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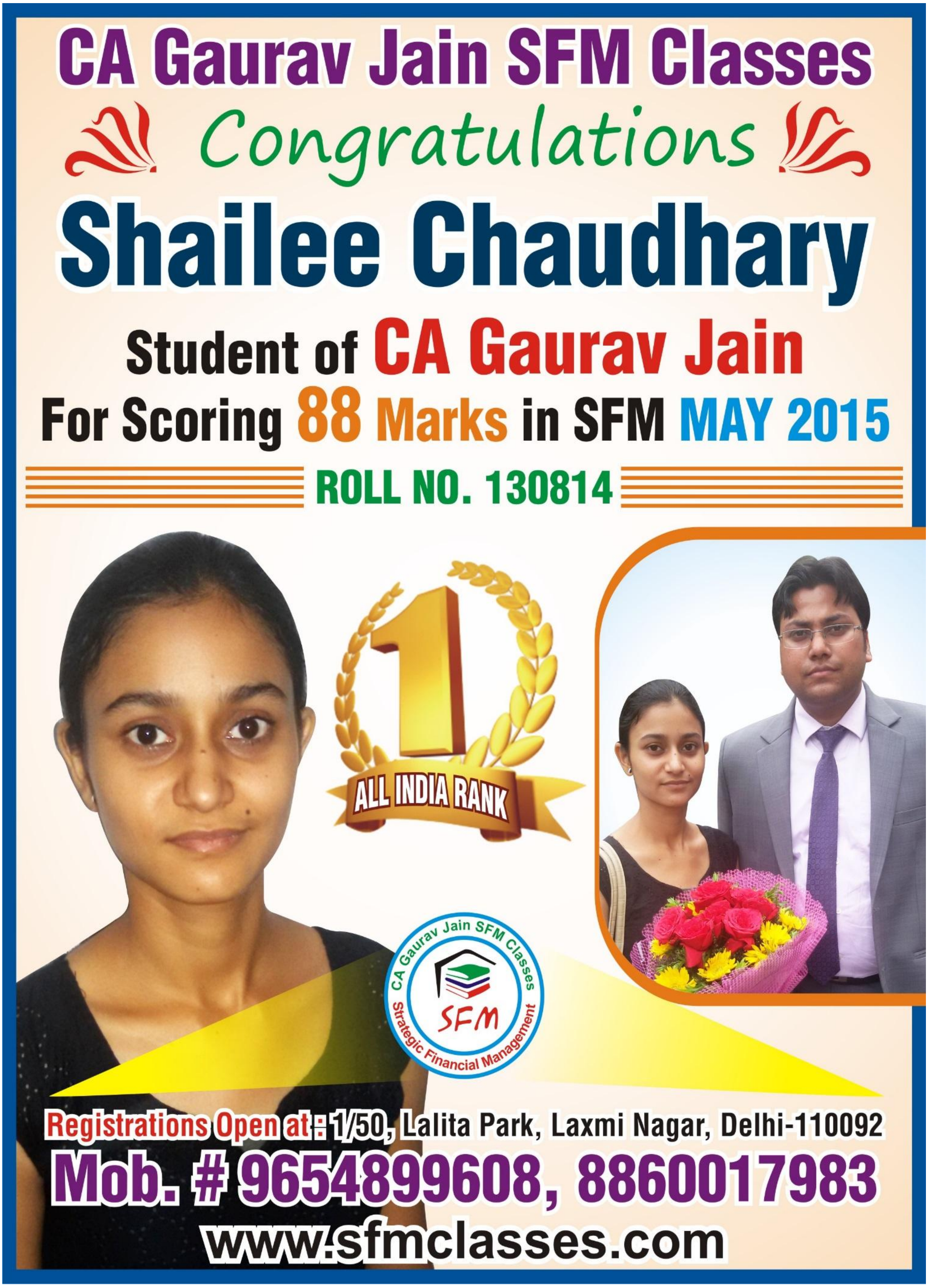
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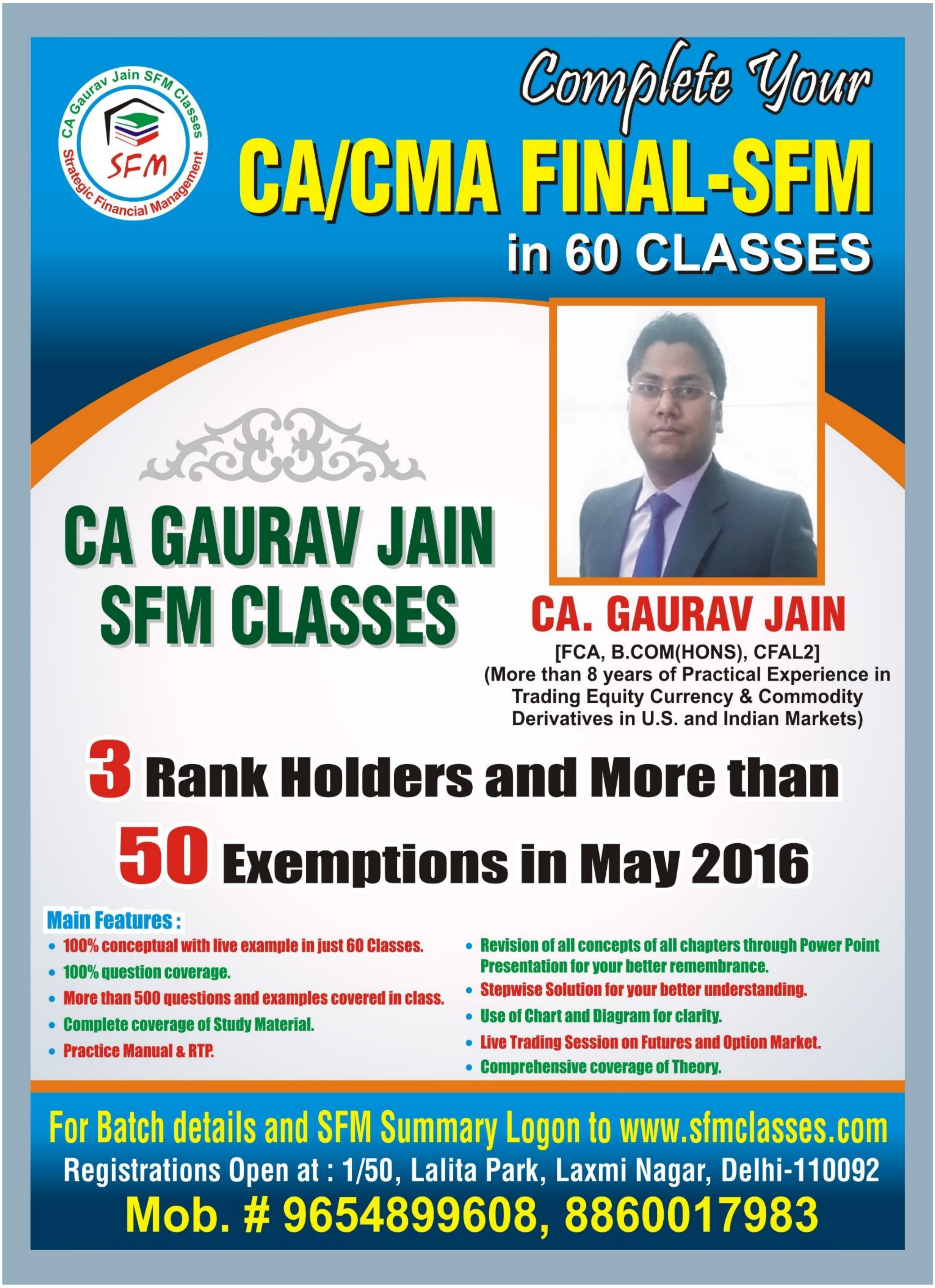
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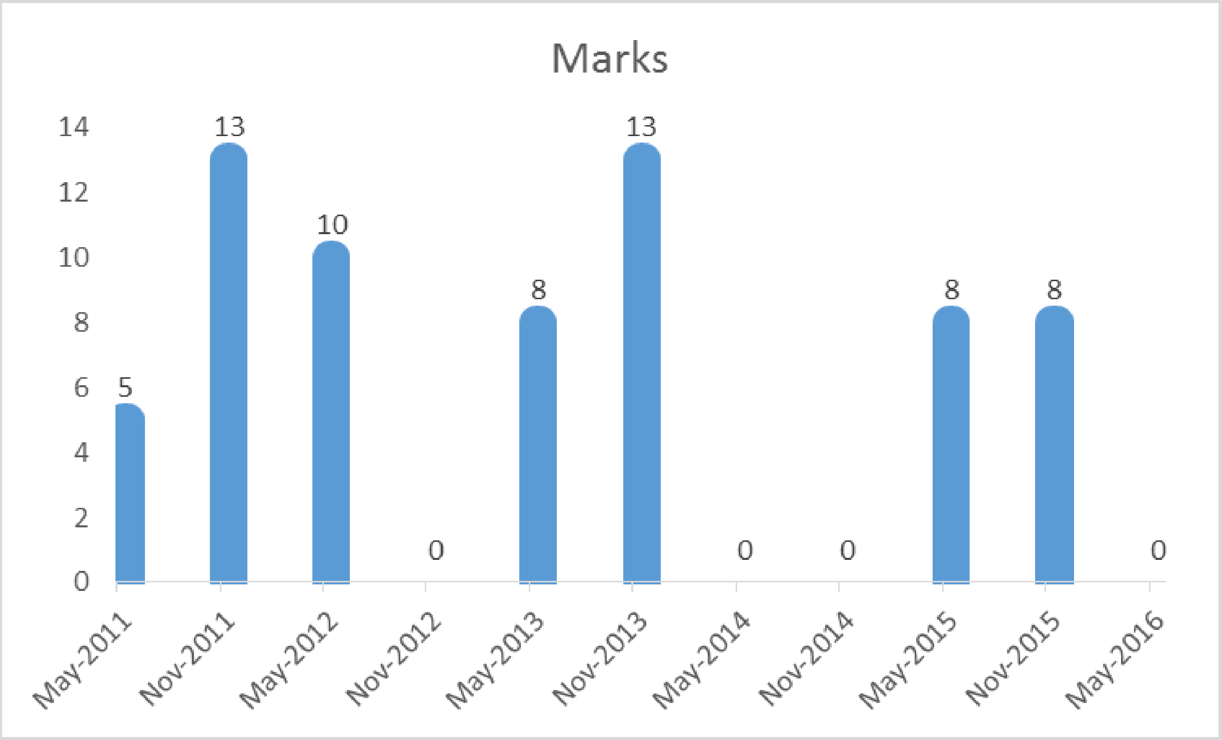
DERIVATIVES (FUTURES)

