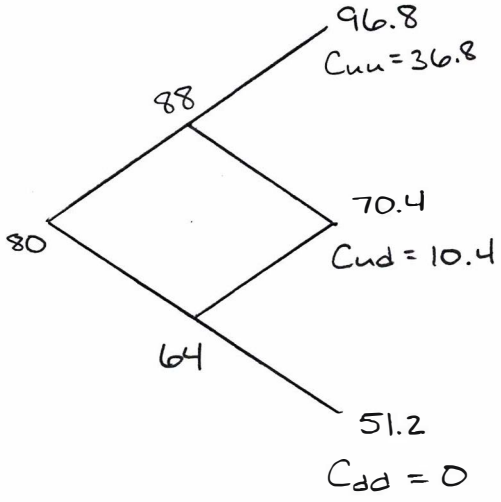
HW 10.4 Key

1. Prices for a stock are modeled with a 2-period binomial tree. You are given the following information:
(1) Each period is 6 months.
(2) The stock's current price is 80
(3) $u = 1.1$ and $d = 0.8$.
(4) The continuously compounded risk-free rate is 4.5%.
(5) The stock does not pay dividends.
Find the price of a one year European call option with a strike price of 60. [20e_01]

A) 23.20 B) 22.27 C) 22.73 D) 23.66 E) 24.13



$h = 1/2 \quad r = 4.5\% \quad \delta = 0$

Call: $T = 1, \; K = 60$

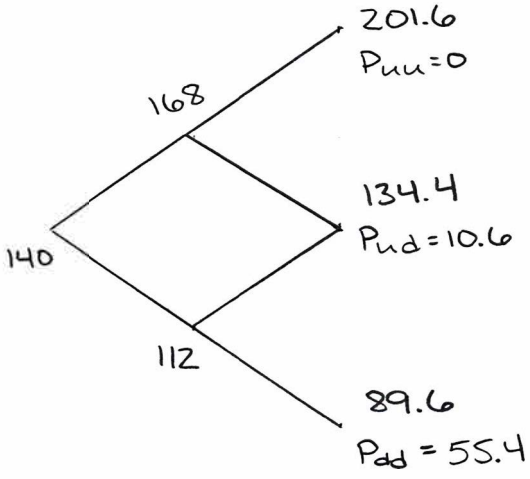
$$p^* = \frac{e^{0.0225} - 0.8}{1.1 - 0.8} = 0.7425$$

$$\text{Call} = [(p^*)^2(36.8) + 2p^*q^*\,10.4]\, e^{-0.045}$$

$$= \boxed{23.20}$$

2. Prices for a stock are modeled with a 2-period binomial tree. You are given the following information:
(1) Each period is 6 months.
(2) The stock's current price is 140
(3) $u = 1.2$ and $d = 0.8$.
(4) The continuously compounded risk-free rate is 8%.
(5) The stock does not pay dividends.
Find the price of a one year European put option with a strike price of 145. [20e_02]

A) 12.79 B) 11.77 C) 12.02 D) 12.28 E) 12.53



$h = 1/2 \quad r = 8\% \quad \delta = 0$

Put: $T = 1, \; K = 145$

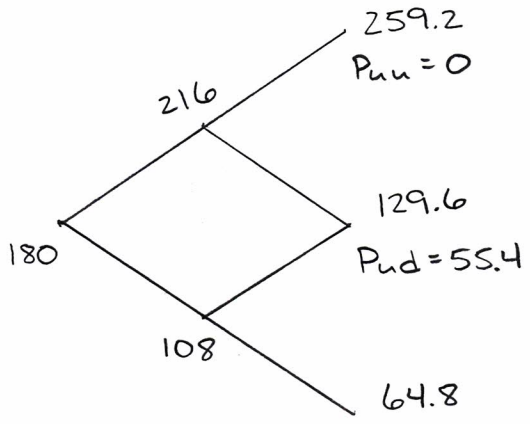
$$p^* = \frac{e^{0.04} - 0.8}{1.2 - 0.8} = 0.6020$$

$$\text{Put} = [10.6(2)p^*q^* + 55.4(q^*)^2]\, e^{-0.08}$$

$$= \boxed{12.79}$$

3. Prices for a stock are modeled with a 2-period binomial tree. You are given the following information:
(1) Each period is 6 months.
(2) The stock's current price is 180
(3) $u = 1.2$ and $d = 0.6$.
(4) The continuously compounded risk-free rate is 5%.
(5) The stock pays continuous dividends proportional to its price at a rate of 3%
Find the price of a one year European put option with a strike price of 185. [20e_03]

