

1 Exercise 1. Advection Equation

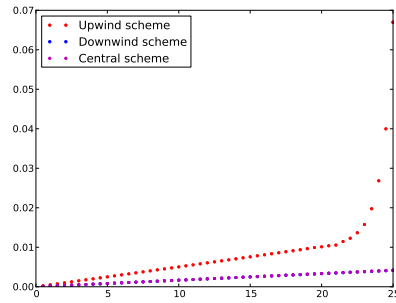


Figure 1: Plot of evolution of relative error through time.

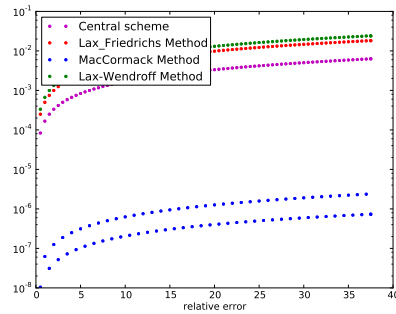


Figure 2: Plot of evolution of relative error through time.

Figure 1 and 2 and 3 shows evolution of relative error through time. Based on Figure 1 it would be obvious that downwind scheme is not a good method for solving this equation and it is unstable. So it is not a good idea to use this method for Advection problem.

Also in the next figures I tried to compare several methods such as: central scheme, upwind scheme, Lax-Friedrichs method, MacCormack method, and Lax-Wendroff method. These figures show that MacCormack method is far better than the others and after that Central Scheme is the

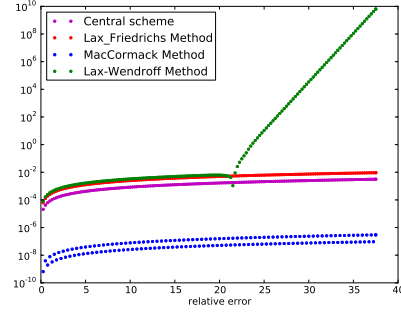


Figure 3: Plot of evolution of relative error through time.

best one. We can check that Lax-Wendroff method is unstable. And by comparing differeng grid size we can demonstrate that upwind scheme and downwind scheme are firs orther and the other methods are second order.

Figure 2 shows the evolution of relative error for $x = 0.1$ and $t = 0.5$ and figure 3 shows the evolution of relative error for $x = 0.05$ and $t = 0.25$.