

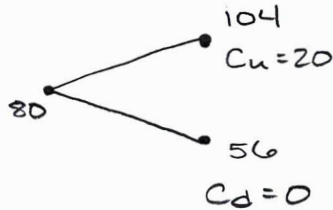
## HW 10.2 (c) Key

1. Prices for a stock are modeled with a 1-period binomial tree. You are given the following information:

- (1) The period is one year.
- (2) The stock's current price is 80
- (3)  $u = 1.3$  and  $d = 0.7$ .
- (4) The continuously compounded risk-free rate is 4.5%.
- (5) The stock pays continuous dividends proportional to its price at a rate of 1.5%.

Find the number of shares of stock in the replicating portfolio for a one year call option with a strike price of 84.  
[20c\_01]

- A)** 0.410    B) 0.361    C) 0.378    D) 0.394    E) 0.427



$K = 84$

$$\Delta = \frac{C_u - C_d}{S_u - S_d} e^{-\delta t}$$

$$= \frac{20}{48} e^{-0.015}$$

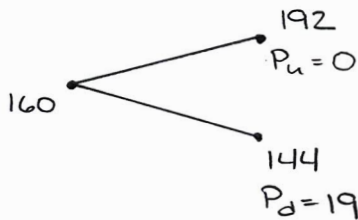
$$= \boxed{0.41046}$$

2. Prices for a stock are modeled with a 1-period binomial tree. You are given the following information:

- (1) The period is one year.
- (2) The stock's current price is 160
- (3)  $u = 1.2$  and  $d = 0.9$ .
- (4) The continuously compounded risk-free rate is 5.5%.
- (5) The stock pays continuous dividends proportional to its price at a rate of 1%.

Find the number of shares of stock in the replicating portfolio for a one year put option with a strike price of 163.  
[20c\_02]

- A)** -0.392    B) -0.376    C) -0.408    D) -0.423    E) -0.439



$K = 163$

$$\Delta = \frac{P_u - P_d}{S_u - S_d} e^{-\delta t}$$

$$= \frac{19}{48} e^{-0.01}$$

$$= \boxed{-0.3919}$$

3. Prices for a stock are modeled with a 1-period binomial tree. You are given the following information:
- (1) The period is one year.
  - (2) The stock's current price is 155
  - (3) The continuously compounded risk-free rate is 3.5%.
  - (4) The stock pays continuous dividends proportional to its price at a rate of 2%.
  - (5) The number of shares in the replicating portfolio for a one year European call option with a strike price of 152 is 0.587.

Find the number of shares of stock in the replicating portfolio for a one year put option with a strike price of 152. [20c\_03]

- [A] -0.393    B) -0.378    C) -0.409    D) -0.425    E) -0.441

$$\Delta_c - \Delta_p = e^{-\delta t}$$

$$0.587 - \Delta_p = e^{-0.02}$$

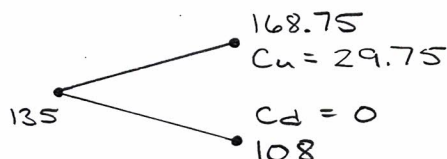
$$\Delta_p = \boxed{-0.3932}$$

4. Prices for a stock are modeled with a 1-period binomial tree. You are given the following information:

- (1) The period is one year.
- (2) The stock's current price is 135
- (3)  $u = 1.25$  and  $d = 0.8$ .
- (4) The continuously compounded risk-free rate is 3.5%.
- (5) The stock pays continuous dividends proportional to its price at a rate of 1%.

Find the price of a one year call option with a strike price of 139. [20c\_04]

- [A] 14.38    B) 14.96    C) 15.53    D) 16.11    E) 16.68



$$168.75 e^{0.01} \Delta + B e^{0.035} = 29.75$$

$$108 e^{0.01} \Delta + B e^{0.035} = 0$$

$$\Delta = 0.4848 \quad B = -51.0698$$

$$K = 139 \quad \delta = 1\%$$

$$r = 3.5\% \quad t = 1$$

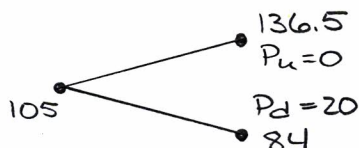
$$\text{Call} = 135 \Delta + B = \boxed{14.38}$$

5. Prices for a stock are modeled with a 1-period binomial tree. You are given the following information:

- (1) The period is one year.
- (2) The stock's current price is 105
- (3)  $u = 1.3$  and  $d = 0.8$ .
- (4) The continuously compounded risk-free rate is 5.5%.
- (5) The stock pays continuous dividends proportional to its price at a rate of 1%.

Find the price of a one year put option with a strike price of 104. [20c\_05]

- [A] 9.62    B) 10.00    C) 10.39    D) 10.77    E) 11.16



$$136.5 e^{0.01} \Delta + B e^{0.055} = 0$$

$$84 e^{0.01} \Delta + B e^{0.055} = 20$$

$$K = 104 \quad \delta = 1\%$$

$$r = 5.5\% \quad t = 1$$

$$\Delta = -0.3772 \quad B = 49.2172$$

$$P_u = 105 \Delta + B = \boxed{9.61}$$