Section A

1. What do you understand by bond pricing?

Determining the price of any financial instrument requires an estimate of (i) the expected cash flows, and (ii) the appropriate required yield. The required yield reflects the yield for financial instruments with comparable risk, or alternative investments.

The cash flows for a bond that the issuer cannot retire prior to its stated maturity date consist of periodic coupon interest payments to the maturity date, and the par (or maturity) value at maturity.

In general, the price of a bond can be computed using the following formula:

\[
P = \sum_{t=1}^{n} \frac{C_t}{1 + r^t} + \frac{M}{1 + r^n}.
\]

Where, \( P \) = price (in dollars), \( n \) = number of periods (number of years times 2), \( C \) = semiannual coupon payment (in dollars), \( r \) = periodic interest rate (required annual yield divided by 2), \( M \) = maturity value, and \( t \) = time period when the payment is to be received.

2. Explain Price – Yield Relationship

A fundamental property of a bond is that its price changes in the opposite direction from the change in the required yield. The reason is that the price of the bond is the present value of the cash flows.
3. What are the various measures available for computing bond yield?

There are three bond yield measures commonly quoted by dealers and used by investors:

**Current yield**

To obtain the current yield, the annual coupon interest is divided by the market price.

The current yield calculation takes into account only the coupon interest and no other source of return that will affect an investor's yield.

The capital gain that the investor will realize when a bond is purchased at a discount or the capital loss that the investor will realize if a bond purchased at a premium is held to maturity are not taken into consideration. The time value of money is also ignored.

**Yield to maturity**

The yield on any investment is the interest rate that will make the present value of the cash flows from the investment equal to the price of the investment.

As a starting point an approximate value is calculated as being the average income per period divided by the average amount invested. FinKit displays this value as the average yield.

To find a more accurate value, an iterative procedure is used. The objective is to find the interest rate that will make present value of the cash flows equal to the price. Fin Kit calculates the yield to maturity to four digits after the decimal point.

**Yield to call**

For bonds that may be called prior to the stated maturity date another yield measure is commonly quoted: it is the yield to call.

To compute the yield to call, the cash flows that occur if the issue is called on its first call date are used.
To calculate the yield to call using FinKit, just enter the call date as the redemption date and enter the call price as the redemption value: the yield to call will equal the yield to maturity result.

5. Write short note on current yield.

Annual income (interest or dividends) divided by the current price of the security. This measure looks at the current price of a bond instead of its face value and represents the return an investor would expect if he or she purchased the bond and held it for a year. This measure is not an accurate reflection of the actual return that an investor will receive in all cases because bond and stock prices are constantly changing due to market factors.

\[
\text{Current Yield} = \frac{\text{Annual Cash Inflows}}{\text{Market Price}}
\]

Also referred to as "bond yield", or "dividend yield" for stocks.

6. What is Yield Spread?

The difference between yields on differing debt instruments, calculated by deducting the yield of one instrument from another. The higher the yield spread, the greater the difference between the yields offered by each instrument. The spread can be measured between debt instruments of differing maturities, credit ratings and risk.

For example, if the five-year Treasury bond is at 5% and the 30-year Treasury bond is at 6%, the yield spread between the two debt instruments is 1% (6% - 5%). If the yield spread has historically been closer to 5%, the investor is much more likely to invest in the five-year bond compared to the 30-year bond (as it should be trading around 1% instead of 6%).

7. Explain Convexity

A measure of the curvature in the relationship between bond prices and bond yields that demonstrates how the duration of a bond changes as the interest rate changes. Convexity is used as a risk-management tool, and helps to measure and manage the amount of market risk to which a portfolio of bonds is exposed.
8. Write a short note on Immunization

Used to protect a bond portfolio against interest rate risk

- Price risk and reinvestment risk cancel
- Price risk results from relationship between bond prices and rates
- Reinvestment risk results from uncertainty about the reinvestment rate for future coupon income

Risk components move in opposite directions

- Favorable results on one side can be used to offset unfavorable results on the other
- Portfolio immunized if the duration of the portfolio is equal to investment horizon
- Ending wealth for a bond following a change in market yields with and without immunization

9. Write a short note on Substitution Swap.

An exchange that is carried out by trading a fixed-income security for a higher yielding bond with similar features. A substitution swap involves the swapping of one bond for another bond that has a higher yield, but has a similar coupon rate, maturity date, call feature, credit quality, etc. A substitution swap allows the investor (such as a firm) to increase returns without altering the terms or risk level of the security. Investors will participate in substitution swaps when they believe there is a temporary discrepancy in bond prices due to market disequilibrium.
Section B

1. Explain Expectations Theory of Interest Rate.

This theory holds that the shape of the yield curve can be explained by the interest rate expectations of those who participate in the market. More precisely, the expectations theory holds that any long-term rate is equal to the geometric mean of current and future one-year rates expected by the market participants.

In general terms, the expectations theory may be expressed as follows:

\[(1+R_n) = [(1+R_1)(1+R_{t+1})…(1+R_{t+n-1})]^{1/n}\]

Where,

\(R_n\) = actual long-term rate

\(n\) = term to maturity of the long issue

\(R_t\) = current year rate

\(R_{t+i}\) = expected one year rate during some future period

Clearly, the expectations hypothesis can explain any shape of yield curve:

<table>
<thead>
<tr>
<th>Yield curve</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascending</td>
<td>short-term rates are expected to rise in future</td>
</tr>
<tr>
<td>Descending</td>
<td>short-term rates are expected to fall in future</td>
</tr>
<tr>
<td>Humped</td>
<td>short-term rates are expected to rise for a while and then fall</td>
</tr>
<tr>
<td>Flat</td>
<td>short-term rates are expected to remain unchanged in future</td>
</tr>
</tbody>
</table>

2. What is price volatility for bonds? How it has implication for investors?

There is inverse relationship between changes in yields and the price of bond. There are specific factors that affect the amount of price change for yield change in different bond. This is
referred as interest rate sensitivity of a bond. Change in Interest rate can cause vastly different percentage price changes for alternative bonds, which implies different interest rate sensitivity.

Bond price volatility is measured as the percentage change in the price of the bond, computed as follows:

\[(\text{EPB}/\text{BPB})-1\]

Where,

\(\text{EPB} = \) the ending price of the bond

\(\text{BPB} = \) the beginning price of the bond

A bond with high price volatility or high interest rate sensitivity is one that experiences a relatively large percentage price change for a given change in yields.

The market price of the bond is a function of four factors:

1. Its par value
2. Its coupon
3. The number of years to its maturity
4. The prevailing market interest rate

3. What is duration? Explain

Duration is a measure of the weighted average life of a bond, which considers the size and timing of each cash flow. The weight assigned to each time period is the present value of the cash flow paid at the time as a proportion of the price of the bond. Mathematically, duration is defined as:

\[\text{Duration} = \frac{\text{PV}(C_1)*1+\text{PV}(C_2)*2+…+\text{PV}(C_n)*n]}{V_o}\]

Where,

\(\text{PV}(C_t) = \) present value of cash flow receivable at the end of the year \(t (t=1, 2, \ldots n)\)
\[ V_0 = \text{current value of the bond} \]

For calculating the present value of cash flow, the yield to maturity (the internal rate of return) of the bond is used as the discount rate.

