

**NANYANG TECHNOLOGICAL UNIVERSITY**

**SEMESTER 2 EXAMINATION 2023-2024**

**BR2210 Financial Risk Management**

April 2024

Time Allowed: 2 ½ hours

**INSTRUCTIONS**

- 1 This paper contains **NINE(9)** questions and comprises **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.

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**Exam questions begin on Page 2.**

Question 1

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

(10 marks)

Question 2

A Eurodollar futures quote for the period between 5.2 and 5.45 years in the future is 97.1. The standard deviation of the change in the short-term interest rate in one year is 1.4%. Use convexity adjustment to estimate the forward interest rate in the forward rate agreement.

(10 marks)

Question 3

An investor has just taken a long 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 \$40. Assume the risk-free rate of interest is 5% per annum with continuous compounding for all maturities.

(a) What are the forward price and the initial value of the forward contract?

(5 marks)

(b) One year later, the price of the stock is still \$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?

(5 marks)

(TOTAL: 10 marks)

Question 4

A stock's price is currently \$10. 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  $(2S_T - 5)^2$  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. The current stock price is 183. All options have the same maturity.

Type	Strike	Premium	Delta	Gamma
Call	180	6.65	0.8442	0.0392
Call	185	2.45	0.5748	0.0696
Put	180	0.50	-0.1560	0.0393
Put	185	1.84	-0.4276	0.0832

- (a) How can the options be used to create a strangle? (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 strangle at maturity.

Stock Price	Payoff	Profit
$S_T \geq 185$		
$180 \leq S_T < 185$		
$S_T < 180$		

(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	1.2
Call	-500	0.8	0.5	0.4
Put	-200	-0.5	1	0.8

The financial institution can trade the stock and the following option:

Type	Delta of Option	Gamma of Option	Vega of Option
Call	0.5	1.3	0.5

How could the portfolio be made delta and gamma neutral?

(10 marks)

Question 7

Suppose that conditional on no earlier default a reference entity has a (risk-neutral) probability of default of 10% 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 50% in the first year and 0% 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 an American call option on a non-dividend-paying stock that expires in one year and has a strike price of \$30 is \$2. The underlying stock price is currently \$30. The risk-free interest rate is 5% per annum with continuous compounding. The volatility of the stock is 25% per annum. What is the price of a European put option that expires in one year and has a strike price of \$30?

(10 marks)

Question 9

A portfolio manager plans to use a Treasury bond futures contract to hedge a bond portfolio over the next three months. The portfolio is worth \$10 million and will have a duration of 5 years in three months. The 3-month Treasury bond futures contract price is \$91,234.50 (each contract is for the delivery of \$100,000 face value of bonds). The bond that is expected to be the cheapest to deliver will have a duration of 12 years at the maturity of the futures contract.

(a) What position in futures contracts is required?

(5 marks)

(b) Suppose that all rates increase over the three months, but long-term rates increase more than short-term and medium-term rates. What is the effect of this on the performance of the hedge? Explain without calculation.

(5 marks)

(TOTAL: 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.