TEXAS A&M UNIVERSITY
DEPARTMENT OF MATHEMATICS

MATH 425-500

Midterm test version A, 18 Oct 2018

On my honor, as an Aggie, I have neither given nor received unauthorized aid on this work.

Name (print):

No detailed analytical work — no points.

Each question is worth 10 points unless noted otherwise

1. You are considering purchasing a *long put ladder* spread on AAPL with expiration Nov 16, 2018: it consists of a long 220 put at \$7.03, a short 210 put at \$3.68 and another short 200 put at \$1.86. Draw the profit diagram (assume $r = 0$). Is your profit limited? Is your loss limited? If yes, by what amount? Describe the range of prices (at expiration) in which you obtain a profit.
Note: if the maximum of profit or loss does not fit on the page in a profit diagram, it counts as "unlimited" for all practical purposes.

2. Find the mean and the variance of the random variable

$$Z = \sum_{j=1}^{2018} X_j,$$

where X_j are i.i.d. Bernoulli variables, i.e.

$$X_i = \begin{cases} 1 & \text{with probability } p, \\ 0 & \text{with probability } 1-p. \end{cases}$$

3. Price a European call with the following parameters: $S_0 = 20$, $E = 18$, $r = 0.10$, $T = 3$ months (i.e. 3/12 of a year) using a tree with $L = 3$ levels and $u = 1.1$ and $d = 0.9$.
Assume you sold a call for \$3.00 (which is above the fair price). Simulate hedging on the price path Down, Up, Up to verify that you get the keep the difference between \$3.00 and the fair price.
You may use two pages for your answer.

4. Use Portfolio Lemma to show that the price of a call $C(E, \tau)$ with strike E and time to expiration τ satisfies the inequality

$$C(E, \tau) \geq S - Ee^{-r\tau},$$

where S is the current price of the underlying. Verify that this inequality is satisfied at every node of the price path in the previous question (i.e. you are asked to check it at 3 nodes only).

Points:	**/30**