The duration of a bond, in effect, represents the length of time that elapses before the “average” rupee of present value from the bond is received.

Duration is a key concept in bond analysis for the following reasons:

- It measures the interest rate sensitivity of a bond
- It is a useful tool for immunizing against interest rate risk

**Duration and Price Change**

Duration reflects coupon, maturity and yield, the three key variables that determine the response of price to interest rate changes. Hence, duration can be used to measure interest rate exposure. In particular a variant of duration called modified duration is used for this purpose.

\[ D^* = \frac{D}{1+y} \]

Where,

\[ D^* = \text{modified duration} \]
\[ D = \text{duration} \]
\[ Y = \text{bonds yield to maturity} \]

4. **What are the different types of Bond Portfolio Management Strategies?**

Two commonly followed strategies by passive bond investors are: buy and hold strategy and indexing strategy.

**Buy and hold strategy:**

An investor who follows a buy and hold strategy selects a bond portfolio and stays with it. He does not churn his bond portfolio in an attempt to improve returns and or reduce risks.
Obviously, such an investor chooses a bond portfolio that promises to meet his investment objectives and hence spends time and effort in his initial selection.

Indexing strategy:

If the capital market if efficient, efforts to find under-priced securities or to time the market may be futile. Empirical researches on this issue suggest that most investors are unlikely to outperform the market. Hence, they may find an indexing strategy appealing. Such a strategy calls for building a portfolio that mirrors a well-known bond index. In the US, two well known bond indices are the Shearson Lehman Index and the Salomon Brothers Index, i-BEX is a popular bond index in India.

5. What are the different types of Bond Portfolio Management Strategies?

Types of strategies:

- Passive, or "buy and hold"
- Index matching, or "quasi passive"
- Immunization, or "quasi active"
- Dedicated and active

Passive Bond Strategy:

The passive buy-and-hold investor is typically looking to maximize the income generating properties of bonds. The premise of this strategy is that bonds are assumed to be safe, predictable sources of income. Buy and hold involves purchasing individual bonds and holding them to maturity. Cash flow from the bonds can be used to fund external income needs or can be reinvested in the portfolio into other bonds or other asset classes. In a passive strategy, there are no assumptions made as to the direction of future interest rates and any changes in the current value of the bond due to shifts in the yield are not important. The bond may be originally purchased at a premium or a discount, while assuming that full par will be received upon maturity. The only variation in total return from the actual coupon yield is the reinvestment of the coupons as they occur. On the surface, this may appear to be a lazy style of investing, but in reality they minimize or eliminate transaction costs, and if originally implemented during a period of relatively high interest rates, they have a decent chance of outperforming active strategies.
One of the main reasons for their stability is the fact that passive strategies work best with very high-quality, non-callable bonds like government or investment grade corporate or municipal bonds. These types of bonds are well suited for a buy-and-hold strategy as they minimize the risk associated with changes in the income stream due to embedded options, which are written into the bond's covenants at issue and stay with the bond for life. Like the stated coupon, call and put features embedded in a bond allow the issue to act on those options under specified market conditions.

**Indexing Bond Strategy:**

Indexing is considered to be quasi-passive by design. The main objective of indexing a bond portfolio is to provide a return and risk characteristic closely tied to the targeted index. While this strategy carries some of the same characteristics of the passive buy-and-hold, it has some flexibility. Just like tracking a specific stock market index, a bond portfolio can be structured to mimic any published bond index. One common index mimicked by portfolio managers is the Lehman Aggregate Bond Index.

Due to the size of this index, the strategy would work well with a large portfolio due to the number of bonds required to replicate the index. One also needs to consider the transaction costs associated with not only the original investment, but also the periodic rebalancing of the portfolio to reflect changes in the index.

**Immunization Bond Strategy:**

This strategy has the characteristics of both active and passive strategies. By definition, pure immunization implies that a portfolio is invested for a defined return for a specific period of time regardless of any outside influences, such as changes in interest rates. Similar to indexing, the opportunity cost of using the immunization strategy is potentially giving up the upside potential of an active strategy for the assurance that the portfolio will achieve the intended desired return. As in the buy-and-hold strategy, by design the instruments best suited for this strategy are high-grade bonds with remote possibilities of default. In fact, the purest form of immunization would be to invest in a zero-coupon bond and match the maturity of the bond to the date on which the cash flow is expected to be needed. This eliminates any variability of return, positive or negative, associated with the reinvestment of cash flows.
Duration, or the average life of a bond, is commonly used in immunization. It is a much more accurate predictive measure of a bond's volatility than maturity. This strategy is commonly used in the institutional investment environment by insurance companies, pension funds and banks to match the time horizon of their future liabilities with structured cash flows. It is one of the soundest strategies and can be used successfully by individuals. For example, just like a pension fund would use an immunization to plan for cash flows upon an individual's retirement, that same individual could build a dedicated portfolio for his or her own retirement plan.

**Active Bond Strategy:**

The goal of active management is maximizing total return. Along with the enhanced opportunity for returns obviously comes increased risk. Some examples of active styles include interest rate anticipation, timing, valuation and spread exploitation, and multiple interest rate scenarios. The basic premise of all active strategies is that the investor is willing to make bets on the future rather than settle with what a passive strategy can offer.

6. **Explain Indexing Strategy of Passive portfolio management.**

Indexing is considered to be quasi-passive by design. The main objective of indexing a bond portfolio is to provide a return and risk characteristic closely tied to the targeted index. While this strategy carries some of the same characteristics of the passive buy-and-hold, it has some flexibility. Just like tracking a specific stock market index, a bond portfolio can be structured to mimic any published bond index. One common index mimicked by portfolio managers is the Lehman Aggregate Bond Index.

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7. **Explain the key determinants interest rate.**

   1. **Real Risk-Free Rate** - This assumes no risk or uncertainty, simply reflecting differences in timing: the preference to spend now/pay back later versus lend now/collect later.
2. **Expected Inflation** - The market expects aggregate prices to rise, and the currency's purchasing power is reduced by a rate known as the inflation rate. Inflation makes real dollars less valuable in the future and is factored into determining the nominal interest rate (from the economics material: nominal rate = real rate + inflation rate).

3. **Default-Risk Premium** - What is the chance that the borrower won't make payments on time, or will be unable to pay what is owed? This component will be high or low depending on the creditworthiness of the person or entity involved.

4. **Liquidity Premium** - Some investments are highly liquid, meaning they are easily exchanged for cash. Other securities are less liquid, and there may be a certain loss expected if it's an issue that trades infrequently. Holding other factors equal, a less liquid security must compensate the holder by offering a higher interest rate.

5. **Maturity Premium** - All else being equal, a bond obligation will be more sensitive to interest rate fluctuations the longer to maturity it is.

8. **What are the Traditional Theories of the Term Structure:**

1. **Pure Expectation Theory**: Pure expectation is the simplest and most direct of the three theories. The theory explains the yield curve in terms of expected short-term rates. It is based on the idea that the two-year yield is equal to a one-year bond today plus the expected return on a one-year bond purchased one year from today. The one weakness of this theory is that it assumes that investors have no preference when it comes to different maturities and the risks associated with them.

