Assignment 1 - OpenMP

- **Use OpenMP to parallelize the deqn code**
  - **The overall objective is to achieve good speedup by inserting OpenMP directives in the deqn code**
  - **You also need to**
  - **benchmark the runtime of each relevant loop and the runtime of the whole parallel program against the number of threads**
  - **Analyze the overhead of OpenMP**

Assignment 1 - OpenMP

- **Write a report**
  - **Explain in detail what you did with the sequential code**
  - **benchmark the runtime of each relevant loop and the runtime of the whole parallel program against the number of threads; present the runtimes in graph or table; analyze the results**
  - **Discuss the iteration scheduling in your program**
  - **Analyze the overhead of OpenMP**
  - **Presentation skills, spelling, punctuation and grammar**
  - **Up to four A4 pages**

Submission

- Put all the codes and the report (pdf file) in a package and submit the package through Tabula

- Deadline: 12 noon, Feb 5th, Monday, 2019

deqn

- Model the transfer of heat through a material
- Expressed as a partial differential equation

$$\frac{\partial u}{\partial t} - \alpha(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}) = 0$$

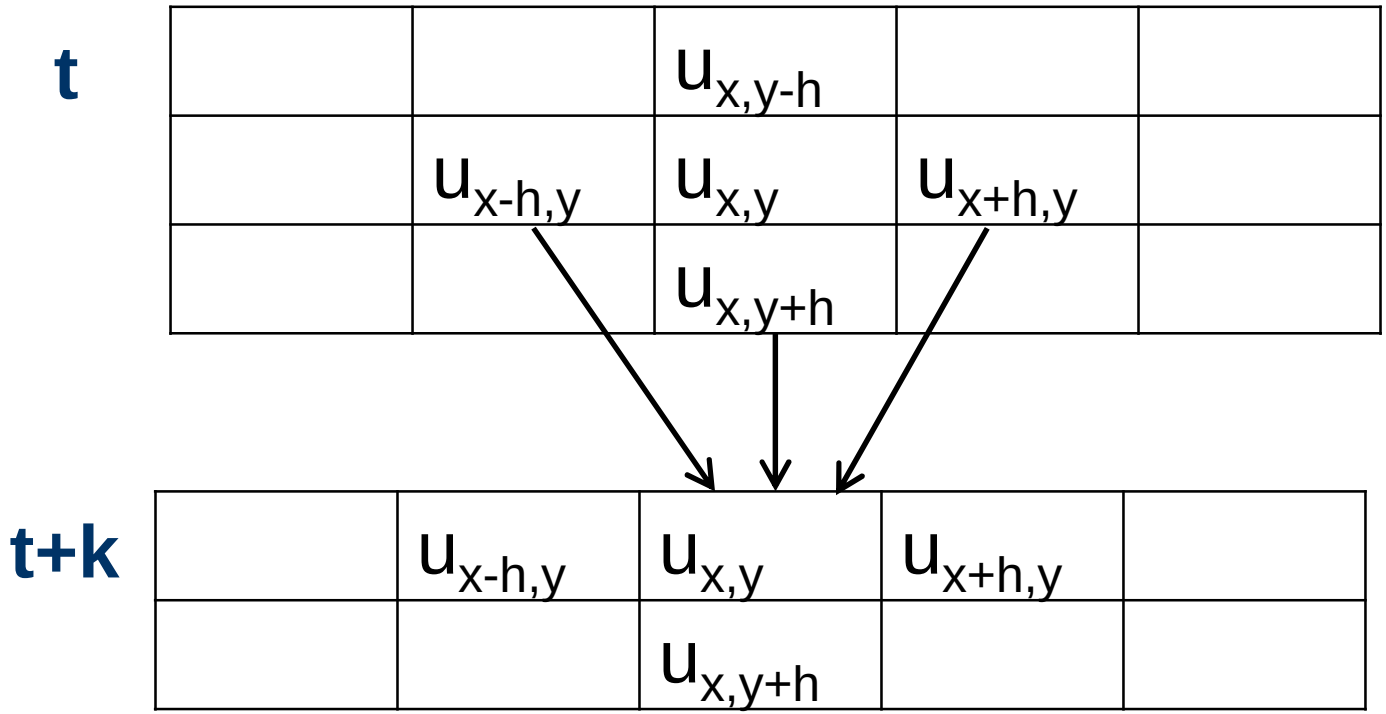
- Discretise the equation over time and space using finite difference method

$$u_{x,y}^{t+k} = ru_{x+h_x,y}^{t} + ru_{x-h_x,y}^{t} + r'u_{x,y+h_y}^{t} + r'u_{x,y-h_y}^{t} + (1 - 2r - 2r')u_{x,y}^{t}$$

