CIVL.666, MANE.666
FUNDAMENTALS OF FINITE ELEMENTS

HOMEWORK 1
Due: September 17, 2019

1. Does the given function for a(v, u) satisfy the Symmetry and bilinearity conditions. Note that κ and λ are given functions.

   Definitions

   $$a(v, u) = \int_{-1}^{1} (v_{,x} \kappa u_{,x} + v \lambda u) dx$$

   symmetry

   $$a(u, v) = a(v, u)$$

   bilinearity (c_1 and c_2 are constants)

   $$a(c_1 u + c_2 v, w) = c_1 a(u, w) + c_2 a(v, w)$$

2. (to be graded) For the following functions indicate if it is positive-definite, positive-semidefinite or neither (α is a scalar). Be sure to explain your answer.

   $$\int_{-1}^{1} (u_{,x}^2 + u_{,xx}^2) dx$$

   $$\left(\int_{-1}^{1} (u^2 + u_{,xx}^2) dx \right)^3$$

   $$\int_{0}^{1} \alpha u^2 dx$$

   $$\left(\int_{0}^{1} \alpha u^2 dx \right)^2$$

3. In on the order of 1/2 page, indicate the why you are interested in finite elements methods (including the application you would apply them to) and what you hope to get out of this course.