2. **Liquidity Preference Theory**: This theory states that investors want to be compensated for interest rate risk that is associated with long-term issues. Because of the longer maturity, there is a greater price volatility associated with these securities. The structure is determined by the future expectations of rates and the yield premium for interest-rate risk. Because interest-rate risk increases with maturity, the yield premium will also increase with maturity. Also known as the Biased Expectations Theory.

3. **Market Segmentation Theory**: This theory deals with the supply and demand in a certain maturity sector, which determines the interest rates for that sector. It can be used to explain just about every type of yield curve an investor can came across in the market. An offshoot to this theory is that if an investor wants to go out of his sector, he'll want to
be compensated for taking on that additional risk. This is known as the Preferred Habitat Theory.

9. How will you value the optionally convertible bonds

An optionally convertible bond may be viewed as a bond warrant package. Its value is a function of three factors:

- Straight Bond Value
- Conversion Value
- Option Value

**Straight Bond Value**

The straight bond value of a convertible bond is the discounted value of the interest and principal repayments receivable on it, if it is retained as a straight debt instrument. The discount rate used in this calculation depends on the general interest rates and the credit rating of the bond. The value of a straight bond depends on the value of the firm. If a firm’s value declines, the value of its straight bond may fall. In the extreme, if the value of a firm shrinks to zero, the value of its straight bond becomes nil. The maximum value of a firm’s straight to bond would be equal to the value of an equivalent risk-free bond.

**Conversion Value**

The conversion value is the value of the bond if the bond holders seek conversion. It is equal to the stock price multiplied by the conversion rate. Thus the conversion value is linearly related to the value of the firm. We have defined the straight bond value and the conversion value of a convertible bond. The value of a convertible bond theoretically cannot fall below its straight bond value as well as its conversion value. Put differently, the convertible bond has two floor values: as straight bond value and its conversion value.

**Option Value**

If you hold a convertible bond, you are not compelled to make an immediate choice in favor of or against conversion. You can wait, learn from hand sight, and finally choose the most profitable alternative. The option to wait is valuable. Hence, the value of the convertible bond lies above its floor value. The difference between the dashed line and the thick lower bound line
represents the value of the option to convert. Thus the value of a convertible bond may be expressed as follows:

\[
\text{Value of the convertible bond} = \text{Max} (\text{Straight bond value, Conversion Value}) + \text{Option value}
\]

10. **What is the meaning of Bond Swap? Explain the concept of Pure Yield Pickup Swap.**

**Meaning of Bond Swap:**

It involves liquidating a current position and simultaneously buying a different issue in its place with similar attributes but having a chance for improved return.

**Different Types of Bond Swap:**

- Pure Yield Pickup Swap
- Substitution Swap
- Tax Swap

**a. Pure Yield Pickup Swap:**

It involves swapping out of a low-coupon bond into a comparable higher coupon bond to realize an automatic and instantaneous increase in current yield and yield to maturity.

**Advantages:**

- No need for interest rate speculation
- No need to analyze prices or overvaluation or under valuation
- No specific work-out period needed because the investor is assumed to hold new bond to maturity

**Disadvantages:**

- Increased risk of call in the event interest rate decline
- Reinvestment risk is greater with higher coupon bonds.
UNIT II

Section A

1. Explain derivatives.

Meaning:

A security whose price is dependent upon or derived from one or more underlying assets. The derivative itself is merely a contract between two or more parties. Its value is determined by fluctuations in the underlying asset. The most common underlying assets include stocks, bonds, commodities, currencies, interest rates and market indexes. Most derivatives are characterized by high leverage.

2. Write short note on: Forward and Futures Contracts

Forward:

In finance, a forward contract or simply a forward is a non-standardized contract between two parties to buy or to sell an asset at a specified future time at a price agreed upon today, making it a type of derivative instrument. This is in contrast to a spot contract, which is an agreement to buy or sell an asset on its Spot Date, which may vary depending on the instrument, for example most of the FX contracts have Spot Date two business days from today. The party agreeing to buy the underlying asset in the future assumes a long position, and the party agreeing to sell the asset in the future assumes a short position. The price agreed upon is called the delivery price, which is equal to the forward price at the time the contract is entered into. The price of the underlying instrument, in whatever form, is paid before control of the instrument changes. This is one of the many forms of buy/sell orders where the time and date of trade is not the same as the value date where the securities themselves are exchanged. The forward price of such a contract is commonly contrasted with the spot price, which is the price at which the asset changes hands on the spot date. The difference between the spot and the forward price is the forward premium or forward discount, generally considered in the form of a profit, or loss, by the purchasing party. Forwards, like other derivative securities, can be used to hedge risk (typically currency or exchange rate risk), as a means of speculation, or to allow a party to take advantage of a quality of the underlying instrument which is time-sensitive. A closely related
contract is a futures contract; they differ in certain respects. Forward contracts are very similar to futures contracts, except they are not exchange-traded, or defined on standardized assets. Forwards also typically have no interim partial settlements or "true-ups" in margin requirements like futures – such that the parties do not exchange additional property securing the party at gain and the entire unrealized gain or loss builds up while the contract is open. However, being traded over the counter (OTC), forward contracts specification can be customized and may include mark-to-market and daily margin calls. Hence, a forward contract arrangement might call for the loss party to pledge collateral or additional collateral to better secure the party at gain. In other words, the terms of the forward contract will determine the collateral calls based upon certain "trigger" events relevant to a particular counterparty such as among other things, credit ratings, value of assets under management or redemptions over a specific time frame, e.g., quarterly, annually, etc.

Future:

In finance, a futures contract (more colloquially, futures) is a standardized contract between two parties to buy or sell a specified asset of standardized quantity and quality for a price agreed upon today (the futures price) with delivery and payment occurring at a specified future date, the delivery date, making it a derivative product (i.e. a financial product that is derived from an underlying asset). The contracts are negotiated at a futures exchange, which acts as an intermediary between buyer and seller. The party agreeing to buy the underlying asset in the future, the "buyer" of the contract, is said to be "long", and the party agreeing to sell the asset in the future, the "seller" of the contract, is said to be "short". While the futures contract specifies a trade taking place in the future, the purpose of the futures exchange is to act as intermediary and mitigate the risk of default by either party in the intervening period. For this reason, the futures exchange requires both parties to put up an initial amount of cash (performance bond), the margin. Margins, sometimes set as a percentage of the value of the futures contact needs to be proportionally maintained at all times during the life of the contract to underpin this mitigation because the price of the contract will vary in keeping with supply and demand and will change daily and thus one party or the other will theoretically be making or losing money. To mitigate risk and the possibility of default by either party, the product is marked to market on a daily basis whereby the difference between the prior agreed-upon price
and the actual daily futures price is settled on a daily basis. This is sometimes known as the variation margin where the Futures Exchange will draw money out of the losing party's margin account and put it into the other party's thus ensuring that the correct daily loss or profit is reflected in the respective account. If the margin account goes below a certain value set by the Exchange, then a margin call is made and the account owner must replenish the margin account. This process is known as marking to market. Thus on the delivery date, the amount exchanged is not the specified price on the contract but the spot value (i.e. the original value agreed upon, since any gain or loss has already been previously settled by marking to market). Upon marketing the strike price is often reached and creates lots of income for the "caller." A closely related contract is a forward contract. A forward is like a future in that it specifies the exchange of goods for a specified price at a specified future date. However, a forward is not traded on an exchange and thus does not have the interim partial payments due to marking to market. Nor is the contract standardized, as on the exchange. Unlike an option, both parties of a futures contract must fulfill the contract on the delivery date. The seller delivers the underlying asset to the buyer, or, if it is a cash-settled futures contract, then cash is transferred from the futures trader who sustained a loss to the one who made a profit. To exit the commitment prior to the settlement date, the holder of a futures position can close out its contract obligations by taking the opposite position on another futures contract on the same asset and settlement date. The difference in futures prices is then a profit or loss.

