Black-Scholes option pricing greeks

[Nematrian website page: BlackScholesGreeks, © Nematrian 2015]

We set out below links to pages containing analytical formulae for the prices and greeks for (European-style) *vanilla* put and call options and *binary* put and call options, in a Black-Scholes world, see also e.g. Wilmott (2007). The relevant pages contain links to pages that allow you to calculate these prices and Greeks interactively or programmatically.

- (Vanilla) calls
- (Vanilla) puts
- Binary calls
- Binary puts

Notation

Throughout these pages we use the following notation:

Input parameters:

K = strike price
S = price of underlying
r = interest rate continuously compounded
q = dividend yield continuously compounded
t = time now
T = time at maturity
σ = implied volatility (of price of underlying)

Formulae elements:

$$N(z) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{z} e^{-t^2/2}dt = \frac{1}{2} + \frac{1}{2}\mathrm{erf}\left(\frac{z}{\sqrt{2}}\right)$$

$$N'(z) = \frac{\partial N(z)}{\partial z} = \frac{1}{\sqrt{2\pi}}e^{-z^2/2}$$

$$d_1 = \frac{\ln\left(\frac{S}{K}\right) + \left(r - q + \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}$$

$$d_2 = d_1 - \sigma\sqrt{T-t} = \frac{\ln\left(\frac{S}{K}\right) + \left(r - q - \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}$$

N.B. $N(-x) = 1 - N(x)$ and $N'(-x) = N'(x)$.