Please Answer Any Four (4) Questions.
All questions carry equal marks.

Question 1 – Futures

Go to the CME Group https://www.cmegroup.com/ and choose any 1 futures market from (i) Agriculture (e.g. corn), (ii) Energy (e.g. natural gas), or (iii) Metals (e.g. gold).

Please use either a June 2021 or July 2021 futures contracts for parts (a) and (b).

Download the futures chart on the day you complete this question.

For example, the September 2021 futures contract for Corn on March 26 was as follows
https://www.cmegroup.com/trading/agricultural/grain-and-oilseed/corn.html

(Use the camera icon on 'Charts' to access this and then use 'save image')

(a) Suppose a trader wants to set up a short hedge using the futures contract selected. Explain clearly any two (2) reasons why hedging with futures contracts works less than perfectly in practice. (3 marks)

(b) Explain what is meant by basis risk when futures contracts are used for hedging. Using the same example as part (a), explain when a short hedge would be appropriate. Using your own numerical example, explain why a short hedger's position improves when the basis weakens unexpectedly and worsens when the basis strengthens unexpectedly.
NB: For this question, you would also need the 'spot' or 'cash' price

(8 marks)

(c) As per https://www.cmegroup.com/trading/why-futures/welcome-to-nymex-wti-light-sweet-crude-oil-futures.html NYMEX WTI Light Sweet Crude Oil futures (ticker symbol CL) is the world's most liquid and actively traded crude oil contract and is the most efficient way to trade today's global oil markets.

Choose your own date to download data for WTI Crude Oil futures.
https://www.barchart.com/futures/quotes/CL*0/futures-prices is a useful website to get data

- Explain what the pattern of oil futures prices indicates.
- Explain the difference between contango and backwardation in oil markets.
- Assume, the term structure of NYMEX WTI crude oil futures goes from backwardation into contango during 2021. Evaluate the main implications of this change for oil traders, consumers, and suppliers.

(9 marks)

(d) A German fund manager has a portfolio worth €500 million with a beta of 1.10. The manager is concerned about the performance of European stock markets over the next 3 months and plans to use 3-month Euro Stoxx 50 futures hedge the risk.
On the day you complete this assignment, find the level of the Euro Stoxx 50 index
https://www.investing.com/indices/eu-stoxx50

Note one futures contract is on 10 times the index
https://www.eurex.com/ex-en/markets/idx/stx/blc/EURO-STOXX-50-Index-Futures-160088 and the dividend yield on the index is 2.1% per annum.
Assume the risk-free rate is 0.2% p.a. with continuous compounding.
(i) Write out the theoretical relationship for the futures price. Calculate its value in the above case.
(ii) What position should the fund manager take to eliminate all exposure to the market over the next 3 months and also to reduce the portfolio beta to 0.80 over the next 3 months?

(5 marks)

Total 25 marks

Question 2 – Swaps

(a) Using your own hypothetical examples, critically evaluate any two reasons why investors may use plain vanilla interest rate swaps. Write out and explain the swaps you have designed.

(6 marks)

(b) A Paris based corporate treasurer tells you that she has just negotiated a 3-year loan at a competitive fixed rate of interest of 2.2%. The treasurer explains that she achieved the 2.2% rate by borrowing at six-month LIBOR plus 150 basis points and swapping LIBOR for 0.7%. She goes on to say that this was possible because her company has a comparative advantage in the floating-rate market.

Explain briefly what issue the treasurer has overlooked.

(2 marks)

(c) Suppose that the term structure of interest rates is flat in the US and UK. The USD interest rate is 1.5% per annum and the GBP rate is 1.9% p.a. Under the terms of a swap agreement, a financial institution pays 2% p.a. in GBP and receives 1.6% p.a. in USD. The principals in the two currencies are GBP50 million and USD70 million. Payments are exchanged every year, with one exchange having just taken place. The swap will last 3 more years

NB: Find the current value of the USD / GBP when you complete this question.

(i) Write out the formula for the valuation of a currency swap in terms of bond prices. From this formula, explain what prices and/or rates you need to calculate the value of a swap.

(ii) Show the payments to be made in a table and then calculate the value of the swap to the financial institution. Assume all interest rates are compounded continuously.

(4 marks)

(e) Using http://www.worldgovernmentbonds.com/sovereign-cds/ find the 5-year CDS spreads on any 3 Eurozone countries on the date you do this assignment.

(i) Using any one of the 3 countries, explain the mechanics of a standard sovereign credit default swap (CDS) using a diagram.

(ii) Assuming a recovery rate of 40%, estimate the implied probability of default for all 3 sovereign bonds.

(iii) Describe any two (2) possible trades that could be undertaken using the 5-year CDS you have used in this example.

[7 marks)

(f) Suppose that the risk-free zero curve is flat at 1.5% per annum with continuous compounding and that defaults can occur at times 0.25 years, 0.75 years, 1.25 years, and 1.75 years in a two-year plain vanilla credit default swap with semi-annual payments. Suppose that the recovery rate is 30% and the unconditional probabilities of default (as seen at time zero) are 1% at times 0.25 years and 0.75 years, and 1.5% at times 1.25 years and 1.75 years.

(i) Estimate the credit default swap (CDS) spread in the example above.

(ii) Evaluate why CDS markets provide an important barometer of the creditworthiness of corporate bond markets.

