The University of Texas at Austin
In-Class Work 13

M339D Introduction to Financial Mathematics

October 21, 2026

Risk-Neutral Probability.

In all the problems below, the stock pays no dividends and is modeled using a one-period binomial tree over one year. The risk-free rate is continuously compounded.

Problem 13.1. 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 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.

Problem 13.2. The current price of a stock is $100 per share. In one year, the stock price will be either $130 or $85.

The continuously compounded, risk-free rate is 0.02.

A one-year contract pays the larger of the payoff of a $105-strike European call and the payoff of a $105-strike European put. What is the contract's price?

a. About $9.27
b. About $12.19
c. About $21.46
d. About $21.89
e. None of the above.

Problem 13.3. The current price of a stock is \$20 per share. In one year, the stock price will be either \$26 or \$16.

The continuously compounded, risk-free rate is 0.04.

A one-year contract pays $(S(1) - 20)^2$. What is the contract's price?

a. 0
b. About \$24.63
c. About \$24.97
d. About \$25.63
e. None of the above.

Problem 13.4. The current price of a stock is \$50 per share. In one year, the stock price will be either S_u or \$40.

The continuously compounded, risk-free rate is 0.05.

A \$55-strike, one-year European call on the stock trades for \$2.99. What is S_u?

a. About \$55
b. About \$58
c. About \$60
d. About \$62.50
e. None of the above.

Problem 13.5. The current price of a stock is $40 per share. In one year, the stock price will be either $50 or $32.

The continuously compounded, risk-free rate is 0.03.

Analyst A believes the probability of an up movement is 0.9. Analyst B believes it is 0.1. Both analysts price a $40-strike, one-year European call using the above model. Which statement is true?

a. Analyst A's price is higher.
b. Analyst B's price is higher.
c. Both prices equal about $4.97.
d. Both prices equal about $5.12.
e. None of the above.

Problem 13.6. The current price of a stock is \$80 per share. In one year, the stock price will be either \$100 or \$70.

The continuously compounded, risk-free rate is 0.04.

The market quotes an \$85-strike, one-year European call at \$6.37 and an otherwise identical put at \$7.50. Which statement is true?

a. The call is underpriced. An arbitrage yields about \$0.54 today.
b. The put is underpriced. An arbitrage yields about \$0.54 today.
c. The call is overpriced. An arbitrage yields about \$0.54 today.
d. The put is underpriced. An arbitrage yields about \$1.67 today.
e. None of the above.

Problem 13.7. The current price of a stock is \$50 per share. In one year, the stock price will be either \$60 or \$45.

The continuously compounded, risk-free rate is 0.03.

You cannot trade the stock. You can only trade a \$50-strike, one-year European call and the risk-free asset. Which portfolio replicates the \$50-strike, one-year European put?

a. Long 0.5 calls and a risk-free investment paying \$5 at time 1.
b. Short 0.5 calls and a risk-free investment paying \$5 at time 1.
c. Short 1 call and a risk-free investment paying \$50 at time 1.
d. Short 1.5 calls and a risk-free investment paying \$45 at time 1.
e. None of the above.

Problem 13.8. The current price of a stock is $30 per share. In one year, the stock price will be either $33 or $27.

The continuously compounded, risk-free rate is 0.12.

Consider the strategy: short sell one share and invest the proceeds at the risk-free rate for one year. What is the smallest possible profit of this strategy at time 1?

a. 0
b. About $0.82
c. About $3.00
d. About $3.82
e. None of the above.