

18.336, Homework # 5, Due 4/27/2005

1. Use the Peaceman–Rachford ADI method to solve

$$u_t = u_{xx} + 2u_{yy}$$

on the unit square for $0 \leq t \leq 1$. Take initial and boundary conditions from the exact solution

$$u = e^{0.75t} \sin(2x - y) \cosh \frac{3}{2}(x + y).$$

Use $\Delta x = \Delta y = \Delta t = \frac{1}{10}, \frac{1}{20}, \frac{1}{40}$. Demonstrate the second order accuracy.

2. Solve the same problem as in 1., but by the Mitchell–Fairweather ADI method. Use $\Delta x = \Delta y = \frac{1}{10}$ and $\Delta t = \frac{1}{30}$. Compare this case with the use of the Peaceman–Rachford method with $\Delta x = \Delta y = \Delta t = \frac{1}{20}$.