Attempt wise Marks Analysis of Chapter



Attempt	Marks
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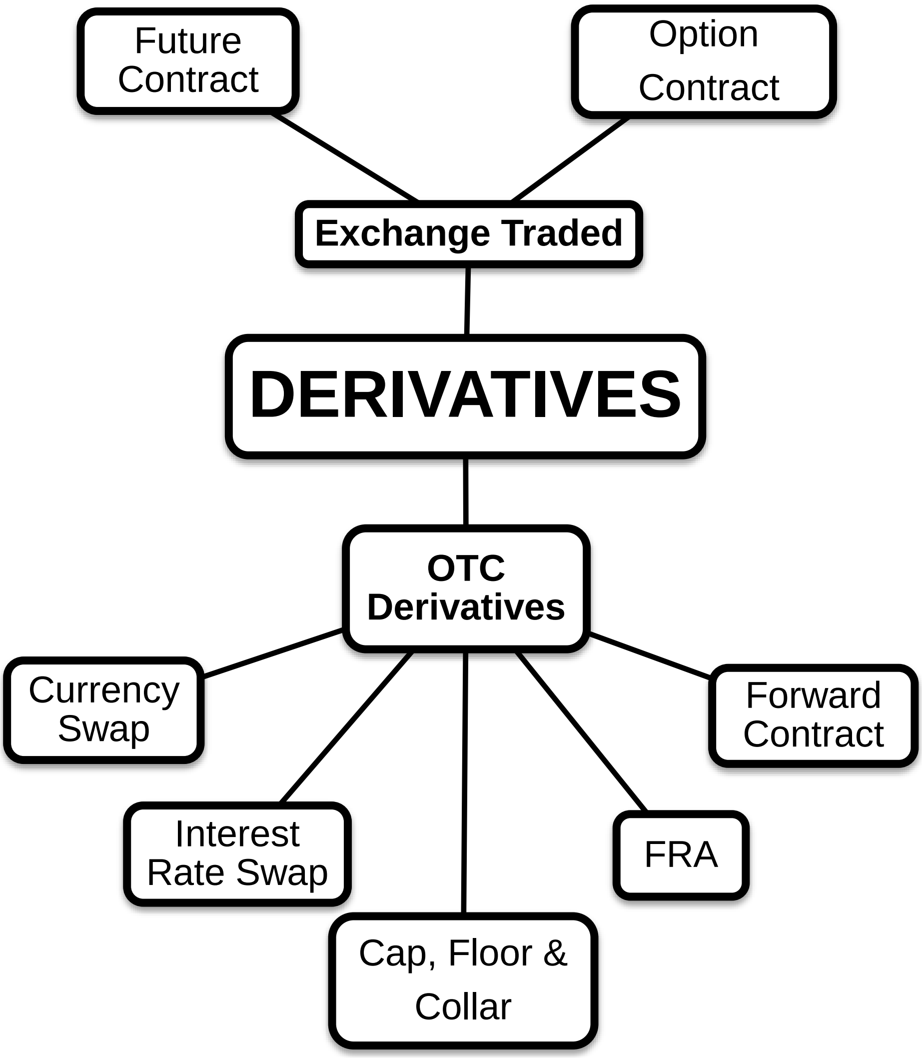
Nov-11	13
May-12	10
Nov-12	0
May-13	8
Nov-13	13
May-14	0
Nov-14	0
May-15	8
Nov-15	8
May-16	0

Concept No. 1: Introduction



➔ **Define Forward Contract, Future Contract.**

- **Forward Contract**, In Forward Contract one party agrees to buy, and the counterparty to sell, a physical asset or a security at a specific price on a specific date in the future. If the future price of the assets increases, the buyer(at the older, lower price) has a gain, and the seller a loss.

- **Futures Contract** is a standardized and exchange-traded. The main difference with forwards are that futures are traded in an active secondary market, are regulated, backed by the clearing house and require a daily settlement of gains and losses.

➔ **Future Contracts differ from Forward Contracts in the following ways:**

- Futures contracts trade on **organized exchange**. Forwards are **private contracts** and do not trade.

- Future contracts are **highly standardized**. Forwards are **customized contracts** satisfying the needs of the parties involved.

- A single **clearinghouse** is the counterparty to all futures contracts. Forwards are contract with the **originating** counterparty.

- The **government regulates** future markets. Forward contracts are **usually not regulated**.

Concept No. 2: How Future Contract can be terminated at or prior to expiration?

- A short can terminate the contract by delivering the goods, and a long can terminate the Contract by accepting delivery and paying the contract price to the short. This is called **Delivery**. The location for delivery (for physical assets), terms of delivery, and details of exactly what is to be delivered are all specified in the contract.

- In a **cash-settlement contract**, delivery is not an option. The futures account is marked-to-market based on the settlement price on the last day of trading.

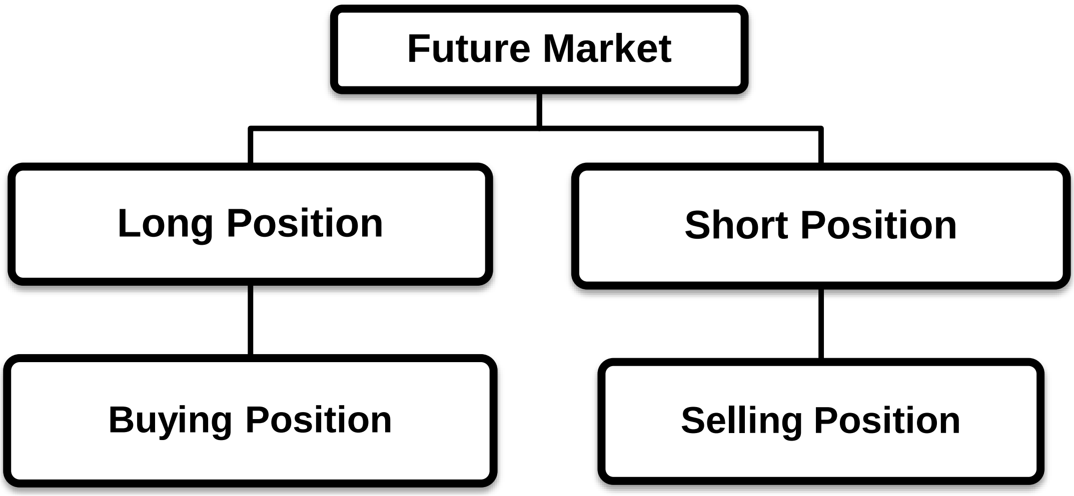
- You may make a **reverse**, or **offsetting**, trade in the future market. With futures, however, the other side of your position is held by the clearinghouse- if you make an exact opposite trade(maturity, quantity, and good) to your current position, the clearinghouse will net your positions out, leaving you with a zero balance. This is how most futures positions are settled.

Note:

- Future Contracts can be taken for any number of periods like in currency future we can take 12 months Contract.

