

Homework #10

1. Consider $u_{xx} + u_{yy} = e^{x+y}$ with $x, y \in [0, 1] \times [0, 1]$ and zero Dirichlet boundary conditions and initial condition $u(x, y, 0) = \sin x \sin y$. Use central differencing

$$\frac{U_{j+1,k} - 2U_{j,k} + U_{j-1,k}}{\Delta x^2} + \frac{U_{j,k+1} - 2U_{j,k} + U_{j,k-1}}{\Delta y^2} = e^{x_j+y_k}$$

with $\Delta x = \Delta y = 0.1$ in Matlab to plot the solution. Use “mesh” to plot.

2. Consider $u_{xx} = 1$ for $x \in [0, 1]$ and $u(0) = u(1) = 0$. Choose an irregular grid with 100 points in $[0, 1]$ using the “rand” command.
 - (a) Plot your approximation using the finite element method.
 - (b) Using the fact that $x(x - 1)/2$ is the exact solution, find the infinity norm error of your approximation.