

# END OF CHAPTER EXERCISES

## Chapter 19 : Real Options

Financial Engineering : Derivatives And Risk Management

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1. You have been asked to put money into a new pop 'girl-band' called the *Nice Girls*. You have heard their material and it doesn't sound too good. In the contract is the possibility, after 3 years, of managing their solo careers as well as continuing to manage 'the group'. You estimate that either taking the group on now or, taking each of them on as solo artists in 3 years time, are separately both negative NPV 'projects'. Why might the combination of taking them on now together with the possibility of also managing their future solo careers, be worthwhile?
2. There is much discussion in the press concerning the possible introduction of 'pollution charging' in cities for those using private (gasoline powered) cars. These charges would not apply to environmentally friendly cars which are battery powered. A decision will be made on this proposal before the end of the current Mayor's term of office in the next 2 years. You calculate that an investment project to market your new battery powered town car (the *City Slicker*) has a positive NPV, today. Should you start marketing the car immediately?
3. You are thinking of purchasing stocks of a new dot.com company called *Love.com* which specialises in 'matching' couples (of any gender). The firm has been in existence for 5 years, has highly variable revenues and has not yet made a profit. What factors might you take into consideration when deciding whether the floatation price of the shares is too high or too low?
4. How can Monte Carlo Simulation be used to determine the value of a firm ? What are the main 'uncertainties' one has to allow for ?

### Data to answer Questions 5, 6 and 7.

If you invest in a project to drill for oil, the (PV of the) capital cost is \$110m. Net revenues over the next three years have an annual volatility of 70%, due to the extreme uncertainty surrounding the price of oil, because of possible turmoil in the Mid-East. The value of net revenues at  $t = 0$  is \$100m. The value of the project then follows a binomial process. The risk-free interest rate is  $r = 3\%$  p.a. and the probability of either an increase or decrease in net revenues is 0.5.

- 5 Construct a binomial lattice for the value of the project from  $t=0$  to  $t=3$  (after which we assume the project is worthless). Calculate the NPV of the project and hence determine whether to invest in the project.

6. Suppose in year-3 (only) you can increase output by 40% by drilling an additional 'hole' which will involve additional investment of \$45m. How does this affect your decision of whether to start the first oil well at  $t=0$ ? What kind of option is available here?
  
7. You now realise that in year-3 or earlier you could if you wished, sell the oil well to a large oil company for \$50m. Does this alter your investment decision? What kind of option is now 'embedded' in the project and what is this option worth?