A) 34.26 B) 35.63 C) 37.00 D) 38.37 E) 39.74



$h = 1/2 \quad r = 5\% \quad \delta = 3\%$

Put: $T = 1, \; K = 185$

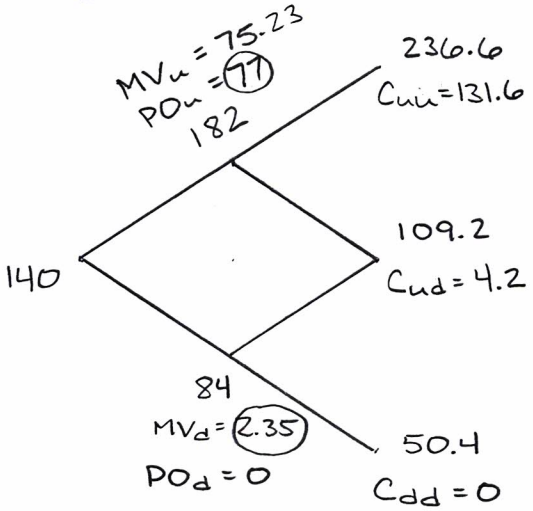
$$p^* = \frac{e^{0.01} - 0.6}{1.2 - 0.6} = 0.6834$$

$$P_{ut} = [55.4(2)p^*q^* + 120.2(q^*)^2]e^{-0.05}$$

$$= \boxed{34.26}$$

4. Prices for a stock are modeled with a 2-period binomial tree. You are given the following information:
(1) Each period is 6 months.
(2) The stock's current price is 140
(3) $u = 1.3$ and $d = 0.6$.
(4) The continuously compounded risk-free rate is 7%.
(5) The stock pays continuous dividends proportional to its price at a rate of 6%
Find the price of a one year American call option with a strike price of 105. [20e_04]

A) 43.97 B) 42.21 C) 45.73 D) 47.49 E) 49.25



$h = 1/2 \quad r = 7\% \quad \delta = 6\%$

Am Call: $T = 1, \; K = 105$

$$p^* = \frac{e^{0.005} - 0.6}{1.3 - 0.6} = 0.5786$$

$$MV_u = [131.6p^* + 4.2q^*]e^{-0.035} = 75.23$$

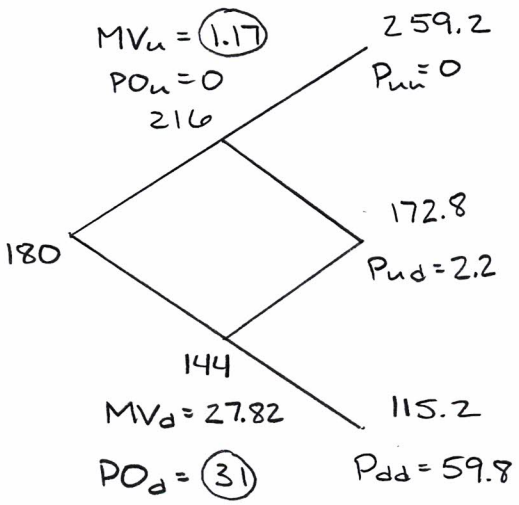
$$MV_d = [4.2p^*]e^{-0.035} = 2.35$$

$$\text{Call} = [77p^* + 2.35q^*]e^{-0.035}$$

$$= \boxed{43.98}$$

5. Prices for a stock are modeled with a 2-period binomial tree. You are given the following information:
(1) Each period is 6 months.
(2) The stock's current price is 180
(3) $u = 1.2$ and $d = 0.8$.
(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%
Find the price of a one year American put option with a strike price of 175. [20e_05]

A) 14.34 B) 12.62 C) 13.19 D) 13.77 E) 14.91



$h = 1/2$ $\quad r = 4.5\%$ $\quad \delta = 1\%$

Am Put: $T = 1$, $K = 175$

$$p^* = \frac{e^{0.0175} - 0.8}{1.2 - 0.8} = 0.5441$$

$$MV_u = [2.2q^*]\, e^{-0.0225} = 1.17$$

$$MV_d = [2.2p^* + 59.8q^*]\, e^{-0.0225} = 27.82$$

$$P_{u+} = [1.17p^* + 31q^*]\, e^{-0.0225}$$

$$= \boxed{14.44}$$