

## UNIVERSITY OF TEXAS AT AUSTIN

HW Assignment 7

## CONTENTS

7.1. Arbitrage.	1
7.2. Put-call parity.	3
7.3. The binomial asset pricing model.	4

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**7.1. Arbitrage.**

**Problem 7.1.** (5 points) Provide the definition of an arbitrage portfolio.

**Problem 7.2.** (5 points) Provide the definition of a replicating portfolio of a European-style derivative security.

**Problem 7.3.** (5 points) Consider a non-dividend-paying stock whose current price equals \$54 per share. A pair of one-year European calls on this stock with strikes of \$40 and \$50 is available in the market for the observed prices of \$4 and \$2, respectively.

The continuously compounded, risk-free interest rate is given to be 10%.

George suspects that there exists an arbitrage portfolio in the above market consisting of the following components:

- **short-sale** of one share of stock,
- **buy** the \$40-strike call,
- **buy** the \$50-strike call.

What is the minimum **gain** from this suspected arbitrage portfolio?

- (a) The above is **not** an arbitrage portfolio.
- (b) \$0.84
- (c) \$8.00
- (d) \$13.05
- (e) None of the above.

**7.2. Put-call parity.**

**Problem 7.4.** (5 points) A certain common stock is priced at \$42.00 per share. Assume that the continuously compounded interest rate is  $r = 10.00\%$  per annum. Consider a \$50–strike European call, maturing in 3 years which currently sells for \$10.80. What is the price of the corresponding 3–year, \$50–strike European put option?

- (a) \$5.20
- (b) \$5.69
- (c) \$5.04
- (d) \$5.84
- (e) None of the above.

**Problem 7.5.** (5 points) The initial price of a non-dividend-paying stock is \$55 per share. A 6–month, at-the-money call option is trading for \$1.89. Let the interest rate be  $r = 0.065$ . Find the price of the European put with the same strike, expiration and the underlying asset.

- (a) \$0.05
- (b) \$0.13
- (c) \$0.56
- (d) \$0.88
- (e) None of the above

**Problem 7.6.** (5 points) *Source: Problem #2 from the Sample IFM (Derivatives: Introductory) questions.* You are given the following information:

- (1) The current price to buy one share of XYZ stock is 500.
- (2) The stock does not pay dividends.
- (3) The risk-free interest rate, compounded continuously, is 6%.
- (4) A European call option on one share of XYZ stock with a strike price of  $K$  that expires in one year costs \$66.59.
- (5) A European put option on one share of XYZ stock with a strike price of  $K$  that expires in one year costs \$18.64.

Determine the strike price  $K$ .

- (a) \$449
- (b) \$452
- (c) \$480
- (d) \$559
- (e) None of the above.

**Problem 7.7.** (5 points) Consider a European call option and a European put option on a non-dividend-paying stock. Assume:

- (1) The current price of the stock is \$55.
- (2) The call option currently sells for \$0.15 more than the put option.
- (3) Both options expire in 4 years.
- (4) Both options have a strike price of \$70.

Calculate the continuously compounded risk-free interest rate  $r$ .

- (a) 0.044
- (b) 0.052
- (c) 0.06
- (d) 0.065
- (e) None of the above.

**Problem 7.8.** (5 points) Consider a European call option and a European put option on a non-dividend paying stock  $S$ . You are given the following information:

- (1)  $r = 0.04$
- (2) The current price of the call option  $V_C(0)$  is by 0.15 greater than the current price of the put option  $V_P(0)$ .
- (3) Both the put and the call expire in 4 years.
- (4) The put and the call have the same strikes equal to 70.

Find the spot price  $S(0)$  of the underlying asset.

- (a) 48.90
- (b) 59.80
- (c) 69.70
- (d) 79.60
- (e) None of the above.

### 7.3. The binomial asset pricing model.

**Problem 7.9.** (10 points) Assume that one of the no-arbitrage conditions in the binomial model for pricing options on a non-dividend paying stock  $S$  is violated. Namely, let

$$e^{r \cdot h} \leq d < u.$$

Illustrate that the above inequalities indeed violate the no-arbitrage requirement. In other words, construct an arbitrage portfolio and show that your proposed arbitrage portfolio is, indeed, an arbitrage portfolio.