(1) Use **Matrix stability method** to analyze the stability of the Crank-Nicolson scheme (equation (9.25) page 142). [Under what condition this scheme is stable]

(2) Consider the following scheme

$$\frac{U_j^{n+1} - U_j^{n-1}}{2k} = \frac{U_{j+1}^n - 2U_j^n + U_{j-1}^n}{h^2}$$

which approximate the parabolic equation $u_t = u_{xx}$
Use Von Neumann Stability method (**Fourier method)** to analyze the stability of this scheme

(3) Problem 10.7 page 161 (Prove Theorem 10.6)

(4) Problem 10.2 part (b) page 159 (FEM)