HOMEWORK 3

Please include this sheet as the cover of your homework assignment.

Due Tuesday, March 3rd

Name: _____

Department: _____

Problem 1. (Part of project)

(a) As discussed in class, write a MATLAB function of the form

```
[ke,fe] = element1D(psi)
```

that takes as input the set of shape functions `psi` (as computed in homework 2) and returns the structure `ke` with components

$$\texttt{ke(i,j).k} \;=\; \int_{-1}^{1} \psi_i' \; \psi_j' \; d\xi,$$

$$\texttt{ke(i,j).b} \;=\; \int_{-1}^{1} \psi_i \; \psi_j \; d\xi$$

and the vector `fe` with components

$$\texttt{fe(i)} \;=\; \int_{-1}^{1} \psi_i \; d\xi.$$

Use Gaussian quadrature to compute the integrals exactly (note: make use of the function `gauss_points_and_weights` posted on the course website).

(b) Given `ke` and `fe` and the relevant mesh and input data, write a second function to assemble the global stiffness matrix $\mathbf{K}$ and global load vector $\mathbf{F}$.

(c) Finally, write a third function to modify $\mathbf{K}$ and $\mathbf{F}$ for a given set of boundary conditions (you do not have to consider the pure Neumann case, i.e., $u'(0) = a$ and $u'(l) = b$).

(d) Use all the functions written to date and the MATLAB scripts `read_1D_input.m` and `read_1D_mesh.m` to solve test problems 1 and 2 posted on the course website (note: these problems are using linear, i.e., $p = 1$, elements). Print out and turn in the final $\mathbf{K}$ and $\mathbf{F}$ for both problems. Please also turn in your source code(s) with comments.