NAG Toolbox for MATLAB

Implied Volatility Exercise

Question 1

Write a function **bs** which takes the following inputs:

S: the initial stock price	K: the strike price	T: the maturity
r: the interest rate	q: the dividend rate	sigma: the volatility

The function **bs** should call NAG function nag_specfun_opt_bsm_price (s30aa) to return the price of a simple European call option. Use your function to price a call option with the following parameters:

S = 100	K = 90	T = 1.5
r = 0.03	q = 0.015	σ = 0.09

Question 1 Answer

You should get an answer of 12.35008695.

Question 2

Refer to the documentation for nag_roots_contfn_cntin (c05aw). We are now going to write a program to compute the Black Scholes implied volatility for a given call option price and set of parameters. In other words, given a call option price C and values of S, K, T, r, q, find the value of σ so that the Black Scholes formula gives the target price C. Modify the function **bs** from Question 1 to have the signature

```
function [result, user] = bs(sigma, user)
```

In your main function, create an array named user to hold 6 values. Define variables S, K, T, r, q and the target call option price Ctarget. Assign S, K, T, r, q and Ctarget to the 6 elements of the array user.

In your function **bs**, assign the first 5 members of the user array to variables S, K, T, r and q, and call nag_specfun_opt_bsm_price to compute the price of a

call option. Return the difference between this price and the 6th member of your user array, Ctarget.

In your main program, call nag_roots_contfn_cntin and pass it **bs** as the function of which the zero is to be computed. Set eps = eta = 1.0e-6 and set nfmax = 1500.

1. Use your program to compute the implied volatility for a (target) call option price of 12.35008695 and

   S = 100 K = 90 T = 1.5 r = 0.03 q = 0.015

   Use an initial guess of $\sigma = 0.15$.

2. Use your program to compute the implied volatility for a (target) call option price of 25.5 and

   S = 100 K = 90 T = 1.5 r = 0.03 q = 0.015

   Use an initial guess of $\sigma = 0.15$.

Question 2 Answers

1. For target price 12.35008695 you should get an answer of 0.090001.

2. For target price 25.5 you should get an answer of 0.429938.