Homework #8 (NQe311, Spring, 2020)

KAIST

(Due June 4)

1. .Let's consider 1-D heat conduction equation below

$$\frac{\partial u(x,t)}{\partial t} = \frac{\partial^2 u(x,t)}{\partial x^2} + f(x,t),$$
$$u(0,t) = u(1,t) = 0,$$
$$u(x,0) = \sin \pi x$$

Assuming that the problem is solved by an implicit time differencing with a constant time step (Δt), show that the numerical scheme is unconditionally stable using the Fourier stability analysis. You can assume that a central difference with a uniform node size (Δx) is applied to the spatial differentiation.

2. For the following matrix A

$$A = \begin{pmatrix} 2 & 3 & 4 \\ 7 & -1 & 3 \\ 1 & -1 & 5 \end{pmatrix},$$

i) Find the largest eigenvalue and corresponding eigenvector by the power method.

ii) Find the smallest eigenvalue and corresponding eigenvector by the inverse power method.

iii) Find the intermediate eigenvalue and corresponding eigenvector by the shifted inverse power method.

You have to develop your program for the tasks.