In The Name of Allah
Finite Element
HW # 6
Due 1398.10.07

1. For the triangular elements shown in Figure 1, determine the element coefficient matrices.

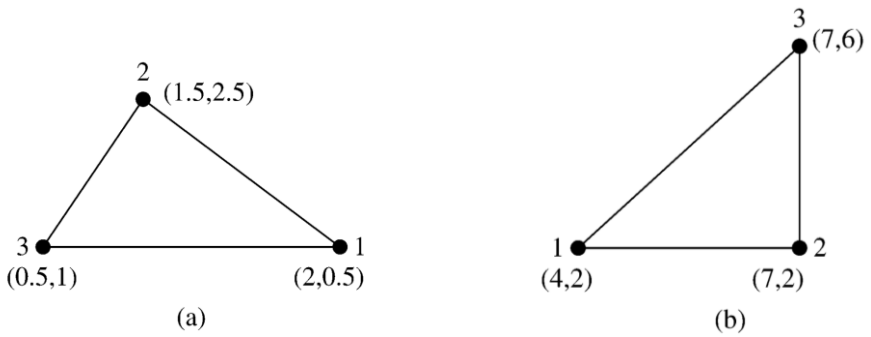


Figure 1

2. Consider the mesh shown in Figure 2. In the shaded region $V = 0$ and has no finite elements. Calculate the global elements $C_{3,10}$ and $C_{3,3}$.

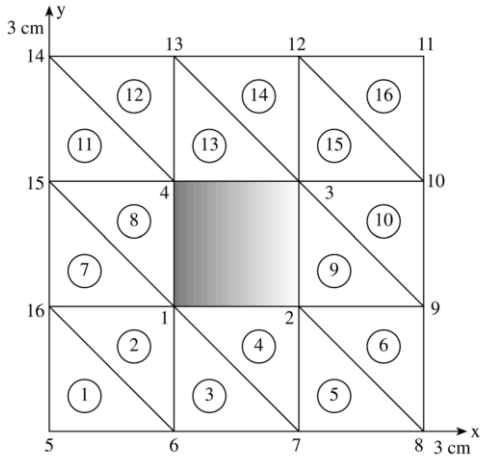


Figure 2

3. Using the area coordinates (ξ_1, ξ_2, ξ_3) for the triangular element in Figure 3, evaluate:

(a) $\int_S x\, dS$

(b) $\int_S y\, dS$

(c) $\int_S xy\, dS$

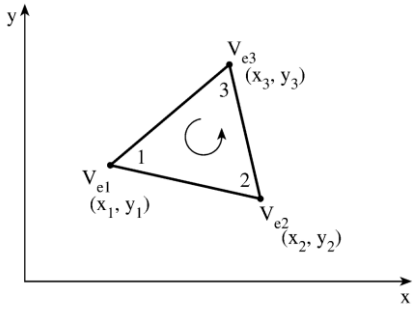
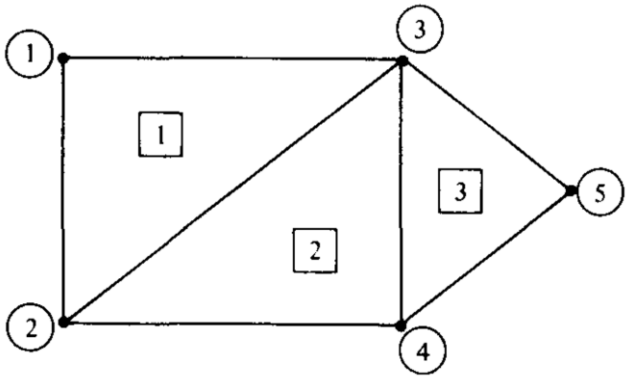


Figure 3

4. By hand calculation, obtain $Q^{(2)}$ and $Q^{(3)}$ for $n = 1$ and $n = 2$.
5. Consider the problem $\Phi'' + x\Phi' + \Phi = 2x, \quad 0 < x < 1$, subject to $\Phi(0) = 1$, $\Phi(1) = 0$. Find the approximate solution using Galerkin method. Use $u_k = x^k(1 - x),\ k = 0, 1, \ldots, N$. Try $N = 3$.
6. Give the expression for the assemblage stiffness matrix for the discretized two-dimensional region in Figure 4.



Element number	Nodes i	j	k
1	2	3	1
2	3	2	4
3	3	4	5

Figure 4