



KTH Computer Science  
and Communication

## Numerical Methods for Partial Differential Equations, 7.5 ECTS

### Homework 4

Consider the Lax–Wendroff approximation of  $u_t = u_x$  for the quarter plane problem

$$u_j^{n+1} = u_j^n + kD_0u_j^n + \frac{k^2}{2}D_+D_-u_j^n, \quad j = 1, 2, \dots$$

$$u_j^0 = f_j, \quad \|u^n\|_h < \infty.$$

Do normal mode analysis and check the Kreiss condition for the following boundary conditions

1.

$$u_2^n - 2u_1^n + u_0^n = 0,$$

2.

$$u_0^{n+1} - u_0^n = \lambda(u_1^n - u_0^n),$$

3.

$$u_0^{n+1} - u_0^n = -\lambda(u_1^n - u_0^n).$$

Verify your results numerically and try to give an intuitive explanation why one of the boundary conditions is unstable.

These exercises are due Dec 8.