Current Month + 11 months

Concept No. 3: Position to be taken under Future Market



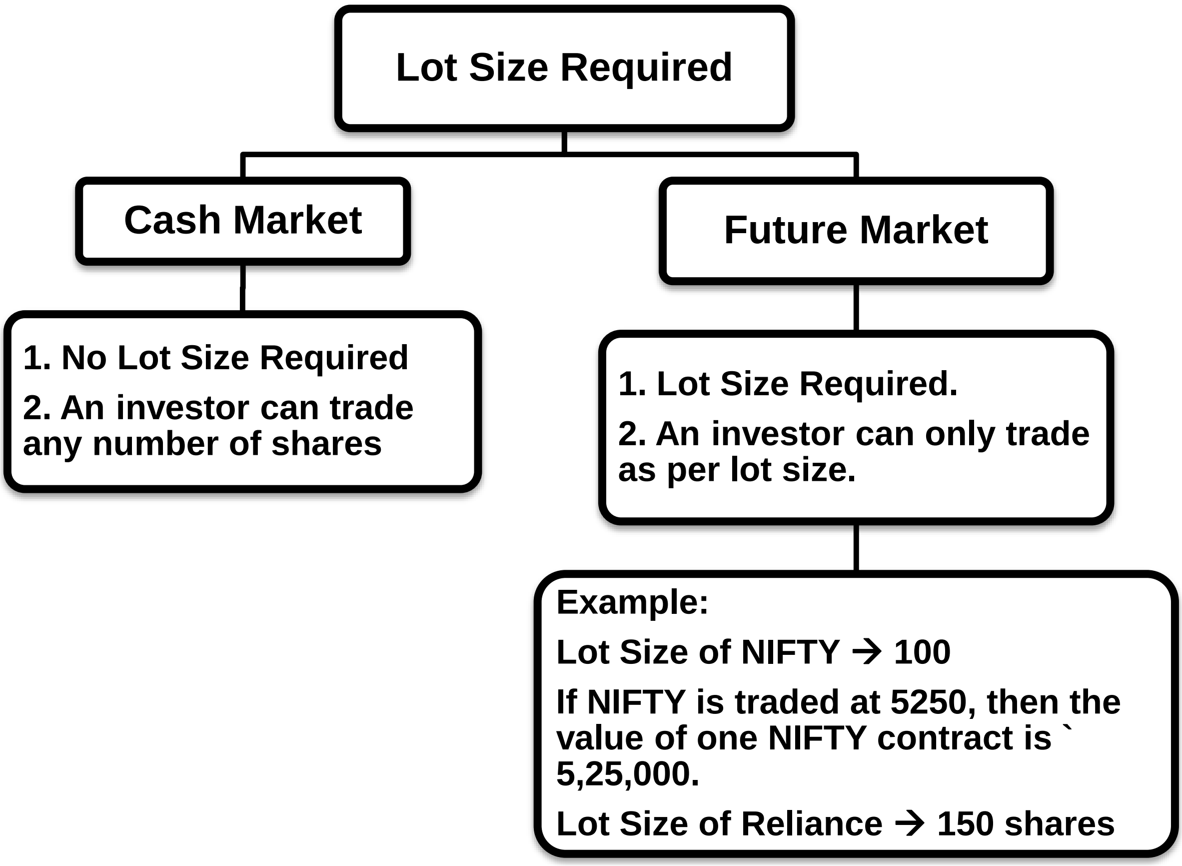
How to settle/ square-off/ covering/ closing out a position

- Long Position should be settled by Short position to calculate Profit/ Loss.
- Short Position should be settled by Long position to calculate Profit/ Loss.

Concept No. 4: Gain or Loss under Future Market

Position	If Price on Maturity/ Settlement Price	Gain/ Loss
Long Position	Increase	Gain
	Decrease	Loss
Short Position	Increase	Loss
	Decrease	Gain

Note:



Note:

- Gain/Loss is net of brokerage charge. Brokerage is paid on both buying & selling.
- Security Deposit is not considered while calculating Profit & Loss A/c.
- Interest paid on borrowed amount must be deducted while calculating Profit & Loss.
- A Future contract is **ZERO-SUM Game**. Profit of one party is the loss of other party.

Concept No. 5: Difference between Margin in the cash market and Margin in the future markets and Explain the role of initial margin, maintenance margin

- In **Cash Market**, margin on a stock or bond purchase is 100% of the market value of the asset.
  - Initially, 50% of the stock purchase amount may be borrowed and the remaining amount must be paid in cash (Initial margin).
  - There is interest charged on the borrowed amount.

- In **Future Markets**, margin is a performance guarantee i.e. security provided by the client to the exchange. It is money deposited by both the long and the short. There is no loan involved and consequently, no interest charges.

  - The exchange requires traders to post margin and settle their account on a daily basis.

1. **Initial Margin**
   - It is the money that must be deposited in a futures account before any trading takes place and paid by both long and short position.
   - It is set for each type of underlying asset.
   - Initial Margin per contract is relatively low and equals about one day's maximum price fluctuation on the total value of the contract.

2. **Maintenance Margin**
   - It is the amount of margin that must be maintained in a futures account. i.e. It is a limit below which our closing balance should not fall.
   - If the initial margin balance in the account falls below the maintenance margin due to the change in the contract price, **additional fund must be deposited to bring the margin balance back-up to the initial margin requirement**.

3. **Variation Margin**
   - It is the amount which the trader has to bring when the maintenance margin is breached.

Note:
- Any amount, over & above initial margin amount can be withdrawn.
- If Initial Margin is not given in the question, then use:

Initial Margin = Daily Absolute Change + 3 Standard Deviation

Concept No. 6: Concept of EAR (Normal Compounding)

- The rate of interest that investor actually realize as a result of compounding is known as the **Effective Annual Rate (EAR).**

- EAR represents the annual rate of return actually being earn after adjustments have been made for different compounding periods.

EAR = (1+ periodic rate) ^{m} – 1

Where:

Periodic rate = $\frac{\text{stated annual rate}}{\text{m}}$

m = the number of compounding periods per year

- Greater the compounding Frequency, the greater the EAR will be in comparison to stated rate.
- For Normal Compounding use,

$$\text{FV} = \text{PV}\left(1+\frac{\text{r}}{\text{m}}\right)^{\text{m} \times \text{n}}$$

Concept No. 7: Concept of e^{rt} & e^{-rt} (Continuous Compounding)

Most of the financial variable such as Stock price, Interest rate, Exchange rate, Commodity price change on a real time basis. Hence, the concept of Continuous compounding comes in picture.

Continuous Compounding means compounding every moment. Instead of (1 + r) we will use e^{rt}

- Under Future & Options Chapter, it is normally assumed that interest rate is compounded continuously (i.e. infinite times)

$$FV = PV\left(1+\frac{r}{\alpha}\right)^{\alpha}$$

$$\mathbf{FV = PV \times e^{rt}}$$

$$\text{Or present value} = \frac{FV}{e^{rt}}$$

$$\text{Or } \mathbf{PV = FV \times e^{-rt}}$$

Where r = rate of interest p.a
t = time period

Concept No. 8: Fair future price of security with no income

In case of Normal Compounding

$$\textbf{Fair future price = Spot Price } (1+r)^n$$

In case of Continuous Compounding

$$\textbf{Fair future price = Spot Price} \times e^{rt}$$

Where r = risk free interest p.a. with Continuous Compounding.
t = time to maturity in years/ days. (No. of days / 365) or (No. of months / 12)

Concept No. 9: Fair Future Price of Security with Dividend Income

In case of Normal Compounding

$$\textbf{Fair Future Price = [Spot Price – PV of Expected Dividend]} (1+r)^n$$

In case of Continuous Compounding

$$\textbf{Fair Future Price = [Spot Price – PV of Expected Dividend]} \times e^{rt}$$

PV of DI = Present Value of Dividend Income = Dividend × e^{-rt}
Where t = period of dividend payments

Concept No. 10: Fair Future Price of security when income is expressed in percentage or when dividend yield is given

In case of Normal Compounding

$$\textbf{Fair Future Price = Spot Price } [1+(r-y)]^n$$

In case of Continuous Compounding

$$\textbf{Fair Future Price = Spot Price} \times e^{(r-y) \times t}$$

Where y = income expressed in % or dividend Yield

Note:

If percentage income is given, it is assumed to be given on per annum basis.

Concept No. 11: Fair Future Price of Commodity with storage cost

It is applicable in case of Commodity futures.

In case of Normal Compounding

Fair Future Price = [Spot Price + PV of S.C] $(1+r)^n$

In case of Continuous Compounding

Fair Future Price = [Spot Price + PV of S.C] $\times e^{rt}$

Where PV of S.C = Present Value of Storage Cost

Note: Fair Future Price when Storage Cost is given in percentage(%).

FFP = Spot Price $\times e^{(r+s) \times t}$

Where S = Storage cost expressed in percentage.

Concept No. 12: Fair Future Price of commodities with Convenience yield expressed in % (Similar to Dividend Yield)

- Applicable in case of Commodity futures.
- The benefit or premium associated with holding an underlying product or physical good rather than contract or derivative product i.e. extra benefit that an investor receives for holding a commodity.

In case of Continuous Compounding

Fair Future Price = Spot Price $\times e^{(r-c)\times t}$

Note: **Fair Future Price when convenience income is expressed in Absolute Amount.**

Fair Future Price = [Spot Price - PV of Convenience Income] $\times e^{rt}$

Concept No. 13: Arbitrage Opportunity between Cash and Future Market

- Arbitrage is an important concept in valuing (Pricing) derivative securities. In its Purest sense, arbitrage is riskless.
- Arbitrage opportunities arise when assets are mispriced. Trading by Arbitrageurs will continue until they effect supply and demand enough to bring asset prices to efficient(no arbitrage) levels.

