Assignment 2

TMA 682, Applied Mathematics

A Finite Element Solver.

1. Write a computer code which solves the *Diffusion-Reaction Equation*

$$-u''(x) + u(x) = 1, \quad 0 < x < \pi,$$
$$u(0) = 0, \quad u'(\pi) = 0.$$

2. Extend the code to also solve the *Diffusion-Convection Equation*

$$-\epsilon u''(x) + u'(x) = 1, \quad 0 < x < \pi,$$
$$u(0) = u(\pi) = 0,$$

   where ϵ is a constant small parameter of your own choice.

Write a short, yet detailed, report not exceeding ten pages explaining your work. Be sure to include a commented version of the computer code and a thorough derivation of the underlying *Finite Element Method*. Give some convincing evidence that your code works, e.g., by comparing the obtained numerical results with analytical ones, if possible. Obtain representative graphs of the computed solutions.