

Homework 2 – Math 206C, Spring 2003

Due on Friday, May 2nd, 2003

The following exercises are from Strikwerda's book:

Section 3.1: 1, 2, 4.

Section 3.2: 4.

Section 4.1: 1, 2.

Additional problem: Consider the following PDE:

$$u_t + \sin(x)u_x = f(x, t), \quad x \in [0, 2\pi], \quad t \in [0, 1] \quad (1)$$

with initial condition

$$u(x, 0) = \cos(x) \quad (2)$$

and periodic boundary conditions. Choose f appropriately so that the solution to the problem is $u(x, t) = \cos(t) \cos(x)$. Implement the 4th order Runge-Kutta method to solve the equation with central differences for u_x , and check the accuracy of the method. For the spatial accuracy, use different grid sizes, and compute the errors at $t = 1$.

For the time accuracy, fix a spatial resolution, and then solve the equation numerically using a small time step, and store the solution at $t = 1$. Then recompute the solution, with the same spatial resolution, but with larger time steps, and compare those results to the one computed with a small time step.

You need to show that you obtain the expected accuracy. You should always check that your programs are producing the right results, and these are standard techniques for that.