Name:

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Name:

All written work handed in by the student is considered to be
their own work, prepared without unauthorized assistance.

The University Code of Conduct

"The core values of The University of Texas at Austin are learning, discovery, freedom, leadership,
individual opportunity, and responsibility. Each member of the university is expected to uphold
these values through integrity, honesty, trust, fairness, and respect toward peers and community. As
a student of The University of Texas at Austin, I shall abide by the core values of the University and
uphold academic integrity."

"I agree that I have complied with the UT Honor Code during my completion of this exam."

Signature:

Provide your **complete solution** to the following problems. Final answers only, without appropriate justification, will receive zero points even if correct.

2.1. TRUE/FALSE QUESTIONS.

Problem 2.1. (5 points) You are using a one-period binomial asset-pricing model to model the evolution of the price of a particular stock. Assume that, in our usual notation, $S_d < K < S_u$ for a European call option. Then, the risk-free component in the replicating portfolio of a single call option on that stock should be interpreted as lending. *True or false? Why?*

Problem 2.2. (5 points) You are using a binomial asset-pricing model to model the evolution of the price of a particular stock. Then, the Δ in the replicating portfolio of a single call option on that stock never exceeds 1. *True or false? Why?*

Problem 2.3. (5 points) You are using a binomial asset-pricing model to model the evolution of the price of a particular stock. Then, the Δ in the replicating portfolio of a single put option on that stock is between -1 and 0. *True or false? Why?*

2.2. **FREE-RESPONSE PROBLEMS.**

Problem 2.4. (10 points) The current stock price is given to be $S(0) = 30$ and its volatility is 0.3 The continuously-compounded, risk-free interest rate is 0.12.

    (i) (2 points) What is the expected stock price in three months under the risk-neutral probability measure?

   (ii) (3 points) What is the median stock price in three months under the risk-neutral probability measure?

  (iii) (5 points) Find the risk-neutral probability that the stock price in three months is less than \$32.

Problem 2.5. (15 points) The current price of a non-dividend paying stock is $100. Its evolution over the following year is modeled using a three-period binomial tree under the assumption that the price can increase by 2% or decrease by 0.5% over each period. The continuously compounded, risk-free interest rate is 0.03.

What is the price of a one-year, $101-strike call option on this stock?

Problem 2.6. (10 points) A non-dividend-paying stock is currently priced at $100 per share. One-year, $102-strike European call and put options on this stock have equal prices. What is the continuously-compounded annual risk-free rate of interest?

Problem 2.7. (10 points) A derivative security has the payoff function given by

$$v(s) = \begin{cases} 10 & \text{if } s < 90 \\ 0 & \text{if } 90 \leq s < 100 \\ 20 & \text{if } 100 \leq s \end{cases}$$

Its exercise date is in one year. You model the time-1 price of the underlying asset as

$$S(1) \sim \begin{cases} 85 & \text{with probability } 1/4 \\ 95 & \text{with probability } 1/2 \\ 105 & \text{with probability } 1/4 \end{cases}$$

What is the expected payoff of the above derivative security?