KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

DEPARTMENT OF MATHEMATICS & STATISTICS

AS498 - Section 01 (Term 172)

Date: April 12, 2018 **Test 4** Duration: 50 minutes

Family Name: _____ **ID #:** 2 0 1 _ _ _ _ _ _ 0 **Serial #:** _ _

1. For a stock that follows the Black-Scholes framework, you are given:

   (i) The current stock price is 20.
   (ii) The stock pays dividends at a rate proportional to its price. The dividend yield is 1%.
   (iii) The stock's volatility is 18%.
   (iv) The continuously compounded risk-free interest rate is 10%.

   A market-maker has sold 100 units of a 6-month 22-strike call on the stock. The call price was 0.602109 per unit. The dividends received are invested by purchasing extra shares.

   (a) Calculate the components of the hedge portfolio.

After one month, when the stock price is 19 and the Black-Scholes price of a unit of the call becomes 0.216633, the market-maker rebalance his hedge portfolio by trading shares and risk-free bonds. The market-maker invests or repays dividends by purchasing or shorting extra shares.

(b) Compute the 1-month profit.

(c) Describe how the market-maker should rebalance his hedge portfolio after 1 month.

[**Hint:** For parts (b) and (c), you may wish to perform the calculations by completing the following table]

Time	Derivative	Hedge Portfolio		Aggregate
		Stock	Cash	
Start				0
Before Rebalancing				
After rebalancing				0
Difference	0			

(6 + 7 + 7 = 20 points)

2. For a nondividend-paying stock, you are given:

   (i) The current stock price is 50.
   (ii) The volatility of the stock is 40%.
   (iii) The continuously compounded risk-free interest rate is 10%.

   By constructing a 2-period binomial forward tree, calculate the price of the following exotic options:

   (a) A 1-year 55-strike arithmetic average price call.

   (b) A 1-year geometric average strike put.

(c) A 1-year deferred up-rebate option with a barrier of 55 and a rebate of 1.

(d) A 1-year lookback call.

(e) A 1-year lookback put.

(8 + 7 + 5 + 5 + 5 = 30 points)