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# Berg-Koppelaar Quadrature

created by **Thijs van den Berg**

Expeced payoff in a Black & Scholes world:

$$\int_0^{\infty} P(S_t) f(S_t) dS_t \approx \sum_{i=1}^{N} w_i f(S_i)$$

Lognormal pdf of an underlying:

$$P(S_t) = \frac{1}{S_t \sigma \sqrt{2\pi t}} \exp \frac{-(\ln S_t/S_0 - [\mu - \frac{1}{2}\sigma^2]t)^2}{2\sigma^2 t}$$

The Berg-Koppelaar quadrature is based on the use of an optimally chosen polynomial to approximate the expected payoff -the theoretical value- of a derivative in a Black & Scholes world. It has an error of order 2n, and is exact for function f(x) that are polynomials order order 2n-1.

## Symbol list:

| | |
|---|---|
| $f(x)$ | The function that is integrated |
| $w_i$ | Weights |
| $x_i$ | Point (abscissae) |
| n | Number op points |