King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
Math 572 , Term: 081
Instructor: Dr. Faisal Fairag
Assignment (2)
Due Tuesday 28/10/2008

Consider the problem :

$$\begin{aligned} -\Delta u + 2u &= f \ \text{ in } \ \Omega = (0,1)\times(0,1) \\ u &= 0 \quad \text{on} \quad \Gamma \end{aligned} \qquad (*)$$

Where $f(x,y) = 10$.

(a) Derive an appropriate bilinear functional $a(u,v)$ and the weak form.

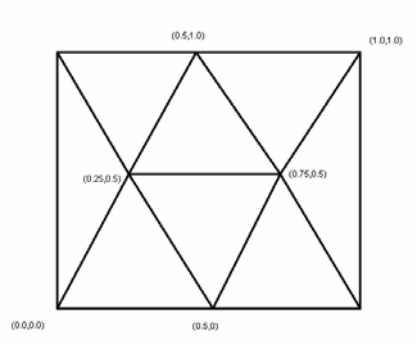
(b) Use the Galerkin's method with

$$S_0 = span\{\phi_1, \phi_2, \phi_3\}$$

$$where \qquad \phi_i(x,y) = \cos(\frac{(2i+1)\pi}{2}x)\cos(\frac{(2i+1)\pi}{2}y)$$

To solve (*) and then approximate $u(\frac{1}{4},\frac{1}{2})$ and $u(\frac{3}{4},\frac{1}{2})$

(c) Compute the stiffness matrix A and the vector b for the problem (*) using the continuous piecewise linear triangular element with the mesh G (see figure) Then solve the linear system.



(d) Use pdetoolbox in Matlab to solve the problem (*) and use the results to approximate $u(\frac{1}{4},\frac{1}{2})$ .and $u(\frac{3}{4},\frac{1}{2})$
