

UNIVERSITY OF TEXAS AT AUSTIN

HW Assignment 5Profit. Forward contracts. European call options.

Please, provide your **complete solutions** to the free-response problems. For those problems, final answers only, without the justification, will earn zero points. For the True/False and Multiple-Choice questions, only your final answer will be graded.

Problem 5.1. (10 points) Let the current price of a continuous-dividend-paying stock be \$40 and let its dividend yield be equal to 0.01. The continuously compounded, risk-free interest rate is 0.04. You model the distribution of the time-1 price of the above stock as follows:

$$S(1) \sim \begin{cases} 45, & \text{with probability } 1/4, \\ 42, & \text{with probability } 1/2, \\ 38, & \text{with probability } 1/4. \end{cases}$$

What is your expected profit under the above model, if you invest in one share of stock at time-0 and liquidate your investment at time-1?

Problem 5.2. (2 points) Derivative securities can reduce the risk of both the buyer and the writer of the security. *True or false?*

Problem 5.3. (2 points) An agent is **only** allowed to long a forward contract if he/she is willing to take physical delivery of the underlying asset. *True or false?*

Problem 5.4. (2 points) A short forward contract has an unlimited loss potential. *True or false?*

Problem 5.5. (5 points) The current price of stock a certain type of stock is \$80. The premium for a 6-month, at-the-money call option is \$5.84. Let the continuously compounded, risk-free interest rate be 0.04. What is the break-even point of this call option?

- (a) \$80
- (b) \$85.72
- (c) \$85.84
- (d) \$85.96
- (e) None of the above.

Problem 5.6. (5 points) The price of gold in half a year is modeled to be equally likely to equal any of the following prices

\$1000, \$1100, and \$1240.

Consider a half-year, \$1050-strike European call option on gold. What is the expected payoff of this option according to the above model?

Problem 5.7. (2 points) A cap is a long position with respect to the underlying asset. *True or false?*

Problem 5.8. (2 points) In our usual notation, the payoff of a **cap** is $\min(S(T), K)$ with the underlying asset not paying any dividends. *True or false?*

Problem 5.9. (5 points) The “Very tasty goat cheese Co” sells artisan goat cheese at \$10 per oz. They need to buy 200 gallons of goat milk in six months to make 200 oz of their specialty fall-equinox cheese. Non-goat milk aggregate costs total \$500. They decide to buy six-month, \$5-strike call options on gallons of goat milk for 0.50 per call option.

The continuously compounded, risk-free interest rate equals 0.04.

In six months, the price of goat milk equals \$6 per gallon. What is the profit of the company’s hedged position?

- (a) 395.92
- (b) 397.98
- (c) 400
- (d) 897.98
- (e) None of the above.

Problem 5.10. (2 points) An agent is **only** allowed to write options on an underlying asset if he/she already owns units of the underlying. *True or false?*

Problem 5.11. (2 points) A covered call is a portfolio consisting of a written call option and the short underlying. *True or false?*

Problem 5.12. (5 points) Today’s price of a non-dividend-paying stock is \$1000 and the annual effective interest rate is given to be 5%. You write a one-year, \$1,050-strike European call option for a premium of \$10 while you simultaneously buy the stock. What is your **profit** if the stock’s spot price in one year equals \$1,200?

Problem 5.13. (6 points) For what values of the final asset price is the profit of a long forward contract with the forward price $F = 100$ and delivery date T in one year smaller than the profit of a long call on the same underlying asset with the strike price $K = 100$ and the exercise date T . Assume that the call’s premium equals \$10 and that the annual effective interest rate equals 10%.

Express your answer as an interval.