

MA2501 Numerical Methods

Assignement 9

Tutorials: 6/4

Exercise 1

Let A be a real $n \times n$ matrix. Prove the following:

- Jacobi iterations will converge if the matrix A is diagonal dominant.
Suggestion: Use the max-norm.
- A is symmetric positive definite (SPD) *if and only if* A is symmetric and all the eigenvalues are positive.
Suggestion: A symmetric matrix has only real eigenvalues and is orthogonal diagonalizable.
- If A is SPD then all the diagonal elements of A are positive.

Oppgave 2

Given the matrix

$$A = \begin{bmatrix} -6.00 & 3.00 & 3.50 \\ -5.00 & 3.50 & 2.75 \\ -10.00 & 3.00 & 7.50 \end{bmatrix}$$

- Use MATLABs routine `eig` to find the eigenvalues and the eigenvectors of A .
- The following script can be used to find the largest eigenvalue (in absolute value) together with its eigenvector.

```
format long
A = [-6,3,3.5;-5,3.5,2.75;-10,3,7.5]
x = [1,1,0]'
for i=1:30
    i
    y = A*x
    lambda = y(1)/x(1)
    x = y/norm(y)
    pause(0.2)
end
```

Make modifications of the script so that you can find the other two eigenvalues as well.

- Use the starting value `x=[1,1,1]'` in the original script rather than `[1,1,0]`. What do you observe, and can you explain why this happens. Increase the number of iterations to 100. What will then happen, and why?