3. **Write a short note on Long & Short Hedges**

**Short hedge:**

A common risk in short hedging is basis risk, or the risk that price levels will not change much over the period the hedge is in place; in this scenario, the asset held in the long position would not gain any value, and the short hedge would lose value. Short hedging is often seen in the agriculture business, as producers are often willing to pay a small premium to lock in a preferred rate of sale in the future. Also, short hedges involving interest rates are common among institutional money managers that hold large amounts of fixed income securities and are concerned about reinvestment risk in the future.
Long Hedge:

A situation where an investor has to take a long position in futures contracts in order to hedge against future price volatility. A long hedge is beneficial for a company that knows it has to purchase an asset in the future and wants to lock in the purchase price. A long hedge can also be used to hedge against a short position that has already been taken by the investor.

4. Write a short note on Swaps

If firms in separate countries have comparative advantages on interest rates, then a swap could benefit both firms. For example, one firm may have a lower fixed interest rate, while another has access to a lower floating interest rate. These firms could swap to take advantage of the lower rates.

5. Give an Example of valuing a forward contract

A forward contract is a private agreement between two parties giving the buyer an obligation to purchase an asset (and the seller an obligation to sell an asset) at a set price at a future point in time.

The assets often traded in forward contracts include commodities like grain, precious metals, electricity, oil, beef, orange juice, and natural gas, but foreign currencies and financial instruments are also part of today's forward markets.

Suppose now that the initial price of Andy's house is $100,000 and that Bob enters into a forward contract to buy the house one year from today. But since Andy knows that he can immediately sell for $100,000 and place the proceeds in the bank, he wants to be compensated for the delayed sale. Suppose that the risk free rate of return $R$ (the bank rate) for one year is 4%. Then the money in the bank would grow to $104,000, risk free. So Andy would want at least $104,000 one year from now for the contract to be worthwhile for him – the opportunity cost will be covered.
6. **What is the difference between Forward weds Futures Prices?**

First of all, futures contracts are exchange-traded and, therefore, are standardized contracts. Forward contracts, on the other hand, are private agreements between two parties and are not as rigid in their stated terms and conditions. Because forward contracts are private agreements, there is always a chance that a party may default on its side of the agreement. Futures contracts have clearing houses that guarantee the transactions, which drastically lowers the probability of default to almost never.

Secondly, the specific details concerning settlement and delivery are quite distinct. For forward contracts, settlement of the contract occurs at the end of the contract. Futures contracts are marked-to-market daily, which means that daily changes are settled day by day until the end of the contract. Furthermore, settlement for futures contracts can occur over a range of dates. Forward contracts, on the other hand, only possess one settlement date.

Lastly, because futures contracts are quite frequently employed by speculators, who bet on the direction in which an asset's price will move, they are usually closed out prior to maturity and delivery usually never happens. On the other hand, forward contracts are mostly used by hedgers that want to eliminate the volatility of an asset's price, and delivery of the asset or cash settlement will usually take place.

7. **What is marking-to-market?**

1. A measure of the fair value of accounts that can change over time, such as assets and liabilities. Mark to market aims to provide a realistic appraisal of an institution's or company's current financial situation.

2. The accounting act of recording the price or value of a security, portfolio or account to reflect its current market value rather than its book value.

3. When the net asset value (NAV) of a mutual fund is valued based on the most current market valuation.
8. Who are the users of futures contract?

- Most participants in the futures markets are commercial or institutional commodities producers or consumers
- Most participants are “hedgers” who trade futures to maximize the value of their assets, and to reduce the risk of financial losses from price changes
- Other participants are “speculators” who attempt to profit from price changes in futures contracts

Section B

1. How to price financial contracts?

- Pricing of Financial Contracts
  - Valuation of performance sensitive debt and other debt contracts
  - Pricing of options on assets that pay out discrete dividends and other specialized derivatives
  - The effect on prices when investors have different information
- The Equity Risk Premium
  - Using stock market participation and consumption to explain the equity premium puzzle
- The Dynamics of the Term Structure of Interest Rates
- Graphically explain the put call options

2. What are the various option strategies?

Bullish Strategy:

Bullish options strategies are employed when the options trader expects the underlying stock price to move upwards. It is necessary to assess how high the stock price can go and the time frame in which the rally will occur in order to select the optimum trading strategy.
The most bullish of options trading strategies is the simple call buying strategy used by most novice options traders. Stocks seldom go up by leaps and bounds. Moderately bullish options traders usually set a target price for the Bull Run and utilize bull spreads to reduce cost. (It does not reduce risk because the options can still expire worthless.) While maximum profit is capped for these strategies, they usually cost less to employ for a given nominal amount of exposure. The bull call spread and the bull put spread are common examples of moderately bullish strategies.

Mildly bullish trading strategies are options strategies that make money as long as the underlying stock price does not go down by the options expiration date. These strategies may provide a small downside protection as well. Writing out-of-the-money covered calls is a good example of such a strategy.

**Bearish Strategy:**

Bearish options strategies are employed when the options trader expects the underlying stock price to move downwards. It is necessary to assess how low the stock price can go and the time frame in which the decline will happen in order to select the optimum trading strategy.

The most bearish of options trading strategies is the simple put buying strategy utilized by most novice options traders. Stock prices only occasionally make steep downward moves. Moderately bearish options traders usually set a target price for the expected decline and utilize bear spreads to reduce cost. While maximum profit is capped for these strategies, they usually cost less to employ. The call spread and the bear put spread are common examples of moderately bearish strategies.

Mildly bearish trading strategies are options strategies that make money as long as the underlying stock price does not go up by the options expiration date. These strategies may provide a small upside protection as well. In general, bearish strategies yield less profit with less risk of loss.

**Neutral or Non-directional Strategy:**

Neutral strategies in options trading are employed when the options trader does not know whether the underlying stock price will rise or fall. Also known as non-directional strategies, they are so named because the potential to profit does not depend on whether the underlying
stock price will go upwards. Rather, the correct neutral strategy to employ depends on the expected volatility of the underlying stock price.

3. What are the factors determine the option value?

**Exercise Price:**

By now it is obvious that, other things being constant, the higher the exercise price the lower the value of the call option. Remember that the value of a call option can never be negative regardless of how high the exercise price is set. Further it has a positive value of there is some possibility that the stock price will be higher than the exercise price before the expiration date.

