
UNIVERSITY OF TEXAS AT AUSTINProblem Set #9

Binomial option pricing.

Problem 9.1. In the setting of the one-period binomial model, denote by i the effective interest rate **per period**. Let u denote the “up factor” and let d denote the “down factor” in the stock-price model. If

$$d < u \leq 1 + i$$

then there certainly is no possibility for arbitrage.

Problem 9.2. In our usual notation, does this parameter choice create a binomial model with an arbitrage opportunity?

$$u = 1.18, \quad d = 0.87, \quad r = 0.05, \quad \delta = 0, \quad h = 1/4$$

Problem 9.3. Let the continuously compounded risk-free interest rate be equal to 0.04. Consider a one-period binomial tree with every period of length one year used to model the stock price of a stock whose current price is \$80 per share. In the model, it is assumed that the stock price can either go up by \$5 or down by \$4.

You use the binomial tree to construct a replicating portfolio for a 78–strike call option on the above stock. What is the stock investment in the replicating portfolio?

Problem 9.4. Let the continuously compounded risk-free interest rate be equal to 0.04. Consider a one-period binomial tree with every period of length one year used to model the stock price of a non-dividend-paying stock whose current price is \$50 per share. In the model, it is assumed that the stock price can either go up by 5% or down by 10%.

You use the binomial tree to construct a replicating portfolio for a 45-strike call on the above stock. What is the risk-free investment in the replicating portfolio?

Problem 9.5. Consider a non-dividend paying stock whose current price is \$95 per share. You model the evolution of this stock price over the following year using a one-period binomial tree under the assumption that the stock price can be either \$120, or \$75 in one year.

The continuously compounded risk-free interest rate is 0.06.

A **straddle** consists of a long call and a long otherwise identical put. Consider a \$100-strike, one-year European **straddle** on the above stock. What is the straddle's price consistent with the above stock-price model?

- (a) About \$10
- (b) About \$10.83
- (c) About \$15.45
- (d) About \$20.84
- (e) None of the above.