- Given the initial temperature of the material, we can calculate the temperature of the material at any time point and space location

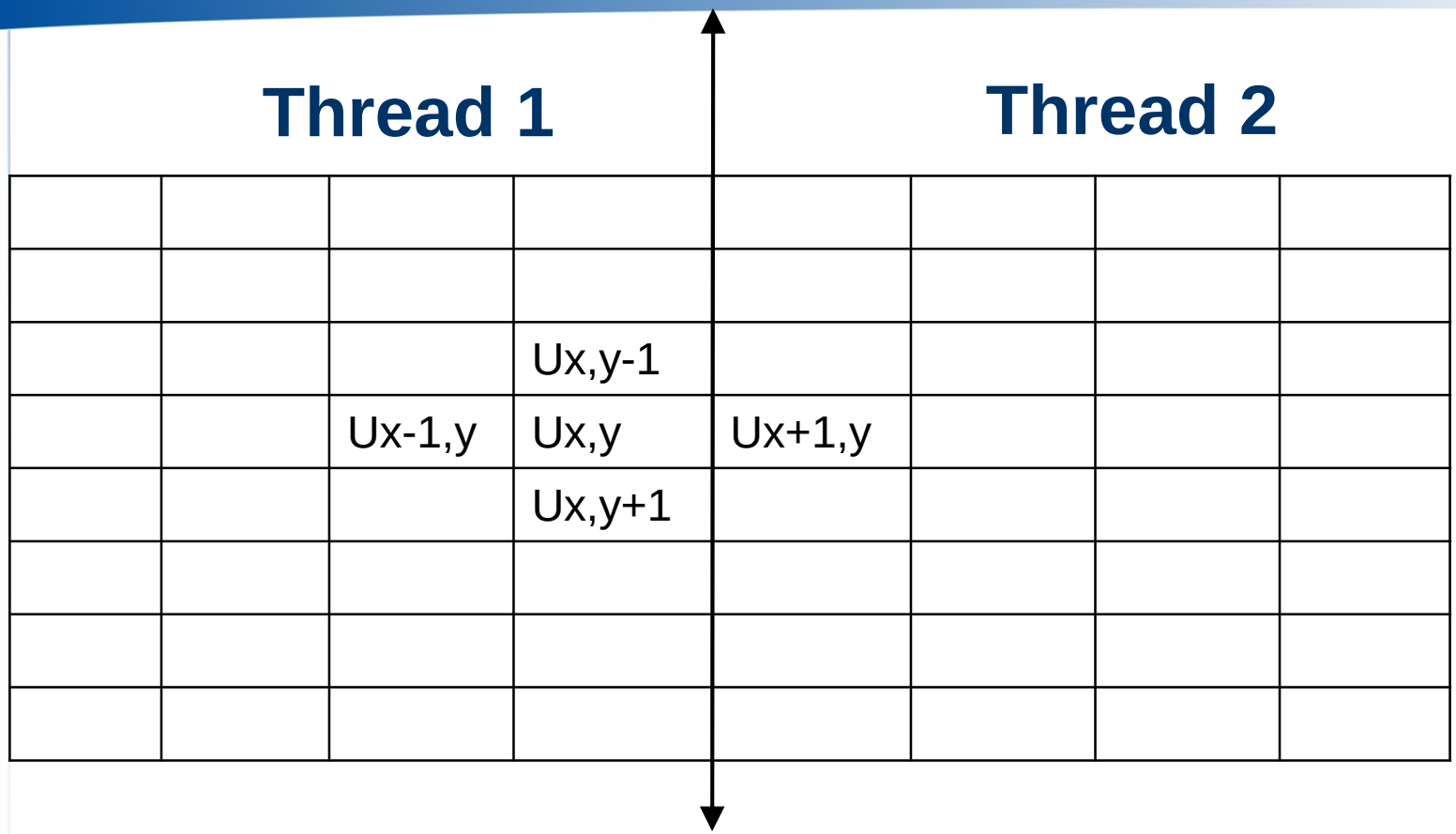
Data Dependency

$$u_{x,y}^{t+k} = ru_{x+h_x,y}^{t} + ru_{x-h_x,y}^{t} + r'u_{x,y+h_y}^{t} + r'u_{x,y-h_y}^{t} + (1-2r-2r')u_{x,y}^{t}$$



Question: How to parallelize the computation?

Parallelism



- **Each thread calculates the temperature at any time and at its local space in parallel**
- **Thread communication**