- Arbitrage is based on “Law of one price”. Two securities or portfolios that have identical cash flows in future, should have the same price. If A and B have the identical future pay offs and A is priced lower than B, buy A and sell B. You have an immediate profit.

Difference between Actual Future Price and Fair Future Price?

Fair Future Price is calculated by using the concept of Present Value & Future Value.

Actual Future Price is actually prevailing in the market.

Case	Value	Future Market	Cash Market	Borrow/ Invest
FFP < AFP	Over-Valued	Sell or Short Position	Buy	Borrow
FFP > AFP	Under-Valued	Buy or Long Position	Sell #	Investment

Here we assume that Arbitrager hold shares

Concept No. 14: Complete Hedging by using Index Futures & Beta

- Hedging is the process of taking an opposite position in order to reduce loss caused by Price fluctuation.
- The objective of Hedging is to reduce Loss.
- Complete Hedging means profit/ Loss will be Zero.

Position to be taken:

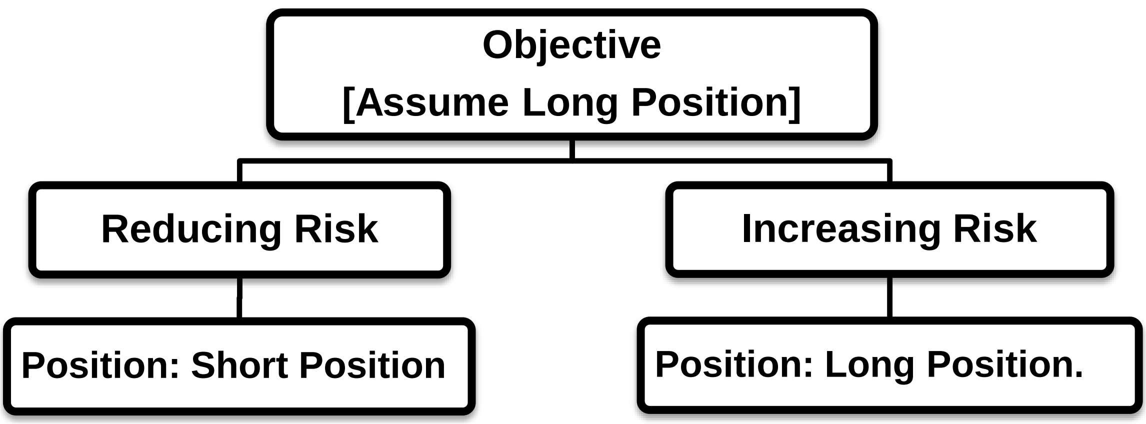
1. Long Position should be hedged by Short Position.
2. Short Position should be hedged by Long Position.

Value of Position to be taken:

Value of Position for Complete hedge should be taken on the basis of **Beta** through index futures.

Value of Position for Complete Hedge = Current Value of Portfolio × Existing Stock Beta

Concept No. 15: Value of Hedging/Position for Increasing & Reducing Beta to a Desired Level



<u>Alternative 1</u> (Hedging Using Index Future)

Case I: When Existing Beta > Desired Beta

Objective: Reducing Risk

Value of Index Position = Value of Existing Portfolio × [Existing Beta – Desired Beta]

Action: Take Short Position in Index & keep your current position unchanged.

Case II: When Existing Beta < Desired Beta

Objective: Increase Risk

Value of Index Position = Value of Existing Portfolio × [Desired Beta – Existing Beta]
Action: Take Long Position in Index & keep your current position unchanged

Note:

<u>No. of future contracts to be sold or purchased for increasing or reducing Beta to a Desired Level using Index Futures</u>.

No. of Future Contract to be taken = $\frac{\textbf{Value of Index Position}}{\textbf{Value of one Future Contract}}$

<u>Alternative 2</u> (Hedging Using Risk free Investment or Borrowing)

<u>Case 1:</u> Reducing Risk

SELL SOME SECURITIES AND REPLACE WITH RISK-FREE INVESTMENT

Step1: Equate the weighted Average Beta formulae to the new desired Beta

Desire Beta = $\text{Beta}_1 \times W_1 + \text{Beta}_2 \times W_2$ (Beta of Risk free investment is Zero)

Step2: Use the weights and decide

<u>Case 2:</u> Increasing Risk

BUY SOME SECURITIES AND BORROW AT RISK-FREE RATE

Step1: Equate the weighted Average Beta formulae to the new desired Beta

Desire Beta = $\text{Beta}_1 \times W_1 + \text{Beta}_2 \times W_2$ (Beta of Risk free investment is Zero)

Step2: Use the weights and decide

<u>Concept No. 16: Partial Hedge</u>

Value of existing Portfolio × Existing beta × percentage (%) to be Hedge

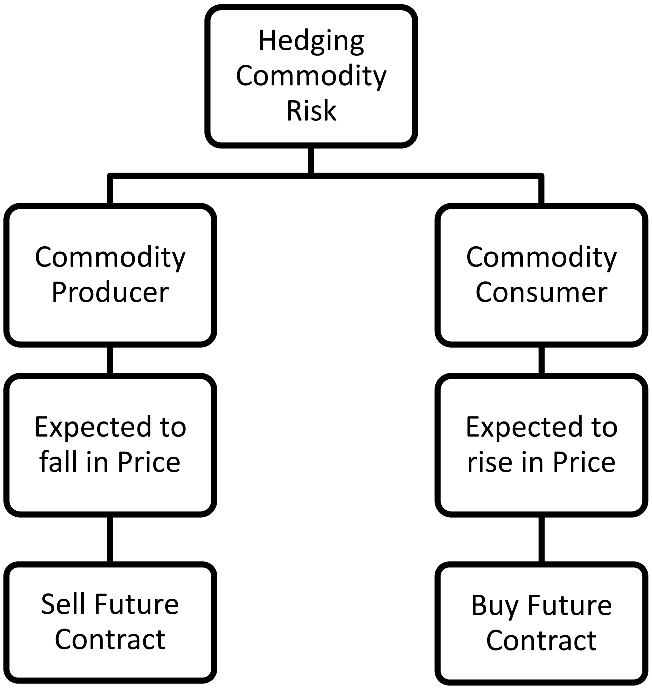
- It result into Over-Hedged or Under-Hedged Position

- There may be profit or loss depending upon the situation.

Concept No. 17: Beta of a Cash and Cash Equivalent

Beta of a cash and Risk free security is Zero.

Concept No. 18: Hedging Commodity Risk Through Futures



Concept No. 19: Calculation of Rate of Return

	Increase or Decrease in Stock Price ($P_1 – P_0$)
(+)	Dividend Received
(-)	Transaction Cost
(-)	Interest Paid on Borrowed Amount
	Net Amount Received

Rate of return:

$$\frac{\textbf{Net Amount Received}}{\textbf{Total Initial Equity Investment}} \times \mathbf{100}$$

Concept No. 20: Hedge Ratio

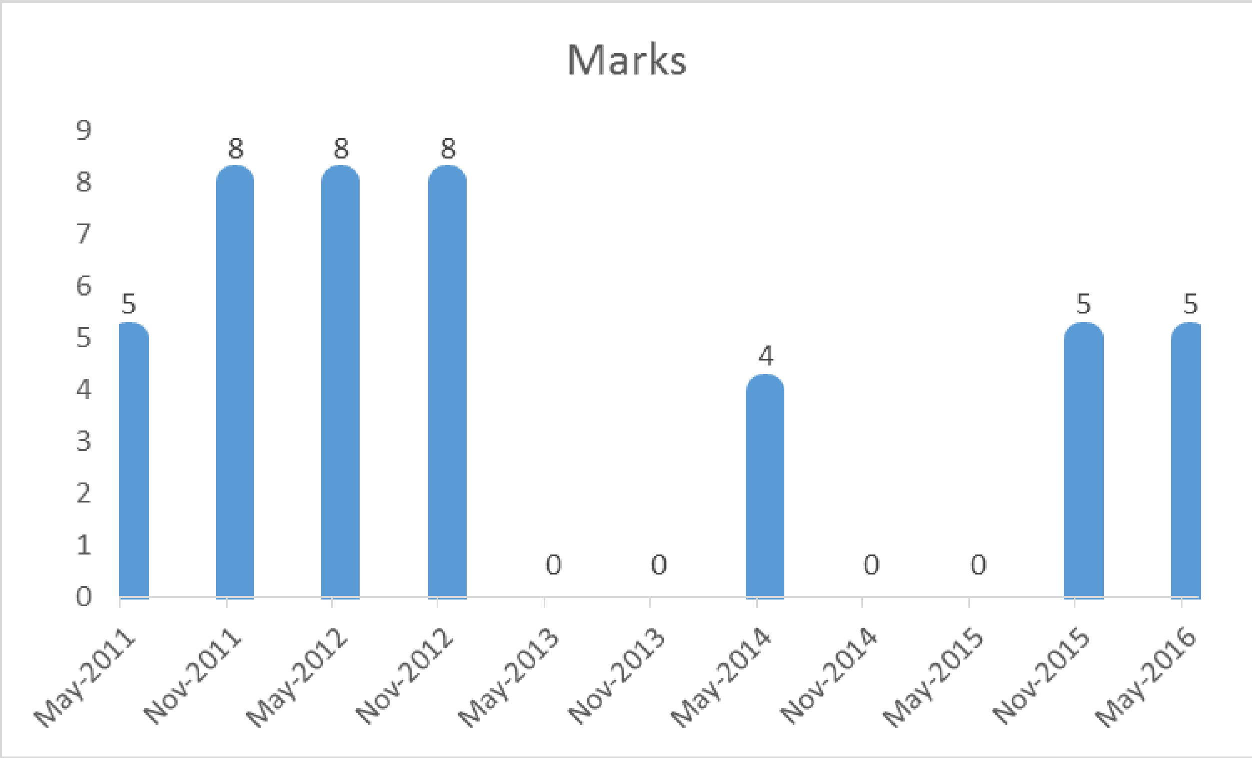
The Optional Hedge Ratio to minimize the variance of Hedger's position is given by:-

