END OF CHAPTER EXERCISES

Chapter 9 : Hedging and Volatility

Financial Engineering : Derivatives And Risk Management

(Keith Cuthbertson, Dirk Nitzsche)

1. What is ”implied volatility” and how is it calculated?

2. At the end of the trading day you are long 40 European calls and short 20 European puts on the same underlying. The calls and puts have the same time to maturity and the delta of the call is $\Delta_c = 0.1$. How can you delta hedge this position over the next 24 hours? Will you buy or sell the underlying asset?

3. In the BOPM how do you calculate the delta and gamma of the option at t=0?

4. The boss of your corporation does not understand options and is therefore worried that the firms' options position will incur large losses over the next few days. Later you report back to him that he need not worry, you have “fixed things” so the portfolio is hedged. What you have actually done is delta and gamma hedged your options position. Should your boss sleep easy?

5. Suppose portfolio–A is delta neutral but has a gamma of -300. A call option with the same underlying (e.g. stock or currencies) is available which has a delta of 0.62 and a gamma of 1.5. Let this call option be denoted 'Z'.
How can you use Z to make the overall portfolio gamma and delta neutral ?

6. An investment bank has the following portfolio–A of OTC, options.

Option	Position (No. of options held, long or short)	Delta	Gamma	Vega
Call	-1,000	0.50	2.2	1.8
Call	-500	0.80	0.6	0.2
Put	-2,000	-0.40	1.3	0.7
Call	-500	0.70	1.8	1.4

A traded option Z is available with delta = 0.6, gamma = 1.5 and vega = 0.8.

A traded option Y is also available with delta of 0.1, gamma of 0.5 and vega of 0.6.

(a.) Calculate the delta, gamma and vega of Portfolio A.
(b.) What position in Z and portfolio-A would make the overall portfolio both gamma and delta neutral?
(c.) What position in Z and portfolio-A would make the overall portfolio both vega and delta neutral?

(d.) What position in Z and Y, together with portfolio–A would make the overall portfolio gamma, vega and delta neutral.

7. Suppose you are provided with the "correct" standard deviation of a stock (from a highly reputable statistical agency) and you believe 25% is the correct value. You now calculate the implied standard deviation using the observed market price of a call option and find that it is 30%. What should you now do to make riskless profits (assuming 25% turns out to be the correct volatility over the life of the call option) ?