The Binomial CEV Model and the Greeks

1. The stock price follows, under the risk-neutral measure, the constant elasticity of variance (CEV) dynamic

$$dS_t = rS_t dt + \delta S_t^{\beta/2} dW_t,$$

where W_t is a Wiener process, r is an interest rate, δ is a model parameter fixing the initial volatility $\sigma = \delta S_0^{\beta/2-1}$ and β is a constant ($0 < \beta < 2$).

2. Write a function in *Octave* which calculates the price of a standard European call option and its Greeks: Delta, Gamma and Theta using the binomial CEV model. The function, called **binomial_CEV(x,y,...)**, needs the following input data (names of variables and values in parenthesis are default and should appear in file **CW1_data.txt**):

- initial stock price, S_0 (`S0 = 105`),
- risk-free interest rate, r (`r = 0.09`),
- volatility of the stock, σ (`sigma = 0.25`),
- time to maturity, T (`T = 1`),
- strike price, K (`K = 100`),
- CEV parameter, β (`beta = 1`),
- number of periods, M (`M = ...`).

The function ought to compute Greek parameters using the binomial extended tree method.

3. Write a program (script) which inputs data to the function **binomial_CEV** (input from the file **CW1_data.txt**) and prints all the results (with identification labels) on the screen.

4. Analyse the dependence of the price and the Greeks values on the number of time steps M. Our "target" is to understand the dependence of the results on M, analyse it as M changes in small and large steps. How to check that the solution you found is good? Report findings together with a short explanation in a separate "comment" file.