Hedge Ratio = Corr. (r) $\frac{\sigma_S}{\sigma_F}$

σ_S = S.D of Δ S
σ_F = S.D of Δ F
r = Correlation between Δ S and Δ F
Δ S = Change in Spot Price
Δ F = Change in Future Price

DERIVATIVES (OPTIONS)

Attempt wise Marks Analysis of Chapter



Attempt	Marks
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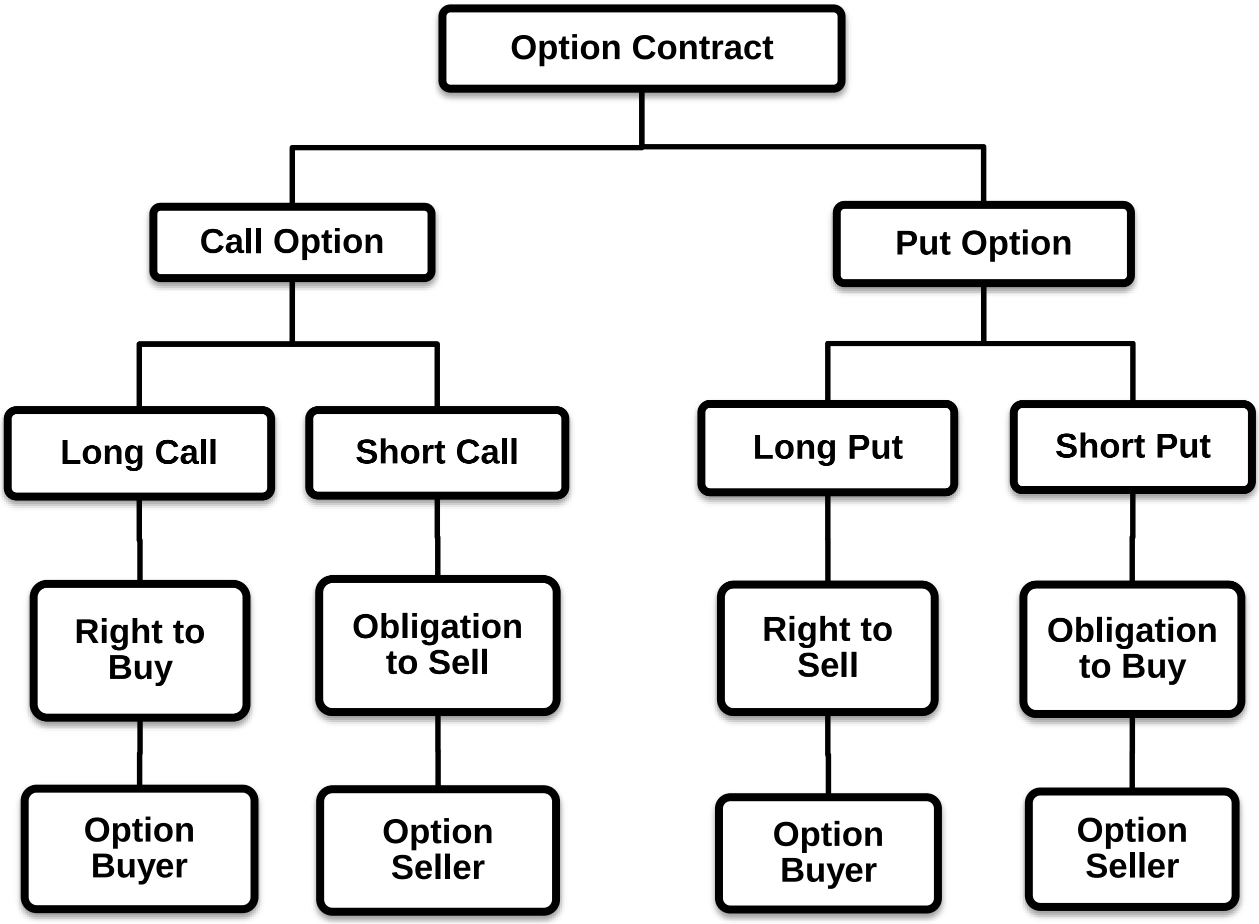
May-12	8
Nov-12	8
May-13	0
Nov-13	0
May-14	4
Nov-14	0
May-15	0
Nov-15	5
May-16	5

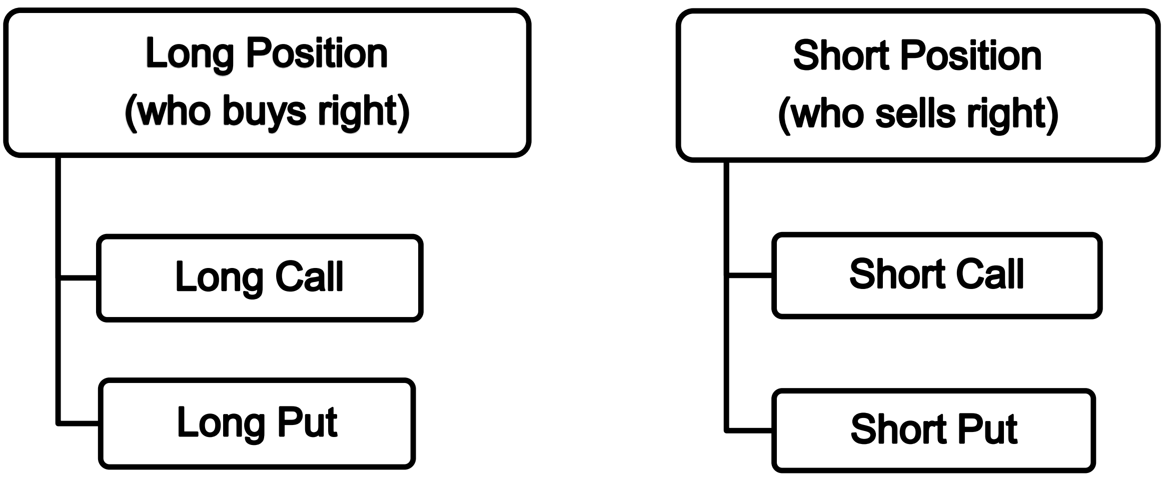
Concept No. 1: Introduction



Option Contract:

An option contract give its owner ***the right, but not the legal obligation***, to conduct a transaction involving an underlying asset at a pre-determined future date(the exercise date) and at a pre-determined price (the exercise price or strike price)

Meaning of Long position & Short position under Option Contract



➢ **There are four possible options position**

1. **Long call**: The buyer of a call option → has the ***right to buy*** an underlying asset.
2. **Short call**: The writer (seller) of a call option →has the ***obligation to sell*** the underlying asset.
3. **Long put**: The buyer of a put option → has the ***right to sell*** the underlying asset.

4. **Short put**: The writer (seller) of a put option → has the ***obligation to buy*** the underlying asset.

Note:
If question is silent always assume Long Position.

➢ **Exercise Price/ Strike Price:**

The fixed price at which buyer of the option can exercise his option to buy/ sell an underlying asset. It always remain constant throughout the life of contract period.

➢ **Option Premium:**

- ❖ To acquire these rights, owner of options must buy them by paying a price called the Option premium to the seller of the option.
- ❖ Option Premium is paid by buyer and received by Seller.
- ❖ Option Premium is non-refundable, non-adjustable deposit.

Note:
- ❖ The option holder will only exercise their right to act if it is profitable to do so.
- ❖ The owner of the Option is the one who decides whether to exercise the Option or not.

Concept No. 2: Call Option

When Call Option Contract are exercised:

- ➢ When CMP > Strike Price → Call Buyer Exercise the Option.
- ➢ When CMP < Strike Price → Call Buyer will not Exercise the Option.

Note:

- ❖ Maximum loss to the call buyer will be equal to option premium paid.
- ❖ Maximum profit for the call Writer/ Seller will be only option premium received
- ❖ Maximum profit for call buyer will be unlimited.
- ❖ Maximum loss for call seller will be unlimited.
- ❖ Break-even point for the buyer and seller is the price at which profit and loss will be zero.