**Expiration date:**

Other things being equal, the longer the time to expiration date the more valuable the call option. Consider two American calls with maturities of one year and two years. The two year call obviously is more valuable than the one year call because it gives its holder one more year within which it can be exercised.

**Stock Price:**

The value of a call option, other things being constant, increases with the stock price. This point is obvious from the figures showing the relationship between the stock price and the value of call option.

**Variability of the Stock Price:**

A call option has value when there is a possibility that the stock price exceeds the exercise price before the expiration date. Other things being equal, the higher the variability of the stock price, the greater is the likelihood that the stock price will exceed the exercise price.

4. What is the value of the call option according to Black-Scholes model?

The Black-Scholes model for calculating the premium of an option was introduced in 1973 in a paper entitled, "The Pricing of Options and Corporate Liabilities" published in the Journal of Political Economy. The formula, developed by three economists – Fischer Black, Myron Scholes and Robert Merton – is perhaps the world's most well-known options pricing model. Black passed away two years before Scholes and Merton were awarded the 1997 Nobel Prize in Economics for their work in finding a new method to determine the value of derivatives (the Nobel Prize is not given posthumously; however, the Nobel committee acknowledged Black's role in the Black-Scholes model).
The Black-Scholes model is used to calculate the theoretical price of European put and call options, ignoring any dividends paid during the option's lifetime. While the original Black-Scholes model did not take into consideration the effects of dividends paid during the life of the option, the model can be adapted to account for dividends by determining the ex-dividend date value of the underlying stock.

The model makes certain assumptions, including:

- The options are European and can only be exercised at expiration
- No dividends are paid out during the life of the option
- Efficient markets (i.e., market movements cannot be predicted)
- No commissions
- The risk-free rate and volatility of the underlying are known and constant
- Follows a lognormal distribution; that is, returns on the underlying are normally distributed.

The formula, takes the following variables into consideration:

- Current underlying price
- Options strike price
- Time until expiration, expressed as a percent of a year
- Implied volatility
- Risk-free interest rates

\[ C = SN(d_1) - N(d_2)Ke^{-rt} \]

\[ d_1 = \frac{\ln \left( \frac{S}{K} \right) + \left( r + \frac{\sigma^2}{2} \right) t}{\sigma \sqrt{t}} \]

\[ d_2 = d_1 - \sigma \sqrt{t} \]

\( C \) = Call premium  
\( S \) = Current stock price  
\( t \) = Time until option exercise  
\( K \) = Option striking price  
\( r \) = Risk-free interest rate  
\( \sigma \) = Volatility of the underlying  
\( N \) = Cumulative standard normal distribution  
\( e \) = Exponential term  
\( s \) = St. Deviation  
\( \ln \) = Natural Log
UNIT- III

Section A

1. What are zero growth models?

The Gordon Growth Model, also known as the dividend discount model (DDM), is a method for calculating the intrinsic value of a stock, exclusive of current market conditions. The model equates this value to the present value of a stock's future dividends.

The model is named in the 1960s after Professor Myron J. Gordon, but Gordon was not the only financial scholar to popularize the model. In the 1930s, Robert F. Weise and John Burr Williams also produced significant work in this area.

There are two basic forms of the model:

I) the stable model

II) The multistage growth model.

**Stable Model**

Value of stock = \( \frac{D_1}{(k - g)} \)

where,

\( D_1 \) = next year's expected annual dividend per share

\( k \) = the investor's discount rate or required rate of return, which can be estimated using the Capital Asset Pricing Model or the Dividend Growth Model (see Cost of Equity)

\( g \) = the expected dividend growth rate (note that this is assumed to be constant)

2. How the value of the equity is calculated under Gordon model?

A model for determining the intrinsic value of a stock, based on a future series of dividends that grow at a constant rate. Given a dividend per share that is payable in one year, and the assumption that the dividend grows at a constant rate in perpetuity, the model solves for the present value of the infinite series of future dividends.
\[ \text{Stock Value (P)} = \frac{D}{k - G} \]

Where,
- \(D\) = Expected dividend per share one year from now
- \(k\) = required rate of return for equity investor
- \(G\) = Growth rate in dividends (in perpetuity)

3. **What are the assumptions made in H model?**

The H model is a two-stage model for growth, but unlike the classical two-stage model, the growth rate in the initial growth phase is not constant but declines linearly over time to reach the stable growth rate in steady stage. This model was presented in Fuller and Hsia (1984).

The model is based upon the assumption that the earnings growth rate starts at a high initial rate (\(g_a\)) and declines linearly over the extraordinary growth period (which is assumed to last 2\(H\) periods) to a stable growth rate (\(g_n\)). It also assumes that the dividend payout and cost of equity are constant over time and are not affected by the shifting growth rates. Figure 13.4 graphs the expected growth over time in the H Model.

4. **What is indexing strategy?**

1. The adjustment of the weights of assets in an investment portfolio so that its performance matches that of an index.

2. Linking movements of rates to the performance of an index.

Section B

1. **Explain hedging models in stock index futures**

Hedging implies minimizing the risk of an investment by taking an offsetting position. The primary purpose of futures market is to provide an efficient and effective mechanism for hedging. Participants buy or sell futures contract which establishes a price level now for the asset to be delivered later, in order to insure themselves against the adverse changes in the price of the
asset being traded. This is termed as hedging with futures. This way a futures hedge reduces the price risk by making the outcome more certain.

Hedger’s are participants who enter the futures market to offset the risk in an underlying risky investment made in the spot market. In a long hedge, participants buy futures to offset a short position in the spot market. In a short hedge, participants sell futures to offset a long position in the spot market. Thus, hedging with futures theoretically works on a simple rule: ‘Long a cash security, sell futures’ which means that any loss /profit in the spot market should be compensated by a profit /loss in futures. The above concept of hedging with futures, as a risk management strategy undertaken to manage the risk associated with the investments made in the spot market has been widely accepted in the finance profession. While the concept is simple and effective, measuring or quantifying the hedge is not a simple one. There are several alternative econometric techniques that can be used to measure the hedge and capture the characteristics of the data on financial time series that is used in the analysis. The fundamental quantitative tool used for measuring hedge is the “hedge-ratio”. Researchers have used several methodologies for measuring hedge ratios to quantify hedging with futures contract. Among these the following four methodologies are most commonly used (1) the Ordinary least square (OLS), (2) the Vector auto regression (VAR), (3) the Vector error correction Model (VECM) and (4) Multivariate GARCH. Empirical studies have extensively explored these four models and their conclusions report that OLS, VAR and VECM estimate static hedge ratio as these models ignore the time varying component of the variables and that the hedge ratio will vary over time as the conditional distribution between spot and futures prices changes. Hence, in order to take account of the time varying dynamic financial time series these studies have estimated hedge ratio using GARCH techniques.

2. Brief the various equity valuation approaches. Which do you think is more practical application for the investors?

Three major categories of equity valuation models are as follows:

- Present value models. These models estimate the intrinsic value of a security as the present value of the future benefits expected to be received from the security. In present value models, benefits are often defined in terms of cash expected to be distributed to
shareholders (dividend discount models) or in terms of cash flows available to be distributed to shareholders after meeting capital expenditure and working capital needs (free-cash-flow-to-equity models).

