either move up and down. So, what I mean now buy a binomial tree is basically there are two arms. It can be multinomial also depending on of the prices are the fluctuating. So, we will consider S0 as the spot price. And the price increases and decreases given by the value of P and 1 minus P, this is a corresponding probabilities. So if you are basically the multinomial tree. So, this would be the S0 and they would be different arms; depending on what you

think other fluctuation on the price. So, the probabilities will given by P1, P2 so and so forth. Till P n if there, P n number of arms remember this P need not be confused with the price of the out option. This P is are the probabilities.

So, we have the probabilities P, in one of 1 minus P in another arm. Say for example, we are tossing a coin; in the first instance if it is a head comes the pricing increases by 45 rupees, the tail comes the price decreases by 45 rupees. Say for example, in that case P would be 1 by 2, similarly 1 minus P would be 1 by 2.

So, now, what you have instance is that add as of now. Today the price S0 is 20 and at some instant price the upward trend and downward trend considering price a probability of P and 1 minus P. It increases to 22 in one instant and it falls back, falls from 22 80. So, what we are going to consider is the fact that, if the prices are given; how we will basically able to find out the prices the stock such that the overall pricing of the options can be done. So, I will explain it in steps in the later class, but with this I will close the this lecture, but again I recap actually what you want to do is that. We will consider the simple Binomial tree concept in order to understand the how the price fluctuation can be done, in order to find out the how the options pricing can be done in a very logical and systematic manner.

Thank you.