Math 128A, Spring 2007

Lab 8 Solution

You'll need to run the associated program to see the tables.

a) Richardson extrapolation obviously worked well here, as the final $|I-T^1| = 5.769 \times 10^{-13}$ is much smaller than the final $|I - T^0| = 4.069 \times 10^{-5}$.

b) It is not clear that extrapolation worked for this problem. Trapezoid rule converged too quickly for us too really see anything.

c) The integrand is very nearly zero everywhere on $[0, 500]$ except for a short interval just past 0, hence the integrand is nearly zero at all nodes of integration until m is sufficiently large. This is why the first 5 values of T^0 are 0. The stopping criterion $|T^3_m - T^3_{m-1}| < 10^{-12}$ worked against us here, because the first 2 values of T^3_m are identical even though we haven't converged.

d) All of the T^ks in this problem converge nicely, but the ratios indicate that they are converging at the same rate. Thus Richardson extrapolation isn't helping. The likely explanation is that since the integrand is not analytic (it has cusps at the endpoints), the error $I - T^0$ doesn't have the form that Richardson extrapolator expects.

e) We have a problem here similar to the one we had in part (c): the integrand is 0 at all nodes until $m \geq 9$. Whence the stopping criterion causes a problem again.

f) As in part (d), we see convergence but no benefit in extrapolation.

g) Once we move away from the cusp in part (f) by shortening the interval, Richardson extrapolation starts to work.