Break-even Market Price = Exercise Price + Option Premium

- ❖ The call holder will exercise the option whenever the stock's price exceeds the strike price at the expiration date.
- ❖ The sum of the profits between the Buyer and Seller of the call option is always Zero. Thus, Option trading is ZERO-SUM GAME. The long profits equal to the short losses.
- ❖ Position of a Call Seller will be just opposite of the position of Call Buyer.

- ❖ In this chapter, we first see whether the Buyer of Option opt or not & then accordingly we will calculate Profit & Loss

Concept No. 3: Put Option

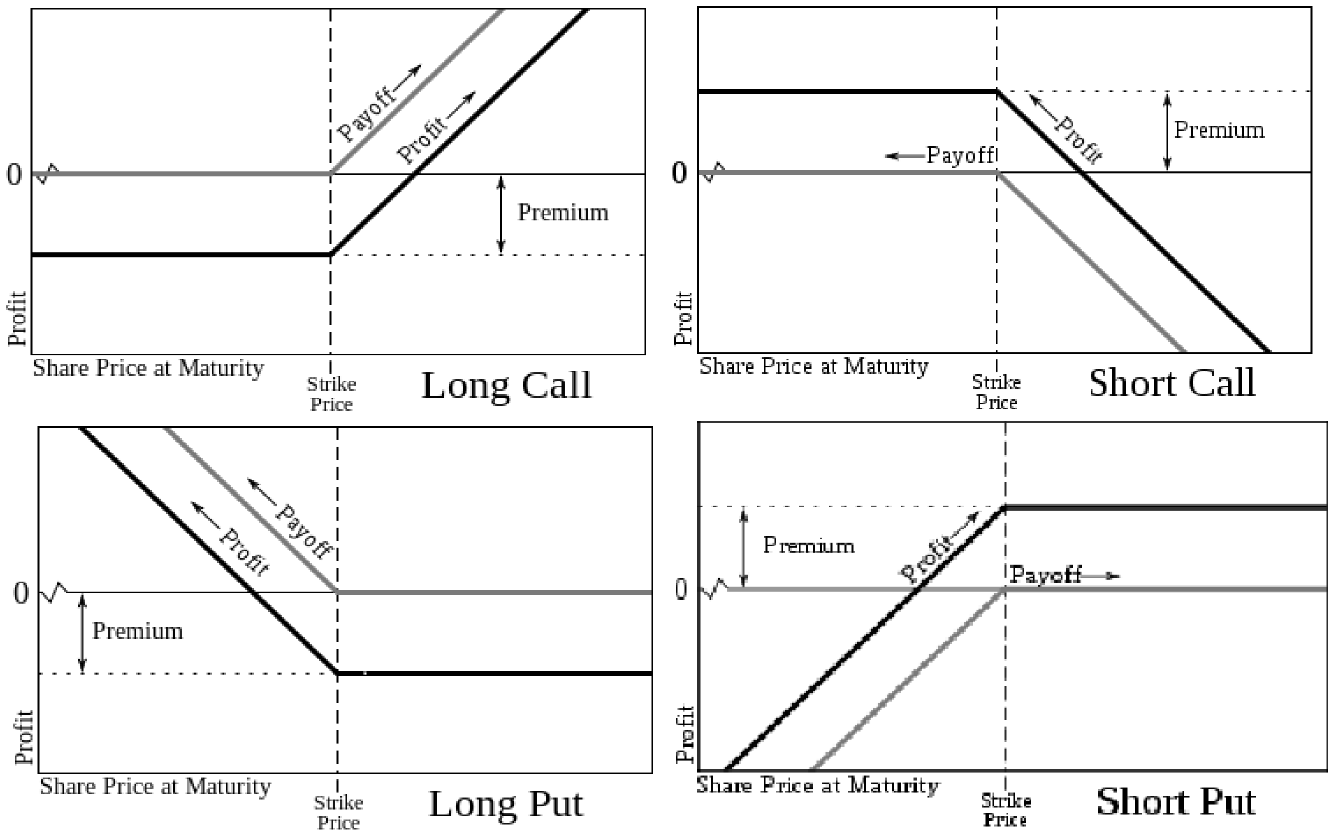
When Put Option Contract are exercised:

- ➢ When CMP > Strike Price → Put Buyer will not Exercise the Option.
- ➢ When CMP < Strike Price → Put Buyer will Exercise the Option.

Note:

- ❖ If Actual Market Price falls to Zero, NP = X – S – OP i.e. X – 0 – OP
  Maximum Profit = X – OP
- ❖ Put Buyer will only exercise the option when actual market price is less the exercise price.
- ❖ Profit of Put Buyer = Loss of Put Seller & vice-versa. Trading Put Option is a Zero-Sum Game.

Pay-off Diagram



Concept No. 4: Profit or Loss/ Pay off of call Option & Put Option

While calculating profit or loss, always consider option Premium,

<table>
<tr><th colspan="2">Call Buyers (Long Call)</th></tr>
<tr><td>If S – X > 0
Exercise the option
Net Profit = S – X – OP</td><td>If S – X < 0
Not Exercise
Loss = Amount of Premium</td></tr>
<tr><th colspan="2">Put Buyers (Long Put)</th></tr>
<tr><td>If X – S >0
Exercise the option
Net Profit = X – S –OP</td><td>If X – S < 0
Not Exercise
Loss = Amount of Premium</td></tr>
</table>

Break-even Market Price for call & Put option

- Break – even Market Price is the price at which Profit & loss is Zero.

<table>
<tr><th>For Call Buyer &Call Seller</th><th>For Put Buyer &Put Seller</th></tr>
<tr><td>Net Profit = S – X – OP</td><td>Net Profit = X – S – OP</td></tr>
<tr><td>If NP = 0
S = X + OP</td><td>If NP = 0
S = X – OP</td></tr>
<tr><td colspan="2">Where S = Stock Price
X = Exercise Price
OP = Option Premium</td></tr>
</table>

Concept No. 5: Concept of Moneyness of an Option

Moneyness refers to whether an option is ***In-the money or Out- of the money***.

Case I

- If immediate exercise of the option would generate ***a positive pay-off***, it is in the money

Case II

- If immediate exercise would result in loss (***negative pay-off***), it is out of the money.

Case III

- When current Asset Price = Exercise Price, exercise will generate ***neither gain nor loss*** and the option is at the money.

	Call Option		**Put Option**
Case 1	S – X > 0	**In-the-Money**	X - S > 0
Case 2	S – X < 0	**Out-of- the-Money**	X - S < 0
Case 3	S = X	**At-the-Money**	X = S

Note:

Do not consider option premium while Calculating Moneyness of the Option.

Concept No. 6: European & American Options

American Option : American Option may be exercised at any time upto and including the contract's expiration date.

European Option : European Options can be exercised only on the contract's expiration date.

❖ The name of the Option does not imply where the option trades – they are just names.

Concept No. 7: Action to be taken under Option Market

If expected Market Price is	Call	Put
Going to rise	Long Call	Short Put
Going to fall	Short Call	Long Put

Concept No. 8: Option Strategies

- Combination of Call & Put is known as OPTION STRATEGIES.

Types of Option Strategies:

Some important Option Strategies are as follows:

1. Straddle Position
2. Strangle Strategy
3. Strip Strategy
4. Strap Strategy
5. Butterfly Spread

1. Straddle Position:

Straddle may be of 2 types:-

Long Straddle	Short Straddle
Buy a Call and Buy a Put on the same stock with both the options having the same exercise price. **Option**: Buy One Call and Buy One Put **Exercise Date**: Same of Both **Strike Price/ Exercise Price:** Same of Both **Note**: A Long Straddle investor pays premium on both Call & Put.	Sell a Call and Sell a Put with same exercise price and same exercise date. **Option**: Sell One Call and Sell One Put **Exercise Date**: Same of Both **Strike Price/ Exercise Price**: Same of Both **Note:** A Short Straddle investor receive premium on both Call and Put.

Note:

- When an investor is not sure whether the price will go up or go down, then in such case we should create a straddle position.
- If Question is Silent, always assume Long Straddle.

2. Strangle Strategy

- An option strategy, where the investor holds a position in both a call and a put with **different strike** prices but with the same maturity and underlying asset is called Strangles Strategy.
- Selling a call option and a put option is called seller of strangle (i.e. Short Strangle).
- Buying a call and a put is called Buyer of Strangle (i.e. Long Strangle).
- If there is a **large price movement** in the near future but unsure of which way the price movement will be, this is a Good Strategy.

