FINANCE THEORY

**A: Basics of stock markets**

1. Stocks are the ownership of a small piece of the company. The holders are entitled a proportion of the company’s asset and profits equal to how much they own
2. The underlying risk can be defined as SD of returns or the beta given by CAPM model
3. People invest in commodities like gold/oil/natural gas via futures markets
4. Future contracts help to control the excessive volatility and trade on an expected price of the commodity in near future
5. Commodity prices usually rise when inflation is accelerating
6. An exchange rate > 1 implies home currency is stronger than the foreign currency
7. Factors affecting exchange rates:
   1. policy rates: foreign investors lend money to central banks for higher returns
   2. money supply: can trigger inflation which can result in foreign investors leaving the currency and thereby pushing down the ex-rate value
   3. financial stability: political conflicts can reduce investments
8. Relational mapping between ex-rates can be built using Bellman-Ford shortest path algorithm
9. Short-selling is borrowing shares and sell immediately, in the hope that we buy it again in the future when the market falls and return to the borrower
10. Investors hold a **long** position in a **bullish** market and **short** position in a **bearish** market
11. Short positions are riskier than long in the sense that there is no limit to how much a stock price can increase.

**B: Bonds theory**

1. Bonds are debt investments where investor loans money to an entity
2. Bonds usually offer a bit higher interest rates than the bank rates
3. Main 2 types of bond: ZCB and coupon bonds
4. Main parameters:
   1. principal amt/par value/face value/nominal value
   2. premium/int rate/coupon rate
   3. maturity
5. Simply put, bond price is the present value of the combined future cashflows (face value + coupons) of the bond
6. Yield to maturity is the IRR earned by an investor who buys the bond today at a certain price
7. Yield curve is given by:
   1. X-axis: time to maturity (years)
   2. Y-axis: yield (%) which is coupon amount upon bond price
8. Longer duration result in higher yield but at a decreasing rate
9. Bond price and market interest are -vely correlated as in when interest is high, it is better to lend money to the bank rather than buying bonds, as a result bonds become cheaper
10. Macauley duration is a measure of how long it takes for the bond price to be repaid by the cashflows from it
11. For ZCB, Macauleys duration = Time to maturity
12. Macaulay duration is commonly used to measure the sensitivity of bond price to changes in market interest
13. Market interest is a strong determinant of bond investment. Bonds with longer duration are more sensitive to market interest changes
14. Investors prefer bonds with longer maturity when interest rates are expected to fall, in the hope that they will be selling at a higher price than they bought
15. Risks associated with bonds:
    1. Interest rate risk: as int rate rise, price falls
    2. Default risk: bond issuer might be unable to return the money
    3. Inflation risk: variations in CF due to inflation as in purchasing power

**C: Modern Portfolio theory (Markowitz-Model)**

1. A portfolio optimization model which assists in the selection of the most efficient portfolio based on expected return and risk
2. Main assumptions:
   1. Returns are normally distributed
   2. Investors are risk-averse; low risk means low return
   3. Does not allow short-selling; 100% of money must be allocated among assets
   4. Future is determined by past
3. Diversification is induced when we use uncorrelated stocks to build portfolio
4. Using Monte-Carlo simulation we generate a set of random weights and perform the optimization exercise along risk-return axes
5. A popular risk-return measure is Sharpe ratio; which is the excess return you are receiving for the extra volatility you are enduring relative to the market
6. The optimal portfolios lie on the capital allocation line. The y-intercept starts at the position where you hold 100% in risk-free assets and where it cuts the efficient frontier, that’s when you hold 100% in the stock portfolio and thereby face the max. risk. Ideally, investors will hold positions somewhere between these.

**D: CAPM**

1. Risk can either be unsystematic (specific to stock which can be diversified via portfolio) and systematic (market)
2. CAPM measures systematic risk
3. Linear relation between expected return of investment and market excess return
4. Beta measures the relative risk of the investment wrt the market
5. If beta > 1, given investment is more volatile than the market (more expected return)
6. A portfolio’s beta is the weighted sum of the stocks’ beta in the portfolio; weight representing the % of money invested in each stock
7. Beta can be computed as the slope of the CAPM model equation (linear regression)
8. Another way to compute beta is covariance(stock return, market return) divided by variance(market return)