- **Multipler models.** These models are based chiefly on share price multiples or enterprise value multiples. The former model estimates intrinsic value of a common share from a price multiple for some fundamental variable, such as revenues, earnings, cash flows, or book value. Examples of the multiples include price to earnings (PIE, share price divided by earnings per share) and price to sales (PIS, share price divided by sales per share). The fundamental variable may be stated on a forward basis (e.g., forecasted EPS for the next year) or a trailing basis (e.g., EPS for the past year), as long as the usage is consistent across companies being examined. Price multiples are also used to compare relative values. The use of the ratio of share price to EPS - that is, the PIE multiple-to judge relative value is an example of this approach to equity valuation.

- **Enterprise value (EV) multiples** have the form (Enterprise value) / (Value of a fundamental variable). Two possible choices for the denominator are earnings before interest, taxes, depreciation, and amortization (EBITDA) and total revenue. Enterprise value, the numerator, is a measure of a company's total market value from which cash and short term investments have been subtracted (because an acquirer could use those assets to pay for acquiring the company). An estimate of common share value can be calculated indirectly from the EV multiple; the value of liabilities and preferred shares can be subtracted from the EV to arrive at the value of common equity.

- **Asset-based valuation models.** These models estimate intrinsic value of a common share from the estimated value of the assets of a corporation minus the estimated value of its liabilities and preferred shares. The estimated market value of the assets is often determined by making adjustments to the book value of assets and liabilities. The theory underlying the asset-based approach is that the value of a business is equal to the sum of the value of the business's assets.
UNIT IV

Section A

1. Define growth company and growth stock

Growth stock

A growth stock usually does not pay a dividend, as the company would prefer to reinvest retained earnings in capital projects. Most technology companies are growth stocks. Note that a growth company's stock is not always classified as growth stock. In fact, a growth company's stock is often overvalued.

Growth company

Growth companies are most often seen in the technology industries. The quintessential example of a growth company is Google, which has grown revenues, cash flows and earnings by leaps and bounds since its initial public offering. Growth companies such as Google are expected to increase profits markedly in the future, and thus the market bids up their share prices to high valuations. This contrasts with mature companies, such as diversified utility companies, which see very stable earnings with little to no growth.

2. Explain value vs. growth investing.

Growth investors often call growth investing a capital growth strategy, since investors seek to maximize their capital gains.

Although it is often said that growth investing and value investing are diametrically opposed, a better way to view these two strategies is to consider a quote by Warren Buffett: "growth and value investing are joined at the hip". Another very famous investor, Peter Lynch, pioneered a hybrid of growth and value investing with what is now commonly referred to as a "growth at a reasonable price (GARP)" strategy.
3. What is Technical Analysis?

Technical analysts believe that the historical performance of stocks and markets are indications of future performance. In a shopping mall, a fundamental analyst would go to each store, study the product that was being sold, and then decide whether to buy it or not. By contrast, a technical analyst would sit on a bench in the mall and watch people go into the stores. Disregarding the intrinsic value of the products in the store, the technical analyst's decision would be based on the patterns or activity of people going into each store.

4. What are the various assumptions of technical analysis?

The field of technical analysis is based on three assumptions:

1. The market discounts everything.
2. Price moves in trends.
3. History tends to repeat itself.

1. The Market Discounts Everything:
A major criticism of technical analysis is that it only considers price movement, ignoring the fundamental factors of the company. However, technical analysis assumes that, at any given time, a stock's price reflects everything that has or could affect the company - including fundamental factors. Technical analysts believe that the company's fundamentals, along with broader economic factors and market psychology, are all priced into the stock, removing the need to actually consider these factors separately. This only leaves the analysis of price movement, which technical theory views as a product of the supply and demand for a particular stock in the market.

2. Price Moves in Trends:
In technical analysis, price movements are believed to follow trends. This means that after a trend has been established, the future price movement is more likely to be in the same direction as the trend than to be against it. Most technical trading strategies are based on this assumption.
3. History Tends To Repeat Itself:
Another important idea in technical analysis is that history tends to repeat itself, mainly in terms of price movement. The repetitive nature of price movements is attributed to market psychology; in other words, market participants tend to provide a consistent reaction to similar market stimuli over time. Technical analysis uses chart patterns to analyze market movements and understand trends. Although many of these charts have been used for more than 100 years, they are still believed to be relevant because they illustrate patterns in price movements that often repeat themselves.

5. What are the various indicators of Technical Analysis?

There are two main types of indicators: leading and lagging. A leading indicator precedes price movements, giving them a predictive quality, while a lagging indicator is a confirmation tool because it follows price movement. A leading indicator is thought to be the strongest during periods of sideways or non-trending trading ranges, while the lagging indicators are still useful during trending periods.

There are also two types of indicator constructions: those that fall in a bounded range and those that do not. The ones that are bound within a range are called oscillators - these are the most common type of indicators. Oscillator indicators have a range, for example between zero and 100, and signal periods where the security is overbought (near 100) or oversold (near zero). Non-bounded indicators still form buy and sell signals along with displaying strength or weakness, but they vary in the way they do this.

The two main ways that indicators are used to form buy and sell signals in technical analysis is through crossovers and divergence. Crossovers are the most popular and are reflected when either the price moves through the moving average, or when two different moving averages cross over each other. The second way indicators are used is through divergence, which happens when the direction of the price trend and the direction of the indicator trend are moving in the opposite direction. This signals to indicator users that the direction of the price trend is weakening.

Indicators that are used in technical analysis provide an extremely useful source of additional information. These indicators help identify momentum, trends, volatility and various other aspects in a security to aid in the technical analysis of trends. It is important to note that while
some traders use a single indicator solely for buy and sell signals, they are best used in conjunction with price movement, chart patterns and other indicators.

6. What is the difference between technical and fundamental analysis?

Main differences between the two types of analysis:

<table>
<thead>
<tr>
<th>Fundamental analysis</th>
<th>Technical analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focuses on what ought to happen in a market</td>
<td>Focuses on what actually happens in a market</td>
</tr>
<tr>
<td>Factors involved in price analysis:</td>
<td>Charts are based on market action involving:</td>
</tr>
<tr>
<td>Supply and demand</td>
<td>Price</td>
</tr>
<tr>
<td>Seasonal cycles</td>
<td>Volume</td>
</tr>
<tr>
<td>Weather</td>
<td>Open interest (futures only)</td>
</tr>
<tr>
<td>Government policy</td>
<td></td>
</tr>
</tbody>
</table>

7. What is bar and line chart?

**Bar chart**

A style of chart used by some technical analysts, on which, as illustrated below, the top of the vertical line indicates the highest price a security traded at during the day, and the bottom represents the lowest price. The closing price is displayed on the right side of the bar, and the opening price is shown on the left side of the bar. A single bar like the one below represents one day of trading.
Line chart

A line chart can give the reader a fairly good idea of where the price of an asset has traveled over a given time frame. Since the closing prices are often seen as the most important ones to keep track of, it is not difficult to see why line charts have become so popular. Other popular styles of charts include, bar charts, candlestick charts and point and figure charts.