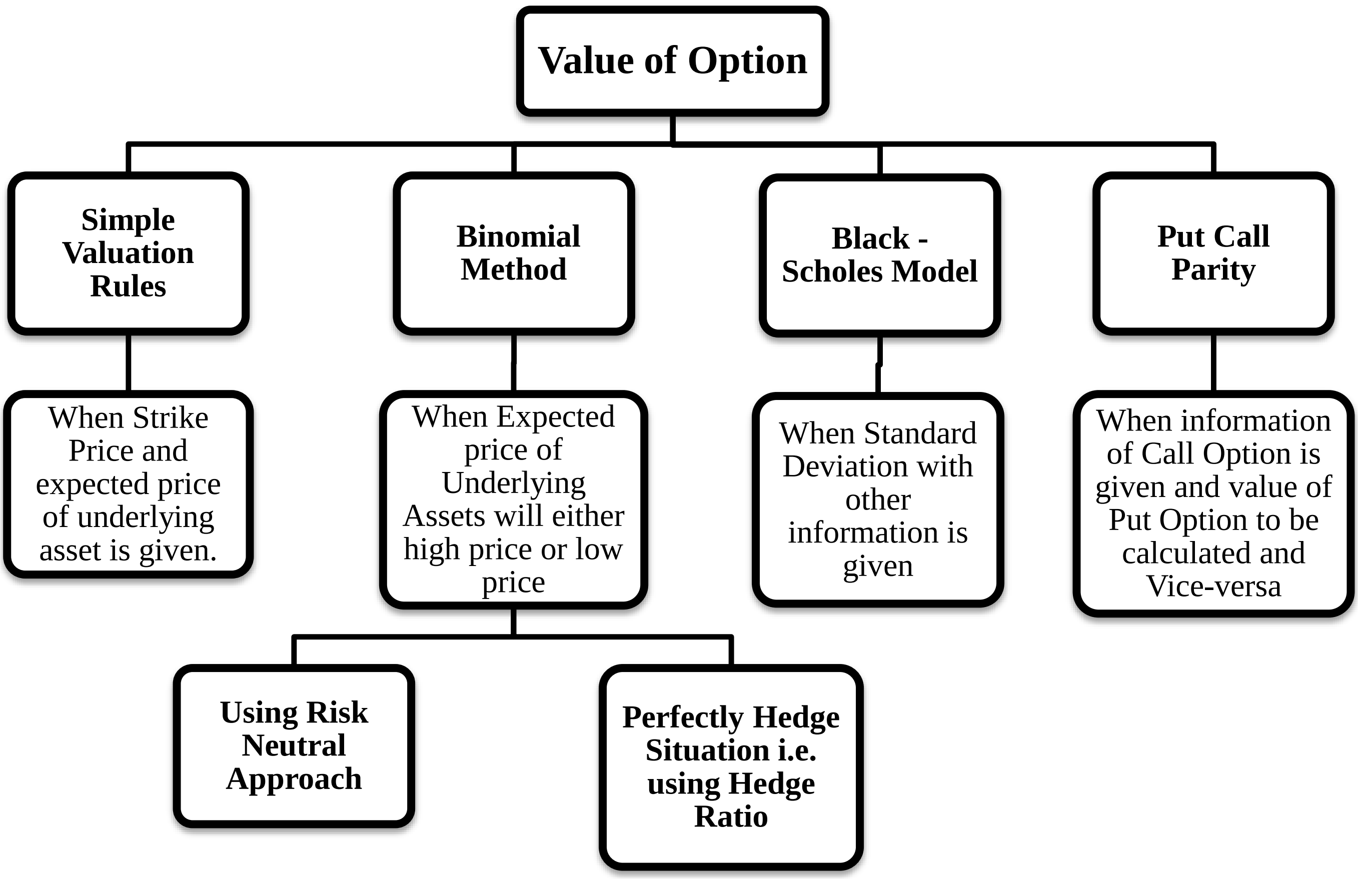
3. Strip Strategy (Bear Strategy)	4. Strap Strategy (Bull Strategy)
➢ Buy Two Put and Buy One Call Option of the same stock at the same exercise price and for the same period. ➢ Strip Position is applicable when decrease in price is more likely than increase. **Option**: Buy One Call and Buy Two Put **Exercise Date**: Same of Both **Strike Price/ Exercise Price**: Same of Both	➢ Buy Two Calls and Buy One Put when the buyer feels that the stock is more likely to rise Steeply than to fall. ➢ Strap Position is applicable when increase in price is more likely than decrease. **Option**: Buy Two Calls and Buy One Put **Exercise Date**: Same of Both **Strike Price/ Exercise Price**: Same of Both

5. **Butterfly Spread**

In Butterfly spread position, an investor will undertake 4 call option with respect to 3 different strike price or exercise price.

It can be constructed in following manner:
- ❖ Buy One Call Option at High exercise Price (S1)
- ❖ Buy One Call Option at Low exercise Price (S2)
- ❖ Sell two Call Option $\left(\frac{S_1 + S_2}{2}\right)$

Calculation of Option Value



Concept No. 9: Intrinsic Value & Time Value of Option

Option value (Premium) can be divided into two parts:-
(i) Intrinsic Value
(ii) Time Value of an Option (Extrinsic Value)

Option Premium = Intrinsic Value + Time Value of Option

Intrinsic Value:

- An Option's intrinsic Value is the amount by which the option is In-the-money. It is the amount that the option owner would receive if the option were exercised.
- Intrinsic Value is the minimum amount charged by seller from buyer at the time of selling the right.
- An Option has ZERO Intrinsic Value if it is At-the-Money or Out-of-the-Money, regardless of whether it is a call or a Put Option.
- The Intrinsic Value of a Call Option is the greater of (S – X) or 0. That is

$$C = \text{Max}\,[0, S - X]$$

- Similarly, the Intrinsic Value of a Put Option is (X - S) or 0. Whichever is greater. That is:

$$P = \text{Max}\,[0, X - S]$$

Time Value of an Option (Extrinsic Value):

- The Time Value of an Option is the amount by which the option premium exceeds the intrinsic Value.
- Time Value of Option = Option Premium – Intrinsic Value
- When an Option reaches expiration there is no "Time" remaining and the time value is ZERO.
- The longer the time to expiration, the greater the time value and, other things equal, the greater the option's Premium (price).

Concept No. 10: Fair Option Premium/ Fair Value/ Fair Price of a Call on Expiration

Fair Premium of Call on Expiry:
= Maximum of [(S – X), 0]

Note:
Option Premium can never be Negative. It can be Zero or greater than Zero.

Concept No. 11 Fair Option Premium/ Fair Value/ Fair Price of a Put on Expiration

Fair Premium of Put on Expiry:

= Maximum of [(X – S), 0]

Concept No. 12: Fair Option Premium/ Theoretical Option Premium/ Price of a Call before Expiry or at the time of entering into contract or As on Today

Fair Premium of Call = Current Market Price – Present Value of Exercise Price

Or

$$= \left[S - \frac{X}{(1+RFR)^{T}}, 0\right] \text{Max}$$

Or

$$= [S - X^{e-rt}, 0] \text{ Max}$$

RFR (r) = Risk-free rate
T = Time to expiration

Concept No. 13: Fair Option Premium/ Theoretical Option Premium/ Price of a Put before Expiry or at the time of entering into contract or As on Today

Fair Premium of Put = Present Value of Exercise Price – Current Market Price

Or

$$= \left[\frac{X}{(1+RFR)^{T}} - S, 0\right] \text{Max}$$

Or

$$= [X^{e-rt} - S, 0] \text{ Max}$$

Concept No. 14: Arbitrage Opportunity in Option Contract

- **When Arbitrage is possible under Option Contract?**

  Fair Option Premium ≠ Actual Option Premium

- **Arbitrage Opportunity on Call → Before Expiry**

FP = Fair Premium AP = Actual Premium

Case I	Value	Option Market	Cash Market	Invest
FP > AP	Under-Valued	Long Call	Sell #	Net Amount

Assume investor is already holding the required shares.

Case 2	Value	Option Market	Cash Market	Borrow
FP < AP	Over-Valued	~~Short Call~~	Buy	Net Amount

* Arbitrage is not possible → Because we can also incur loss in this case

- **Arbitrage Opportunity on Put → Before Expiry**

Case I	Value	Option Market	Cash Market	Borrow
FP > AP	Under-Valued	Long Put	Buy	Net Amount

Case 2	Value	Option Market	Cash Market	Invest
FP < AP	Over-Valued	~~Short Put~~	Sell	Net Amount

* Arbitrage is not possible → Because we can also incur loss in this case

Concept No. 15: Expected Value of an Option on expiry

Under this approach, we will calculate the amount of Option premium on the basis of Probability.

Value of Option at expiry × Probability = Expected value of an option at Expiry

Concept No. 16: Risk Neutral Approach for Call & Put Option(Binomial Model)

- Under this approach, we will calculate Fair Option Premium of Call & Put as on Today.
- The basic assumption of this model is that share price on expiry may be higher or may be lower than current price.

