# ECG790C - Problem Set 7 - Spring 2009

1. Suppose that the price of a commodity (under the risk neutral measure) evolves according to

$$dS = \alpha(m - S)Sdt + \sigma SdW$$

Use `finsolve` to numerically the price of a put option on $S$ with strike price $K$ and $T$ periods till maturity (the maturity value of a put option is $\max(K-S, 0)$).

Use parameter values $\alpha = 0.5$, $m = 1$, $\sigma = 0.2$, $K = 1$, $T = 1$ and the risk-free interest rate $r = 0.05$.

What is the current value of the option if $S = 0.95$? What is the $\Delta$ of the option (i.e., $V_S(S, \tau)$) for this value of $S$?

2. Modify `demfin01` to include a coupon rate of 1% per year. Change the demo to plot the residual function rather than the error function.

3. Transform the problem in `demfin01` so the state variable lies on [0,1] using the transform

$$z = \frac{\alpha}{\alpha + r}$$

Solve the transformed problem. Compare the number of nodes needed for a similar sized error compared to the method used in `demfin01`.

4. Alter your approach in the bond pricing problem in `demfin01` to handle a discrete coupon of 1% per year paid at the end of the first year and in each subsequent year except the terminal year (when the face value is paid). For this problem `finsolve` cannot be used directly but can be used recursively (i.e., solve it one year at a time and use the results of each step as terminal conditions for the next step).