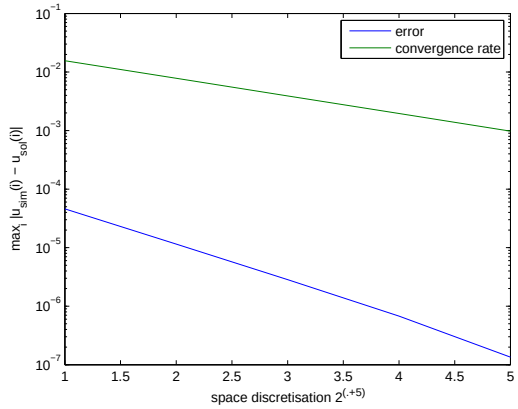
Summer Term 2016

Antonia Mayerhofer

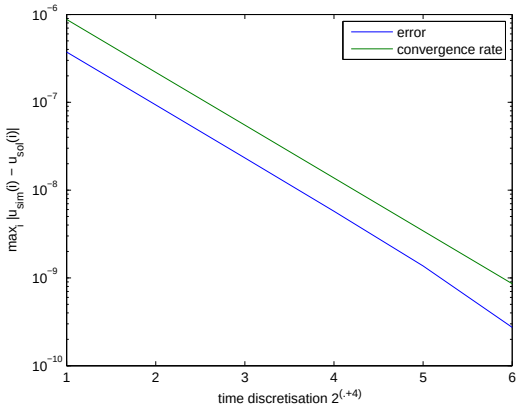
Computational Finance - Excercise Sheet 11

Exercise 1 Show that the Laplace operator is an elliptic operator in $H_0^1(\Omega)$.

Exercise 2 Consider the following results of the Crank Nicolson finite difference scheme for the 2D heat equation.



(a) Time discretisation given by $M = 2^{10}$.



(b) Space discretisation given by $N = 2^{11}$

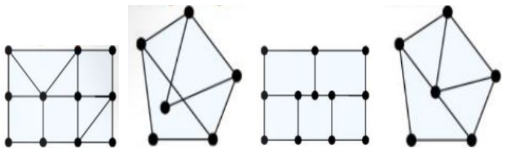
(i) What do you observe in both figures? Why is it necessary to plot both figures?

(ii) What kind of convergence rates do you expect from the theory? What do you observe?

(iii) What do you have to change in figure (a) to get a correct figure with correct description?

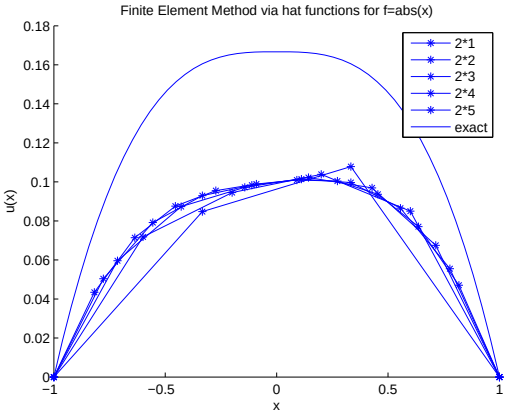
(iv) Which other method can be used to solve the equation? Give a reason for using Finite Differences anyway.

Exercise 3 Are those admissible triangulations for the FEM?



(c) (d) (e) (f)

Exercise 4 We are interested in solving the poisson problem with given right-hand side f with the finite element method in 1D. The result of the current code version is shown in the figure.



(i) Write down the original problem formulation using the given information.

(ii) What is shown in the figure?

(iii) What happens? Where would you start debugging the implemented finite element method?