A user guide and a brief description of the C-program for generating integrated Brownian motion + drift

1- How to compile the program:

The C-program is currently under the name 'IntbrownGen.c' and can be compiled under both unix and linux with the command:

g++ -o intbrown IntbrownGen.c

To get the output printed in a .txt file, the user may use the command

./intbrown m c k myfile.txt

where m is a parameter that controls the precision of the approximation of Brownian motion on a grid, [-c, c] is the interval on which two-sided Brownian motion and its integrals are considered, k is an integer that should be at least be equal to 2, and it is the same parameter considered in the nonparametric shape constrained (k-monotone) density estimation problem.

2- A brief description of the program:

For chosen parameters m, c and k, the output is of the form of matrix of n= $2^{m+1}c+1$ rows and k columns. The rows correspond to the points of the grid obtained by subdividing the interval [-c, c] to sub-intervals of length 2^{-m} , whereas the j-th column store the value of the j-th fold integral of two-sided Brownian motion + $t^{k+j}/(k+j)!$ for j=0, ..., k-1.
The approximation of Brownian motion and its j-th fold integral is based on the construction of the Haar functions on [0,1] (see Rogers and Williams (1994)) and their integrals, which can be calculated in closed form (see Balabdaoui (2004), appendix). The output can be fed to the iterative (2k-1) spline algorithm (coded in S) to find an approximation to the envelopes (invelopes) of the (k-1)-fold integral of Brownian motion + the corresponding drift when k is odd (even) on [-c, c].
Beside the main function, IntbrownGen.c consists essentially of the following sub-functions:

- Schauder and InSchauder: return the value of the Schauder function and its integral (of any chosen degree).
- IntBrownFunc: returns the j-th integral of Brownian motion on [0,1] (approximated on a grid of mesh size 2^{-m}) , for j=0, ..., k-1.
- IntBrown0C: uses InBrownFunc to extend the j-th integral of approximated Brownian motion on the interval [0,c] (c > 1).
- IntBrownCCdrift: uses IntBrown0C to extend the above approximation to [-c, c], and adds the drift $t^{k+j}/(k+j)!$ for j=0, ..., k-1.