Name:

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

Notes: This is a closed book and closed notes exam. The maximal score on this exam is 76 points.
Time: 50 minutes

TRUE/FALSE

2.12 (2)	TRUE	FALSE
2.15 (2)	TRUE	FALSE
2.16 (2)	TRUE	FALSE
2.17 (2)	TRUE	FALSE
2.5 (2)	TRUE	FALSE
2.6 (2)	TRUE	FALSE
?? (2)	TRUE	FALSE
2.7 (2)	TRUE	FALSE
2.8 (2)	TRUE	FALSE
2.9 (2)	TRUE	FALSE
2.10 (2)	TRUE	FALSE
2.11 (2)	TRUE	FALSE

MULTIPLE CHOICE

?? (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
2.18 (5)	a	b	c	d	e
2.19 (5)	a	b	c	d	e
?? (5)	a	b	c	d	e
?? (5)	a	b	c	d	e
?? (5)	a	b	c	d	e

FOR GRADER'S USE ONLY:

T/F	**??**	M.C.	**Σ**	

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

Problem 2.1. (2 points)

In the setting of the binomial asset-pricing model, let d and u denote the up and down factors, respectively. Moreover, let r denote the continuously compounded, risk-free interest rate. Let h denote the length of a single period in our model.

Then, if,

$$d < e^{rh} < u$$

then there is no possibility for arbitrage regardless of whether the stock pays dividends. *True or false?*

Problem 2.2. (2 points) Let the current exchange rate of euros (€) to USD ($) be denoted by $x(0)$, i.e., currently, $1 € = \$X(0)$.

Let $r_\$$ denote the continuously compounded, risk-free interest rate for the $, and let r_e denote the continuously compounded, risk-free interest rate for the €.

Denote the price of a $-denominated European call option with strike K and exercise date T by $V_C(0)$ and the price of an otherwise identical put option by $V_P(0)$. Then,

$$V_C(0) - V_P(0) = x(0)e^{-r_\$ T} - Ke^{-r_e T}.$$

True or false?

Problem 2.3. If the strike is kept equal to the trigger of a gap call, then increasing the trigger reduces the premium of the gap call. *True or false?*

Problem 2.4. (2 points) Strangles are financial positions designed to hedge against decreasing prices of the underlying asset. *True or false?*

Problem 2.5. (2 points) The payoff of a gap call option is always nonnegative regardless of the choice of the trigger and the strike. *True or false?*

Problem 2.6. (2 points) In the replicating portfolio for a call option whose underlying asset's price is modeled using a binomial tree, the value of the Δ is always nonnegative. *True or false?*

Problem 2.7. (2 points)

The following is a replicating portfolio for a *ratio spread*:

Long a two-year European call and write a three-year European call with the same strike price and the same underlying asset.

True or false?

Problem 2.8. (2 points) An investor wants to speculate on **low** volatility combined with a higher likelihood of lower than higher prices. Then, he should long a ratio spread with fewer calls of the lower strike.

True or false?

Problem 2.9. (2 points) In the binomial asset pricing model, the replicating portfolio for a put option has a bond investment which is equivalent to lending at the risk-free interest rate. *True or false?*

Problem 2.10. (2 points) A butterfly spread can be constructed in this way:

Buy a 90 call, sell a 100 put, sell a 100 call, buy a 110 put.

True or false?

Problem 2.11. The strike price at which the European call and the otherwise identical European put have the same premiums is the forward price for delivery of the underlying on the exercise date of the two options. *True or false?*

Problem 2.12. (2 points) The payoff of the call bull spread is equal to the payoff of the put bull spread. *True or false?*

Problem 2.13. (2 points)

You long a $(90, 100, 110)-$butterfly spread with one long \$90-strike call. Then, you short one \$110-strike European call with the same exercise date and underlying asset. The portfolio you end up with is equivalent to a ratio spread. *True or false?*

Problem 2.14. (2 pts) In our usual notation, we **always** have that

$$V_C(t) > S(t) - Ke^{-r(T-t)}$$

for every $t \in [0, T]$ regardless of whether the stock pays dividends or not. *True or false?*

Problem 2.15. (2 points) The chooser option with the exercise date T and with the strike K is worth at least as much as a vanilla call with the same underlying, strike and exercise date. *True or false?*

Problem 2.16. (2 points) The payoff curve of a call bear spread is never positive. *True or false?*

Problem 2.17. (2 points) *Source: MFE Exam, Spring 2009, #12.*
Let $V_C(K)$ and $V_P(K)$ denote the prices at time 0 of the European call and put options (respectively) both with maturity T. Denote the price at time 0 of the underlying asset by $S(0)$ and the constant continuously compounded interest rate by r. Then,

$$0 \leq V_C(50) - V_C(55) \leq 5e^{-rT}.$$

True ore false?

Problem 2.18. The current stock price is 20 per share. The price at the end of a four-month period is modeled with a one-period binomial tree so that the stock price can either increase by \$5, or decrease by \$5. The stock pays dividends continuously with the dividend yield 0.04.

The continuously-compounded, risk-free interest rate is 0.05.

What is the stock investment in a replicating portfolio for four-month, \$20-strike European call option on the above stock?

(a) Long 0.4917 shares
(b) Long 0.4934 shares
(c) Long 0.5 shares
(d) Short 0.5 shares
(e) None of the above.

Problem 2.19. The current price of a continuous-dividend-paying stock is \$65 per share. Its dividend yield is 0.02. We model the stock price at the end of two years using a binomial tree. It is assumed that the stock price can either go up, or go down by 30%.

The continuously-compounded, risk-free interest rate equals 0.05.

Consider a two-year, \$70-strike European call option on the above stock. What is the risk-free component of the replicating portfolio for this option?

(a) Borrow \$15.31.
(b) Lend \$15.31.
(c) Borrow \$17.45.
(d) Lend \$17.45.
(e) None of the above.