Assignment 3 - Math 799
Numerical Methods for Finance

05/03/2003

1. Choose **only one** of the following items.

(i) Consider an up-and-out call option. Use a Monte Carlo pricing routine to investigate the dependence of its price with respect to the different parameters. In particular, find out the behaviour of the price with respect to the volatility, but for different levels of the barrier (for instance, one level relatively close to the strike price, one far from it and an intermediate one).

(ii) Consider two types of Asian put options, an average strike put with payoff

$$\Phi(S_T) = (A - S_T)^+$$

and an average rate put with payoff

$$\Phi(S_T) = (X - A)^+,$$

where A is some average for the stock price S_t in the interval $[0, T]$. Use a Monte Carlo pricing routine to compare their prices for different strike prices (i.e, the average rate is written in, out or at the money) and different averaging procedures (i.e, arithmetic or geometric).

Summarize your findings for either item (i) or (ii) above in the form of a short essay, describing the essential features of these options. Try to write it as if you were describing a newly create product to a potential client, that is, be brief but informative. Use tables or pictures to backup your claims.

2. (a) Write a crude Monte Carlo routine to price an European style look-back call option with payoff

$$\Phi(S_T) = S_T - S_M,$$

where

$$S_m = \min_{t \in [0,T]} S_t.$$

Compare its price with the price of a vanilla European call with different strike prices. Set the number of replication so that the relative error in your estimates is less then 0.5%.

(b) Use antithetic variates to try to improve your confidence intervals and test it against your crude Monte Carlo from item (a).

(c) Use a control variate to try to improve your confidence intervals and test it against both the crude Monte Carlo and the antithetic variates version.