Introduction to Numerical Methods
Tutorial 13

Exercise 1:

Let

$$A = \begin{pmatrix} 12 & 2 & -13 \\ -9 & 1 & 9 \\ 2 & 2 & -3 \end{pmatrix} \in \mathbb{R}^{3\times3}$$

be given.

(i) Compute manually the eigenvalues of A.

(ii) Compute manually the corresponding eigenvectors to the eigenvalues of A.

(iii) Give the algebraic and geometric multiplicity of each eigenvalue of A.

(*)-Exercise 2: $(4 + 2 + 5 + 2 + 1 + 2 = 16$ points$)$

Let

$$A = \begin{pmatrix} 1 & -\frac{1}{2} & -\frac{1}{2} & 0 \\ -\frac{1}{2} & \frac{3}{2} & i & 0 \\ 0 & -\frac{i}{2} & 5 & \frac{i}{2} \\ -1 & 0 & 0 & 5i \end{pmatrix} \in \mathbb{C}^{4\times4}$$

be given.

(i) Determine the Gerschgorin circles K_i for A and $\tilde{K}_i$ for A^T.

(ii) Plot the circles in one diagram. Mark which circle belongs to which matrix.

(iii) Use the 2. and 3. theorem of Gerschgorin to determine an approximate solution of the eigenvalues, i.e., Theorem 6.2 and 6.3 from the lecture.

(iv) Include the statement of the 2. theorem of Gerschgorin into your diagram.

(v) Compute the eigenvalues of A using matlab.

(vi) Display the eigenvalues you obtained from matlab in your diagram. Is this in accordance with the theorems?

Delivery: 27. January 2011

Explanatory notes regarding the written exam

- The written exam will take place on the **14. february 2011** in room **T03 R02 D39** in the time of **10:00 - 12:00 o'clock**.

- Don't forget to sign up at the examination office in time.

- Send an e-Mail to stefanie.vanis@uni-due.de until the 4th february (**4.02.2011**) if you take part in the exam. The subject should be "written exam" and it should include your name and your student id-number.

- You are allowed to bring your pocket calculator.

- You are allowed to bring one sheet of paper Din A4 with notes on front and back.

- You will get paper. You are not allowed to use your own paper.

- Don't forget to bring your student id-card.

- Mobile phones are not allowed on the desks during the exam. There will be a wall clock organized for you to know the time.

- You will not pass the course if the programming exercises are not submitted.