Step 1: **Calculate Value of Call or Put as on expiry at high price & low price**

Value of Call as on expiry = Max [(S – X),0]
Value of Put as on expiry = Max [(X – S), 0]

Step 2: **Calculate Probability of High Price & Low Price**

Probability of High Price = $\frac{\text{CMP } (1+r)^n - S_2}{S_1 - S_2}$ **or** Probability of High Price = $\frac{\text{CMP } (e^{rt}) - S_2}{S_1 - S_2}$

Step 3: **Calculate expected Value/ Premium as on expiry by using Probability**

Step 4: **Calculate Premium as on Today**

By Using normal Compounding

$$= \frac{\text{Expected Premium as on expiry}}{(1+r)^t}$$

By Using Continuous Compounding

= Premium as on expiry × e^{-rt}

Concept No. 17: Two Period Binomial Model

We divide the option period into two equal parts and we are provided with binomial projections for each path. We then calculate value of the option on maturity. We then apply backward induction technique to compute the value of option at each nodes.

Concept No. 18: Put Call Parity Theory (PCPT)

Put Call Parity is based on Pay-offs of two portfolio combination, a fiduciary call and a protective put.

Fiduciary Call
A Fiduciary Call is a combination of a pure-discount, riskless bond that pays X at maturity and a Call.

Protective Put
A Protective Put is a share of stock together with a put option on the stock.

$$\textbf{PCPT} \rightarrow \textbf{Value of Call} + \frac{X}{(1+RFR)^T} = \textbf{Value of Put} + \textbf{S}$$

Through this theory, we can calculate either Value of Call or Value of Put provided other Three information is given.

Assumptions:

- Exercise Price of both Call & Put Option are same.
- Maturity Period of both Call & Put are Same.

Concept No. 19: Put - Call Parity Theory → ARBITRAGE

As per PCPT,

$$\underbrace{\text{Value of Call} + \frac{X}{(1+RFR)^T}}_{\text{LHS}} = \underbrace{\text{Value of Put} + S}_{\text{RHS}}$$

Case I
If LHS = RHS, no arbitrage is possible.

Case II
If LHS ≠ RHS, arbitrage is possible.

A. If **LHS > RHS**, Call is Over-Valued & Put is Under-Valued

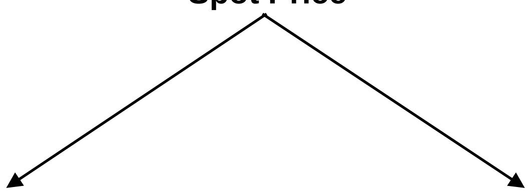
Option Market		Cash Market	Net Amount
Short Call i.e. Obligation to sell & receive Option Premium	**Long Put** i.e. Right to sell & pay Option Premium	**Buy** i.e. Buy one share	**Borrow**

B. If **LHS < RHS**, Call is Under-Valued & Put is Over-Valued

Option Market		Cash Market	Net Amount
Long Call i.e. Right to Buy & pay Option Premium	**Short Put** i.e. Obligation to Buy & receive Option Premium	**Sell** i.e. Sell one share	**Invest**

Concept No. 20: Binomial Model (Delta Hedging / Perfectly Hedged technique) for Call Writer

- Under this concept, we will calculate option premium for call option.
- It is assumed that expected price on expiry may be greater than Current Market Price or less than Current Market Price.



- This model involves 3 Steps:

Step 1: Compute the Option Value on Expiry Date at high price and at low price

Value of Call as on expiry = Max [(S – X),0]

Step 2: Buy 'Delta' No. of shares 'Δ' at Current Market Price as on Today. Delta 'Δ ' also known as Hedge Ratio.

$$\text{Hedge Ratio or } `\Delta' = \frac{\text{Change in Option Premium}}{\text{Change in Price of Underlying Asset}}$$

OR

$$= \frac{\text{Value of call on expiry at High Price} - \text{Value of call on expiry at Low Price}}{\text{High Price} - \text{Low Price}}$$

$$= \frac{C_1 - C_2}{S_1 - S_2}$$

Step 3: Construct a Delta Hedge Portfolio i.e. Risk-less portfolio / Perfectly Hedge Portfolio
Sell one call option i.e. Short Call ,Buy Delta no. of shares and borrow net amount.

Step 4: Borrow the net Amount required for the above steps

$$B = \frac{1}{1+r}[\Delta \times S_2 - C_2]$$

Or

$$B = \frac{1}{1+r}[\Delta \times S_1 - C_1]$$

Where r = rate of interest adjusted for period

Step 5: Calculate Value of call as on today
Borrowed Amount = Amount required to purchase of share – Option Premium Received

B = Δ × CMP – OP

Or

(Option Premium = Δ × CMP – Borrowed Amount)

Note: **Calculation of Cash flow Position/ Value of holding after 1 year**

- **If on Maturity Actual Market Price is S_1**
  Cash Flow = $\Delta \times S_1 - C_1$

- **If on Maturity Actual Market Price is S_2**
  Cash Flow = $\Delta \times S_2 - C_2$

- **Cash Flow at S_1 and S_2 will always be same**.

Concept No. 21: Black & Scholes Model

The BSM Model uses five variables to value a call option:
1. The price of the Underlying Stock (S)
2. The exercise price of the option (X)
3. The time remaining to the expiration of the option (t)
4. The riskless rate of return (r)
5. The volatility of the underlying stock price (σ)

For Call:

Value of a Call Option/ Premium on Call = $\mathbf{S} \times \mathbf{N(d_1)} - \frac{\mathbf{X}}{\mathbf{e^{rt}}} \times \mathbf{N(d_2)}$

Where $N(d_1)$ and $N(d_2)$ are statistical term which takes into account standard deviation, logarithm (l_n) and other relevant factors (It denotes Probability).

$N(d_1)$ and $N(d_2)$ can be calculated by Using d_1 and d_2

Calculation of d_1 and d_2

$$d_1 = \frac{l_n\left[\frac{S}{X}\right] + \left[r + 0.50\sigma^2\right] \times t}{\sigma \times \sqrt{t}}$$

where
S = Current Market Price
X = Exercise Price
r = risk-free interest rate
t = time until option expiration
σ = Standard Deviation of Continuously Compounded annual return

$$d_2 = d_1 - \sigma\sqrt{t}$$

Or

$$d2 = \frac{l_n\left[\frac{S}{X}\right] + \left[r - 0.50\sigma^2\right] \times t}{\sigma \times \sqrt{t}}$$

For Put:

Value of a Put Option/ Premium on Put = $\frac{\mathbf{X}}{\mathbf{e^{rt}}} \times [\,\mathbf{1} - \mathbf{N(d_2)}] - \mathbf{S} \times [\mathbf{1} - \mathbf{N(d_1)}]$

Where,
S = Current Market Price
X = Exercise Price

Note:
Value or Premium of Put can either be calculated by using PCPT or BSM. However if value of Call is given or calculated, then in such case PCPT is preferred.

Concept No. 22: BSM → when dividend amount is given in the question

Adjust Spot Price (S) or CMP
[Spot Price – PV of Dividend Income]

Value of a Call Option/ Premium on Call

$$= [S - \text{PV of Dividend Income}] \times N(d_1) - \frac{X}{e^{rt}} \times N(d_2)$$

$$d_1 = \frac{l_n\left[\frac{S - \text{PV of Dividend Income}}{X}\right] + [r + 0.50\sigma^2] \times t}{\sigma \times \sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

Concept No. 23: High Profit & High Losses under Future & Option

By investing in Future & Options we have huge profits with low initial investments in comparison to cash markets but at the same time we can also have huge losses.

Concept No. 24: Put-Call Ratio

Put- Call Ratio = $\frac{\text{Volume of Put Traded}}{\text{Volume of Call Traded}}$

- The ratio of the volume of put options traded to the volume of Call options traded, which is used as an indicator of investor’s sentiment (bullish or bearish)
- The put-call Ratio to determine the market sentiments, with high ratio indicating a bearish sentiment and a low ratio indicating a bullish sentiment.

Concept No. 25: Option Greek Parameters

Option price depends on 5 factors:

Option Price = f [S, X, t, r, σ], out of these factors X is constant and other causing a change in the price of option.
We will find out a rate of change of option price with respect to each factor at a time, keeping others constant.

Delta: It is the degree to which an option price will move given a small change in the underlying stock price. For example, an option with a delta of 0.5 will move half a rupee for every full rupee movement in the underlying stock.

The delta is often called the hedge ratio i.e. if you have a portfolio short ‘n’ options (e.g. you have written n calls) then n multiplied by the delta gives you the number of shares (i.e. units of the underlying) you would need to create a riskless position - i.e. a portfolio which would be worth the same whether the stock price rose by a very small amount or fell by a very small amount.

Gamma: It measures how fast the delta changes for small changes in the underlying stock price i.e. the delta of the delta. If you are hedging a portfolio using the delta-hedge technique described under "Delta", then you will want to keep gamma as small as possible, the smaller it is the less often you will have to adjust the hedge to maintain a delta neutral position. If gamma is too large, a small change in stock price could wreck your hedge. Adjusting gamma, however, can be tricky and is generally done using options.

Vega: Sensitivity of option value to change in volatility. Vega indicates an absolute change in option value for a one percentage change in volatility.

Rho: The change in option price given a one percentage point change in the risk-free interest rate. It is sensitivity of option value to change in interest rate. Rho indicates the absolute change in option value for a one percent change in the interest rate.

Theta: It is a rate change of option value with respect to the passage of time, other things remaining constant. It is generally negative.