Name:

M339D=M389D Introduction to Actuarial Financial Mathematics
University of Texas at Austin
Sample In-Term Exam I
Instructor: Milica Čudina

Notes: This is a closed book and closed notes exam. The maximal score on this exam is 100 points.
Time: 50 minutes

MULTIPLE CHOICE

?? (5)	a	b	c	d	e
1.22 (5)	a	b	c	d	e
?? (5)	a	b	c	d	e
?? (5)	a	b	c	d	e
?? (5)	a	b	c	d	e
?? (5)	a	b	c	d	e
?? (5)	a	b	c	d	e
1.23 (5)	a	b	c	d	e

TRUE/FALSE

1.2 (2)	TRUE	FALSE

FOR THE GRADER'S USE ONLY:

Def'n	T/F	**??**	1.15	M.C.	Σ

1.1. **DEFINITIONS.**

Problem 1.1. (10 points) Write the definition of an **arbitrage portfolio**.

1.2. **TRUE/FALSE QUESTIONS.** *Please, circle the correct answer on the front page of this exam.*

Problem 1.2. (2 pts) A (long) put is a short position with respect to the underlying asset price.

Problem 1.3. (2 pts) Consider a portfolio consisting of the following four European options with the same expiration date T on the underlying asset S:
long one call with strike 40,
long two calls with strike 50,
short one call with strike 65.

Let $S(T) = 69$. Then, the payoff from the above position at time T is less than 60.

Problem 1.4. It is possible for the buyer and the writer of the same option to end up having the same profit on the exercise date.

Problem 1.5. (2 points)

Naked writing is the practice of writing options without taking an offsetting position in the underlying asset. *True or false?*

Problem 1.6. (2 points) Consider a one-year, \$45-strike European call option and a one-year, \$45-strike European put option on the same underlying asset. You observe that the time-0 stock price equals \$40 while the time-1 stock price equals \$50. Then, both of the options are out-of-the-money at expiration. *True or false?*

Problem 1.7. (2 points)

A covered call is a portfolio consisting of a written call option and the short underlying. *True or false?*

Problem 1.8. (2 points)
Derivative securities can only be used for hedging, i.e., they can only be bought and written by agents who already have a position in the underlying asset. *True or false?*

Problem 1.9. (2 points)
On the expiration date of your American call option, you look back and you realize that you exercised the option at the optimal time. This means that the time of early exercise was when the price of the underlying asset achieved its maximum during the life of the option. *True or false?*

Problem 1.10. (2 points)
The prepaid forward price of a non-dividend-paying stock is strictly decreasing with respect to the delivery date. *True or false?*

Problem 1.11. (2 points)
Writing derivative securities can be a regulatory requirement. *True or false?*

Problem 1.12. (2 pts) A non-dividend-paying stock sells today for \$100 per share. The yearly effective interest rate is 0.21. Then, $F_{0,1/2}(S) > 110$.

Problem 1.13. (2 points) The profit diagram and the payoff diagram for long positions in a forward contract are identical.

Problem 1.14. (2 points) A portfolio consisting of a long forward contract and a bond can replicate a long prepaid forward contract.

1.3. **FREE-RESPONSE PROBLEMS.**

Please, record your final numerical answers in the boxes at the bottom of every page with a free-response problem. Single-word or one-number answers without a justification will receive zero credit.

Problem 1.15. (15 points)

The *Huxley Hatch* company has an exclusive contract to supply hatch chiles to the local annual roasting contest. The contract guarantees that the contest organizers will take delivery of $10,000$ hatch chiles in one year at the market price at that time. The **total and aggregate** costs of producing the hatch chiles is \$2,000.

To hedge, *Huxley Hatch* buys one hundred one-year, $(24, 28)-$collars for one hundred hatch chiles each. The premium for the one-year, \$24-strike European put on one hundred hatch chiles is \$168. The premium for the one-year, \$28-strike European call option on one hundred hatch chiles is \$150.

Assume that the continuously compounded risk-free interest rate equals 0.04. What is the range of the possible total profit for *Huxley Hatch*?

1.4. **MULTIPLE CHOICE QUESTIONS.**

Please, circle the correct answer on the front page of this exam.

Problem 1.16. The initial price of a non-dividend-paying asset is \$100. A six-month, \$95-strike European call option is available at a \$8 premium.

The continuously compounded risk-free interest rate equals 0.04.

What is the break-even point for this call option?

(a) 86.84
(b) 87
(c) 103
(d) 103.16
(e) None of the above.

Problem 1.17. (5 points) A non-dividend-paying stock sells for \$100 per share today. The one-year forward price is \$110. You short sell the stock and close the short sale in exactly one year. Find your profit if the stock's spot price in one year equals \$130 per share.

(a) 20 loss
(b) 20 gain
(c) 30 loss
(d) 30 gain
(e) None of the above.

Problem 1.18. A market index is currently trading at \$1,000. Which of the following options is/are **in the money**? More than one answer can be true. You get the credit if you circled **all** acceptable answers and **none** of the incorrect ones.

(a) \$1,500-strike put

(b) $900-strike put
(c) $1,250 strike call
(d) $950 strike call
(e) None of the above.

Problem 1.19. For a continuous-dividend-paying stock, the current stock price is observed to be $80. The forward price for delivery in two years is $82.44. What is the forward price for delivery in three years?

(a) About 81.36
(b) About 83.67
(c) About 84.32
(d) About 85.91
(e) None of the above.

Problem 1.20. Maryam bakes batches of cupcakes for a cupcake convention. She buys forward 21 pounds of raspberries from a local farmer at the forward price of $5.60 per pound.

She projects to bake 336 cupcakes and sell each for $3. The total and aggregate non-raspberry costs of baking the cupcakes are $200.

If the market price of raspberries on the day of the cupcake convention is $5.40, what is Maryam's profit?

(a) $690.40
(b) $694.60
(c) $890.40
(d) $894.60
(e) None of the above.

Problem 1.21. The current price of a discrete-dividend-paying stock is $90 per share. The company projects to pay quarterly dividends starting three months from today to perpetuity. The first dividend amout is $2 and the dividends are scheduled to increase by a factor of 0.01 every time a dividend is paid.

The continuously compounded risk-free interest rate is 0.06. What is the prepaid forward price of the above stock for delivery in eight months?

(a) $84.24
(b) $86.07
(c) $88.70
(d) $90.00
(e) None of the above.

Problem 1.22. Let the current price of a non-dividend-paying stock equal 100. The forward price for delivery of this stock in 3 months equals $101.26

Consider a $90-strike, six-month put option on this stock whose premium today equals $2.22.

What will the profit of this long put option be if the stock price at expiration equals $96?

(a) About $2.28 loss.
(b) About $2.22 loss.

(c) About \$2.28 gain.
(d) About \$2.22 gain.
(e) None of the above.

Problem 1.23. (5 points) You are tasked with buying oranges in the market in grove A, transporting the oranges to a juice factory in the market B, and selling the oranges to the juice factory in the market B. You want to hedge. Which of the following would be a satisfactory hedge?

(a) Long a call in market A and long a put in market B
(b) Short a call in market A and long a put in market B
(c) Long a call in market A and short a put in market B
(d) Short a call in market A and short a put in market B
(e) None of the above.