(6 marks)

Total 25 marks

Question 3 – Real Options (1,250 – 1,500 words in total)

(a) Explain the six (6) levers of real options and how they differ from financial options. Use an example of investing in a gold mine versus purchasing a call option on a gold mining company's share to explain your answer. (9 marks)

(b) "Real options are everywhere," Copeland, Koller, and Murrin, in *Valuation: Measuring and Managing the Value of Companies 2/e*, p. 470. Analyse critically using any case study why real options have the potential to be an important tool for firms in strategic and financial analysis.

Notes: There are several readings on each case study *on Blackboard. In addition, please make use the usual sources – e.g. journals, newspapers, library, Google Scholar - for additional readings.* [16 marks]

Total 25 marks

Question 4 – Derivatives Case Study (1,250 – 1,500 words)

Warren Buffett has labelled certain derivatives as "financial weapons of mass destruction", while the former Chair of the US Federal Reserve, Alan Greenspan, has stated "by far the most significant event in finance in recent decades has been the extraordinary development and expansion of financial derivatives".

Critically evaluate the above statements in the context of any case(s) with which you are familiar.

(i) Outline the trading strategy responsible for the losses in each case and
(ii) Discuss the main lessons that you believe should be learned from the cases in question.

Notes: There are several readings on each case study *on Blackboard. In addition, please make use the usual sources – e.g. journals, newspapers, library, Google Scholar - for additional readings.*

Total 25 marks

Question 5 – Options I

(a) Using https://finance.yahoo.com/quote/PFE/options/ find the share price on the day you do this assignment.

Choose your own selected September 17th 2021 call and puts data with the same strike price:
Assume that over each of the next two 2-month periods to September 2021, the Pfizer share price is expected to go up by 10% or down by 10% each quarter.
Assume the risk-free interest rate is 2% per annum with continuous compounding.
Estimate the value of the 4-month European call option with the strike price chosen?
Estimate the value of the 4-month European put option with a strike price chosen?

Show the binomial tree in each case. (6 marks)

(b) Find the current price of Bank of America (BAC) https://www.nasdaq.com/market-activity/stocks/bac on the day you do this assignment. Using options data website, locate the price of a 6-month (November 2021) put option on BAC with a strike price pf $30 and the price of a 6-month (November 2021) call option with a strike price of $50.

Suppose the trader buys 100 shares, shorts 100 call options, and buys 100 put options.

Draw a diagram illustrating how the investor's profit or loss varies with the stock price over the next 6 months.

How does your answer change if the investor buys 100 shares, shorts 200 call options, and buys 200 put options?

(6 marks)

(c) Using the OIC Options Calculator (or equivalent)
https://www.optionseducation.org/toolsoptionquotes/optionscalculator
consider a 2-month European call option on Exxon Mobild (XOM) stock. Using an 'at-the-money' call option (nearest strike price on the day you do this assignment), use the data provided by the Options Calculator to calculate the option's:

- Price
- Delta
- Gamma
- Vega
- Theta
- Rho

(i) Explain briefly how to interpret each of these Greeks.
(ii) Verify the delta is correct by changing the stock price by \$0.10 and recomputing the option price.
(iii) Verify the gamma is correct by recomputing the delta with the same increase in price as in (ii).

(6 marks)

(d) Calculate the value of a six-month at-the-money European call option on the Eurostoxx 50 stock index https://www.bloomberg.com/quote/SX5E:IND

NB: Note the value of the Eurostoxx 50 the day you do this question (screenshot it)

Assume the risk-free interest rate is 1.0% per annum, the volatility of the index is 25% per annum, and the dividend yield on the index is 2.1% per annum.

Note: Use the following equations

$$c = S_0 e^{-qT} N(d_1) - K e^{-rT} N(d_2)$$

$$p = K e^{-rT} N(-d_2) - S_0 e^{-qT} N(-d_1)$$

$$\text{where} \quad d_1 = \frac{\ln(S_0 / K) + (r - q + \sigma^2 / 2)T}{\sigma\sqrt{T}}$$

$$d_2 = \frac{\ln(S_0 / K) + (r - q - \sigma^2 / 2)T}{\sigma\sqrt{T}}$$

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(7 marks)

Total 25 marks

Question 6 – Options II

Find the price of AMD shares on the day you do this assignment. Using any online options calculator, find the current volatility and risk-free rate applicable for AMD options.

Use https://www.optionsprofitcalculator.com/ or similar to calculate the cost of setting up the following positions.

In each case, explain the rationale for establishing these strategies. Then provide a table showing the relationship between the profit and final stock price.

Note: You can ignore the impact of discounting.

(i) A bull spread using European call options with strike prices approximately $10 below and $5 below the spot price chosen and a maturity of 3 months (5 marks]

(ii) A bear spread using European put options with strike prices approximately $10 below and $5 below the spot price chosen and a maturity of 3 months [5marks)

(iii) A butterfly spread using European call options with strike prices approximately $10 below and above the spot price chosen and two nearest the money calls and a maturity of 3 months [5 marks]

(iv) A straddle using options with a strike price of approximately $5 below and a 3-month maturity [5 marks]

(v) A strangle using options with strike prices approximately $10 below and $10 above the spot price chosen and a 3-month maturity [5 marks]

. **Total 25 marks**