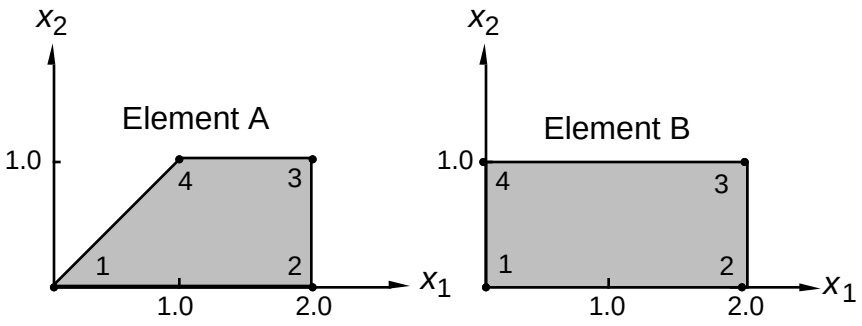
CE 222— FINITE ELEMENT METHODS

PROBLEM SET #6

Problem 1

To examine the effect of distortion in the previous problem, consider the following elements generated from an isoparametric transformation:



For each element:

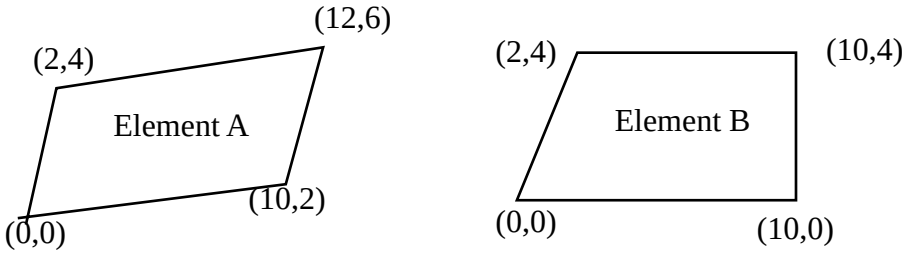
(a) On a figure of the element show the line with ξ=0.

(b) Plot the shape function for Node 3 on the line with ξ=0.

(c) For a unit displacement in the x_1 direction at Node 3, determine the strain ε_{11} along the line with ξ=0.

Problem 2

Two quadrilateral elements are shown in the figure below with the x_1, x_2 coordinates in parentheses. For each element compute the nodal forces in equilibrium with the following stress distribution in the element $\sigma^T = \begin{bmatrix} 1 & -1 & 0 \end{bmatrix}$, using the isoparametric formulation. Evaluate the element integrals numerically with the lowest order Gauss rule necessary for an exact answer.



Problem 3

Determine the plane stress distribution in a plate, with a hole under (i) uniform tension, (ii) pure bending, by a finite element analysis using 4–node elements in FEAP.

a) Define two lines of symmetry so it is only necessary to analyze one–quarter of the plate. Discretize the domain with a approximately 30 4-node elements.

b) Plot σ_{11} along line A–A, and plot σ_{22} along line B–B.

c) How well does the mesh capture the stress field? Reanalyze with approximately 60 elements and comment on the differences with the first mesh.