8. What is efficient market hypothesis?

Although it is a cornerstone of modern financial theory, the EMH is highly controversial and often disputed. Believers argue it is pointless to search for undervalued stocks or to try to predict trends in the market through either fundamental or technical analysis.

Meanwhile, while academics point to a large body of evidence in support of EMH, an equal amount of dissension also exists. For example, investors, such as Warren Buffett have consistently beaten the market over long periods of time, which by definition is impossible according to the EMH. Detractors of the EMH also point to events, such as the 1987 stock market crash when the Dow Jones Industrial Average (DJIA) fell by over 20% in a single day, as evidence that stock prices can seriously deviate from their fair values.

9. What are the Implications of Efficient Market Hypothesis for investment decisions?

EMH and Technical Analysis:

Technical analysis bases decisions on past results. EMH, however, believes past results cannot be used to outperform the market. As a result, EMH negates the use of technical analysis as a means to generate investment returns.

With respect to fundamental analysis, the EMH also states that all publicly available information is reflected in security prices and as such, abnormal returns are not achievable through the use of this information. This negates the use of fundamental analysis as a means to generate investment returns.

EMH and the Portfolio Management Process

The portfolio management process begins with an investment policy statement, including an investor's objectives and constraints. Given EMH, the portfolio management process should
thus, not focus on achieving above-average returns for the investor. The portfolio management process should focus purely on risks given that above average returns are not achievable.

A portfolio manager's goal is to outperform a specific benchmark with specific investment ideas. The EMH implies that this goal is unachievable. A portfolio manager should not be able to achieve above average returns.

Section B

1. How will you evaluate the intrinsic value of any stock?

A stock also is capable of holding intrinsic value, outside of what its perceived market price is, and is often touted as an important aspect to consider by value investors when picking a company to invest in.

Outside of this area of analysis, some buyers may simply have a "gut feeling" about the price of a good without taking into deep consideration the cost of production, and roughly estimate its value on the expected utility he or she will derive from it. Others may base their purchase on the much publicized hype behind an asset ("everyone is talking positively about it; it must be good!") However, in this article, we will look at another way of figuring out the intrinsic value of a stock, which reduces the subjective perception of a stock's value by analyzing its fundamentals and determining the worth of a stock in-and-of-itself.

For the sake of brevity, we will exclude intrinsic value as it applies to call and put options.

2. Explain Dow Theory.

Dow Theory is an analysis that explores the relationship between the Dow Jones Industrial Average (DJIA) and the Dow Jones Transportation Average (DJTA). When one of these averages climbs to an intermediate high, then the other is expected to follow suit within a reasonable amount of time. If not, then the averages show "divergence" and the market is liable to reverse course.
How it works/Example:

Dow Theory has its origins in the writings of Charles Dow -- founder of the Wall Street Journal and creator of the Dow Jones Industrial Average. His editorials pioneered technical analysis. On his death in 1902, William Hamilton continued Dow's work, writing editorials of his own until 1929. Robert Rhea then collected the work of both of these men and used it as a basis to publish The Dow Theory in 1932.

This book expounds upon many key principles of technical analysis, such as defining the nature of the primary, secondary and minor trends. Dow Theory divergence is fully explained in the idea that "the two averages must confirm."

In Dow's time, the two averages were the Industrials and the Rails. The logic behind the theory is simple: Industrial companies manufactured the goods and the rails shipped them. When one average recorded a new secondary or intermediate high, the other average was required to do the same in order for the signal to be considered valid.

If the two averages acted in harmony -- with both reaching new highs or lows around the same time period -- then the price action of each was said to be confirming.

However, if one average went to a new high, while the other was left behind, then there was bearish divergence. If the opposite occurred, with one average reaching a new low while the other held above a previous bottom, then the divergence was bullish.

At present, of course, the rails are now the Transports. However, Dow Theorists argue that the principle remains valid. As such, they contend that the activity of the Industrials and Transports provides a filter to detect whether the stock market is in a healthy or unhealthy state.

Why it Matters:

The behavior of the Dow Jones Industrial Average (DJIA) typically grabs the headlines. Few investors, however, are aware of the tenets of Dow Theory. By understanding the Dow Theory, traders are better able to spot hidden trends that more experienced investors may be noticing. This allows them to make more informed decisions regarding their open positions.
3. What are the charting techniques available?

Line chart:

This is the simplest form of charting and is done with the help of closing prices only, that is, the dates are plotted along the X-axis and closing prices along the Y-axis. Why do they consider only the closing prices? To understand this, one should know what goes on in the stock market on a daily basis.

Every day, there is a tug of war in the market between bulls, who try to push the prices up, and the bears, who try to pull them down. At closing time, there is a clear winner for the day and the closing price indicates the winner—bulls or bears. In other words, closing price is assumed to be the consensus value arrived at by the market for a particular stock after a day's gyrations.

Bar chart:

Though the closing price is the most important data point in a day, it is not fair to ignore the others, such as price highs and lows spurred by extreme greed or fear. So, if you want to capture more data points during the day, you need to go for bar charts. Traditionally, technical analysts use three data points—high, low and closing—for making bar charts.

As evident from the chart, the upper end of the bar represents the highest price on that day, the lower end shows the lowest price, and the small line on the right side of the bar represents the closing price. Most technical analysts have also started using the opening price and it can be plotted as a small line on the left side of the bar.
Candlestick chart:

This is plotted with four data points—opening, high, low and closing. It differs from a bar chart in the way these data points are plotted. The portion between the opening and closing is marked as a thick line (body of candle), and the remaining parts as thin lines (shadows, wicks, tails, etc). This is because the relationship between the opening price and closing price explains a lot about the action during the day. If the closing price is higher than the opening price, it hints at the strength of the bulls, and the body is marked white. Similarly, if the former is lower than the latter, it reflects the strength of the bears, and hence, the body is marked black. To make the chart visually more appealing, several technical charting programmes now plot these in green and red, instead of white and black, respectively.

While there are several other charting techniques (Point and figure, Kagi, Renko, etc), these are more complicated and not used frequently.

Time-wise charts:

All the above-mentioned charts can be plotted for different time periods (minute-wise, hourly, daily, and weekly, quarterly, monthly, annual). This is done according to the requirement of the trader, that is, to identify the trends for different time periods. For example, a day trader, who squares off his position on the same day, will use intra-day charts.
4. What are the technical indicators available to access the market?

The Technical Indicator establishes near-term market bias and identifies patterns, trends, support and resistance levels, moving averages, attractive entry and exit points, buying opportunities and more.

- **Make more educated trades.** Each issue gives detailed charts showing movements in the major averages, along with Michael Ashbaugh's analysis.

- **Get individual stock recommendations.** The Technical Indicator points you to 5 or more stocks daily — at least 25 stocks a week — that are well positioned to make substantial moves.

- **Invest with the trend.** Every issue brings authoritative analysis on whether the market is trending bullish or bearish, so you know whether to favor long or short positions.

- **Save time.** High-volume and professional traders can save an hour or two every day of prep time by using The Technical Indicator.

- **Add discipline to your trading.** The objective tools of technical analysis eliminate emotional responses to market movements.

- **Benefit from continuity.** The Technical Indicator reviews the previous day’s market moves, so you have a clear view of the broad market's direction.

