Exercise 2

1. Consider the problem

$$-((1+x)u')' = 0, \quad x \in I = [0,1], \quad u(0) = 0, \ u'(1) = 1$$

   Divide the interval I in n subintervals of equal length and let V_h be the corresponding space of continuous piecewise linear functions vanishing at $x = 0$.

   - What is the weak form of the above equation?
   - Write a MATLAB code that assembles the stiffness matrix A and the load vector $\mathbf{b}$.

   Hint: Check with the MATLAB function `StiffnessAssembler1D` in the book by Larson & Bengzon.

2. **Generation of an own geometry and mesh.** Generate two different domains **(i)** a square and **(ii)** a Swiss cross.

   (a) Generate a geometry array `g`, analogous to the one on p. II-8 of the slides or in `Rectg.m` of the book by Larsen & Bengzon.

   (b) Initialize the mesh using `initmesh` with the parameter `hmax = 0.5`. This will generate a coarse mesh.

   (c) Refine the mesh.

   (d) "Jiggle" the nodes of the mesh to improve the mesh quality.

   (e) Plot the 3 meshes.

General MATLAB hints

- Use `doc` and `help` to get more information about a command

- Use `edit` or `type` to see the code of an M-file

- Use `pause` to interrupt the program execution.

- Use debugging functions to debug your program. set breakpoints by using `dbstop`. Type `doc debug` to get details of all debugging functions.

- Type `doc pdetool` to get informations on the MATLAB's PDE toolbox.

Please submit your solution via e-mail to Peter Arbenz (`arbenz@inf.ethz.ch`) by Thursday October 5, 2017. (12:00). Please specify the tag **FEM17** in the subject field.