# NANYANG TECHNOLOGICAL UNIVERSITY

## SEMESTER 2 EXAMINATION 2022-2023

## BR2210 Financial Risk Management

April 2023 Time Allowed: 2 ½ hours

## INSTRUCTIONS

1 This paper contains **NINE(9)** questions and comprises of **FOUR(4)** pages.

2 Answer **ALL** questions.

3 This is a **closed-book** examination.

4 The number of marks allocated is shown at the end of each question.

5 Begin your answer to each question on a separate page of the answer book.

6 Answers will be graded for content and appropriate presentation.

7 Do **NOT** use pencils.

8 Do **NOT** use correction tapes.

---

**Note: Exam Questions begin on Page 2**

Question 1

An investor has just taken a short position in a two-year forward contract on a dividend-paying stock. The expected dividend yield of the stock is 4% per annum with quarterly compounding. The current stock price is $50. Assume the risk-free rate of interest is 5% per annum with continuous compounding for all maturities.

(a) What is the forward price?

(4 marks)

(b) One year later, the price of the stock is $40. The expected dividend yield of the stock and the risk-free rate remain unchanged. What are the forward price and the value of the forward contract?

(6 marks)

(TOTAL: 10 marks)

Question 2

In an interest rate swap, a financial institution pays 8% per annum and receives three-month LIBOR in return on a notional principal of $100 million with payments being exchanged every three months. The swap has a remaining life of 5 months. The current LIBOR/swap zero rate is 12% per annum for all maturities. The three-month LIBOR rate one month ago was 11.8% per annum. All rates are compounded quarterly. What is the value of the swap? Use LIBOR discounting.

(10 marks)

Question 3

Suppose that the principal assigned to the senior, mezzanine, and equity tranches is, respectively, 50%, 40%, and 10% for ABSs. Furthermore, the senior tranche of the ABS CDO accounts for 45% of the principal of the ABS mezzanine tranches, the mezzanine tranche of the ABS CDO accounts for 40% of the principal of the ABS mezzanine tranches, and the equity tranche of the ABS CDO accounts for the remaining 15%. Assume that all ABS portfolios have the same default rate. What is the loss to the mezzanine tranche of ABS CDO if the loss on the underlying assets is 20%?

(10 marks)

Question 4

A stock's price is currently $100. For the next month, it is expected to increase by 10% or reduce by 5%. The risk-free interest rate is 5% per annum compounded continuously. Use a one-period binomial tree to calculate the value of a derivative that pays off $\max[(100 - S_T)^3, 0]$ where $S_T$ is the stock price in 1 month.

(10 marks)

Question 5

You are given the following information about European options on a stock. All options have the same maturity.

| Type | Strike | Premium | Delta | Gamma |
|---|---|---|---|---|
| Call | 150 | 5.05 | 0.6555 | 0.0436 |
| Call | 155 | 2.45 | 0.4208 | 0.0474 |
| Put | 155 | 4.35 | -0.6781 | 0.0452 |

(a) How can the options be used to create a bear spread?

(3 marks)

(b) What is the initial cash flow?

(1 mark)

(c) What is the delta of your strategy?

(1 mark)

(d) Complete the following table to show the profit and payoff for the spread at maturity.

| Stock Price | Payoff | Profit |
|---|---|---|
| $S_T \geq 155$ | | |
| $150 \leq S_T < 155$ | | |
| $S_T < 150$ | | |

(5 marks)

(TOTAL: 10 marks)

Question 6

A financial institution has the following portfolio of options on a stock:

| Type | Position | Delta of Option | Gamma of Option | Vega of Option |
|---|---|---|---|---|
| Call | -100 | 0.5 | 2.5 | 1.5 |
| Call | -500 | 0.8 | 0.5 | 0.2 |
| Put | -200 | -0.4 | 1.5 | 0.8 |
| Call | -500 | 0.7 | 2.0 | 1.5 |

The financial institution can trade the stock and the following two options:

| Type | Delta of Option | Gamma of Option | Vega of Option |
|---|---|---|---|
| Call | 0.5 | 1.5 | 0.8 |
| Call | 0.1 | 0.5 | 0.4 |

(a) Calculate delta, gamma, and vega of the portfolio.

(3 marks)

(b) How could the portfolio be made delta, gamma, and vega neutral?

(7 marks)

(TOTAL: 10 marks)

Question 7

Suppose that conditional on no earlier default a reference entity has a (risk-neutral) probability of default of 5% in each of the next 2 years. Assume payments are made annually in arrears, that defaults always happen half-way through a year, and that the expected recovery rate is 20% in the first year and 10% in the second year. The risk-free zero curve is flat at 5% per annum with continuous compounding. What is the credit default swap spread?

(20 marks)

Question 8

The price of a European call that expires in one year and has a strike price of $30 is $2. The underlying stock price is currently $30, and a dividend of $1 is expected in six months. The price of a European put option that expires in one year and has a strike price of $30 is $3. What is the one-year risk-free rate with continuous compounding?

(10 marks)

Question 9

Consider an American call option on a non-dividend-paying stock when the stock price is $30, the exercise price is $30, the risk-free interest rate is 5% per annum with continuous compounding, the volatility is 25% per annum, and the time to maturity is one year. What is the price of the option? You are given

$$N(0.05) = 0.5199, N(0.075) = 0.5299, N(0.3) = 0.6179, N(0.325) = 0.6274.$$

(10 marks)

**- END OF PAPER -**

**BR2210 FINANCIAL RISK MANAGEMENT**

Please read the following instructions carefully:

1. **Please do not turn over the question paper until you are told to do so. Disciplinary action may be taken against you if you do so.**

2. You are not allowed to leave the examination hall unless accompanied by an invigilator. You may raise your hand if you need to communicate with the invigilator.

3. Please write your Matriculation Number on the front of the answer book.

4. Please indicate clearly in the answer book (at the appropriate place) if you are continuing the answer to a question elsewhere in the book.