

UNIVERSITY OF TEXAS AT AUSTIN

Problem Set 10Black-Scholes pricing.

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**Problem 10.1.** Let the stock prices be modeled using the lognormal distribution. Under the risk-neutral probability measure, the mean stock price at time  $-1$  equals 120 and the median stock price 115. What is the risk-neutral probability that the time  $-1$  stock price exceeds 100?

**Problem 10.2.** (5 pts) Let the stochastic process  $S = \{S(t); t \geq 0\}$  denote the stock price. The stock's rate of appreciation is 10% while its volatility is 0.30. Then,

- (a)  $Var[\ln(S(t))] = 0.3t$
- (b)  $Var[\ln(S(t))] = 0.09t^2$
- (c)  $Var[\ln(S(t))] = 0.09t$
- (d)  $Var[\ln(S(t))] = 0.09$
- (e) None of the above.

**Problem 10.3.** (5 pts) Assume the Black-Scholes framework. Let the current price of a non-dividend-paying stock be equal to  $S(0) = 95$  and let its volatility be equal to 0.35. Consider a European call on that stock with strike 100 and exercise date in 9 months. Let the risk-free continuously compounded interest rate be 6% per annum.

Denote the price of the call by  $V_C(0)$ . Then,

- (a)  $V_C(0) < \$5.20$
- (b)  $\$5.20 \leq V_C(0) < \$7.69$
- (c)  $\$7.69 \leq V_C(0) < \$9.04$
- (d)  $9.04 \leq V_C(0) < \$11.25$
- (e) None of the above.

**Problem 10.4.** Assume the Black-Scholes setting. Let  $S(0) = \$63.75$ ,  $\sigma = 0.20$ ,  $r = 0.055$ . The stock pays no dividend and the option expires in 50 days (simplify the number of days in a year to 360).

What is the price of a \$60-strike European put?

- (a) 0.66
- (b) 0.55
- (c) 0.44
- (d) 0.37
- (e) None of the above.