1. Perform a complete error analysis (similar to Theorem 4.3) for the scheme (4.35) to approximate (4.8) with \( \epsilon = 1 \), \( p(x) = 0 \) and \( q(x) = 1 \).

2. Design a full diagonalization algorithm for solving the following separable equation

\[
(\alpha(x) + \beta(y))u - (a(x)u_x)_x - (b(y)u_y)_y = f \quad \text{in } \Omega = (-1,1)^2;
\]

\[
a_{\pm}u(x, \pm1) + b_{\pm}u_y(x, \pm1) = 0, \quad \forall x \in (-1,1);
\]

\[
c_{\pm}u(\pm1, y) + d_{\pm}u_x(\pm1, y) = 0, \quad \forall y \in (-1,1).
\]

3. Implement a full diagonalization algorithm for the Legendre-Galerkin approximation to

\[
\alpha u - \Delta u = f \quad \text{in } \Omega = (-1,1)^2; \quad u|_{\partial \Omega} = 0.
\]

Test it with the exact solution \( u(x, y) = \sin(4\pi x) \sin(4\pi y) \).