- **See what others can't see.** The Technical Indicator breaks down market averages by time frame, revealing patterns and key technical levels other methods of analysis overlook.

- **Increase your confidence.** Using Mike Ashbaugh's world-class insight and authoritative commentary, you'll make trades with a reliable perspective on the outlook going forward.

- **Help control downside risk.** The Technical Indicator disciplines your trading so that you limit losing trades while allowing your winners to run.
UNIT V

Section A

1. What is the expected return of portfolio of risky stock

Expected return is calculated as the weighted average of the likely profits of the assets in the portfolio, weighted by the likely profits of each asset class. Expected return is calculated by using the following formula:

\[ E(R) = w_1 R_1 + w_2 R_2 + \ldots + w_n R_n \]

Written another way, the same formula is as follows: \( E(R) = w_1 R_1 + w_2 R_2 + \ldots + w_n R_n \)

2. What is covariance?

The Covariance between the returns on two stocks can be calculated using the following equation:

\[ \text{Cov}(R_1, R_2) = \sum (R_1 - \mu_1)(R_2 - \mu_2) \]

Where,

- \( N \) = the number of states,
3. What is the relationship between covariance and correlation?

The Covariance between the returns on two stocks can be calculated using the following equation:

\[
\text{Cov} = \sum_{i=1}^{N} p_i (R_{1i} - E[R_1])(R_{2i} - E[R_2])
\]

Where,

- \(N\) = the number of states,
- \(p_i\) = the probability of state \(i\),
- \(R_{1i}\) = the return on stock 1 in state \(i\),
- \(E[R_1]\) = the expected return on stock 1,
- \(R_{2i}\) = the return on stock 2 in state \(i\), and
- \(E[R_2]\) = the expected return on stock 2.
The Correlation Coefficient between the returns on two stocks can be calculated using the following equation:

4. What is an efficient portfolio?

Since the efficient frontier is curved, rather than linear, a key finding of the concept was the benefit of diversification. Optimal portfolios that comprise the efficient frontier tend to have a higher degree of diversification than the sub-optimal ones, which are typically less diversified.

The efficient frontier concept was introduced by Harry Markowitz in 1952 and is a cornerstone of modern portfolio theory.

5. Explain the nature of indifference curve.

- The concept of an indifference curve is predicated on the idea that a given consumer has rational preferences in regard to the purchase of groupings of goods, with a series of key properties that define the process of mapping these curves.
- Indifference curves only reside in the non-negative quadrant of a two-dimensional graphical illustration (or the upper right).
- Indifference curves are always negatively sloped. Essentially this assumes that the marginal rate of substitution is always positive.
- All curves projected on the indifference map must not intersect in order to ensure transitivity.
- Nearly all indifference lines will be convex, or curving inwards at the center (towards the bottom left).
6. What is passive strategy?

Also known as a buy-and-hold or couch potato strategy, passive investing requires good initial research, patience and a well diversified portfolio.

Unlike active investors, passive investors buy a security and typically don't actively attempt to profit from short-term price fluctuations. Passive investors instead rely on their belief that in the long term the investment will be profitable.

Section B

1. Explain the single index model proposed by William Sharpe.

The single-index model (SIM) is a simple asset pricing model to measure both the risk and the return of a stock, commonly used in the finance industry. Mathematically the SIM is expressed as:

\[ r_{it} - r_f = \alpha_i + \beta_i (r_{mt} - r_f) + \epsilon_{it} \]

\[ r_{it} - r_f = \alpha_i + \beta_i (r_{mt} - r_f) + \epsilon_{it} \]

Where,

- \( r_{it} \) is return to stock \( i \) in period \( t \)
- \( r_f \) is the risk free rate (i.e. the interest rate on treasury bills)
- \( r_{mt} \) is the return to the market portfolio in period \( t \)

- \( r_{it} - r_f = \alpha_i + \beta_i (r_{mt} - r_f) + \epsilon_{it} \) is the stock's alpha, or abnormal return
- \( r_{it} - r_f = \alpha_i + \beta_i (r_{mt} - r_f) + \epsilon_{it} \) is the stock's beta, or responsiveness to the market return

Note that \( r_{it} - r_f = \alpha_i + \beta_i (r_{mt} - r_f) + \epsilon_{it} \) is called the excess return on the stock, \( r_{it} - r_f = \alpha_i + \beta_i (r_{mt} - r_f) + \epsilon_{it} \) the excess return on the market

\( r_{it} - r_f = \alpha_i + \beta_i (r_{mt} - r_f) + \epsilon_{it} \) are the residual (random) returns, which are assumed independent normally distributed with mean zero and standard deviation \( r_{it} - r_f = \alpha_i + \beta_i (r_{mt} - r_f) + \epsilon_{it} \)
These equations show that the stock return is influenced by the market (beta), has a firm specific expected value (alpha) and firm-specific unexpected component (residual). Each stock’s performance is in relation to the performance of a market index (such as the All Ordinaries). Security analysts often use the SIM for such functions as computing stock betas, evaluating stock selection skills, and conducting event studies.

**Assumption of simple Index model:**

To simplify analysis, the single-index model assumes that there is only 1 macroeconomic factor that causes the systematic risk affecting all stock returns and this factor can be represented by the rate of return on a market index, such as the S&P 500. According to this model, the return of any stock can be decomposed into the expected excess return of the individual stock due to firm-specific factors, commonly denoted by its alpha coefficient ($\alpha$), the return due to macroeconomic events that affect the market, and the unexpected microeconomic events that affect only the firm.

The term $r_{it} - r_f = \alpha_i + \beta_i (r_{mt} - r_f) + \epsilon_{it}$ represents the movement of the market modified by the stock’s beta, while $r_{it} - r_f = \alpha_i + \beta_i (r_{mt} - r_f) + \epsilon_{it}$ represents the unsystematic risk of the security due to firm-specific factors. Macroeconomic events, such as changes in interest rates or the cost of labor, causes the systematic risk that affects the returns of all stocks, and the firm-specific events are the unexpected microeconomic events that affect the returns of specific firms, such as the death of key people or the lowering of the firm’s credit rating, that would affect the firm, but would have a negligible effect on the economy. In a portfolio, the unsystematic risk due to firm-specific factors can be reduced to zero by diversification.

The index model is based on the following:

- Most stocks have a positive covariance because they all respond similarly to macroeconomic factors.

- However, some firms are more sensitive to these factors than others, and this firm-specific variance is typically denoted by its beta ($\beta$), which measures its variance compared to the market for one or more economic factors.
Covariance among securities results from differing responses to macroeconomic factors. Hence, the covariance of each stock can be found by multiplying their betas and the market variance:

The single-index model assumes that once the market return is subtracted out the remaining returns are uncorrelated:

\[ r_{it} - r_f = \alpha_i + \beta_i (r_{mt} - r_f) + \epsilon_{it} \]

This is not really true, but it provides a simple model. A more detailed model would have multiple risk factors. This would require more computation, but still less than computing the covariance of each possible pair of securities in the portfolio. With this equation, only the betas of the individual securities and the market variance need to be estimated to calculate covariance. Hence, the index model greatly reduces the number of calculations that would otherwise have to be made to model a large portfolio of thousands of securities.