Solution Homework 5

9. a. $uS_0 = 130 \Rightarrow P_u = 0$

$dS_0 = 80 \Rightarrow P_d = 30$

The hedge ratio is: $H = \dfrac{P_u - P_d}{uS_0 - dS_0} = \dfrac{0 - 30}{130 - 80} = -\dfrac{3}{5}$

b.

Riskless Portfolio	$S_T = 80$	$S_T = 130$
Buy 3 shares	240	390
Buy 5 puts	150	0
Total	390	390

Present value = \$390/1.10 = \$354.545

c. The portfolio cost is: 3S + 5P = 300 + 5P

The value of the portfolio is: \$354.545

Therefore: 300 + 5P = \$354.545 → P = \$54.545/5 = \$10.91

10. The hedge ratio for the call is: $H = \dfrac{C_u - C_d}{uS_0 - dS_0} = \dfrac{20 - 0}{130 - 80} = \dfrac{2}{5}$

Riskless Portfolio	S = 80	S = 130
Buy 2 shares	160	260
Write 5 calls	0	-100
Total	160	160

Present value = \$160/1.10 = \$145.455

The portfolio cost is: 2S – 5C = \$200 – 5C

The value of the portfolio is: \$145.455

Therefore: C = \$54.545/5 = \$10.91

Does P = C + PV(X) – S?

10.91 = 10.91 + 110/1.10 – 100 = 10.91

11. $d_1 = 0.2192 \Rightarrow N(d_1) = 0.5868$

$d_2 = -0.1344 \Rightarrow N(d_2) = 0.4465$

$Xe^{-rT} = 49.2556$

$C = \$50 \times 0.5868 - 49.2556 \times 0.4465 = \$7.34$

12. $P = \$6.60$

This value is derived from our Black-Scholes spreadsheet, but note that we could have derived the value from put-call parity:

$P = C + PV(X) - S_0 = \$7.34 + \$49.26 - \$50 = \$6.60$

18. The best estimate for the change in price of the option is:

Change in asset price × delta = −\$6 × (-0.65) = \$3.90

23. Implied volatility has increased. If not, the call price would have fallen as a result of the decrease in stock price.

24. Implied volatility has increased. If not, the put price would have fallen as a result of the decreased time to expiration.