# 18.330 Handout

Mon 08 Mar 04

Except when debugging, almost no one these days consults published tables of $x_i$ and $w_i$ when using **Gaussian quadrature** amidst any sizable computing project. On the contrary, one typically regenerates these abscissas and weights from scratch for each new run, since doing so via recursion formulas and the like that have been well-known (to experts!) for at least a century also happens to be dirt cheap in modern CPU terms.

Like many professors, I still own a homemade Fortran subroutine from years ago that calculates the above $x_i$ and $w_i$ fast and reliably whenever I need them. It does so essentially via Newton's method based on the above recursions, helped also by the Maehly procedure of root suppression so that it does not even need to begin from good guesses as to where those desired roots $x_i$ actually lie.

But I do know when I am beat by clever extra knowledge, in this case by the excellent starting values from the line z = cos(...) below that seem to have been contributed by my old Harvard friend George Rybicki to a similar but now yet terser Fortran code which I lift here for your own inspection and admiration from the 1992 edition of **Numerical Recipes** by Press et al. Of course one should not go xeroxing anything from other people's textbooks, and in that sense I have surely sinned here ... but since I have already been urging y'all to become at least mildly acquainted with **NR**, and perhaps even to acquire it, the following might also serve as a welcome advertisement! AT

Routines 4.5.16 and 4.5.17 from:

Press, William H., Brian P. Flannery, Saul A. Teukolsky, and William T. Vetterling. *Numerical Recipes in C: The Art of Scientific Computing.* 2nd ed. Cambridge University Press, 30 October 1992. ISBN: 0521431085.