

Introduction to Languages for Scientific Computing

Prof. **Paolo Bientinesi**

`pauldj@aices.rwth-aachen.de`



High Performance and
Automatic Computing

RWTHAACHEN
UNIVERSITY



Parallel assignment (1/2)

Inputs: - A collection of k sorted arrays;
- an integer p , representing the number of target processors.

Goal: For each entry of the arrays, indicate to which processor is assigned. The assignment rules are explained in the next slide.

Notes: The arrays might be of different length; the indexing for processors starts from 0.

Parallel assignment (2/2)

The entries are distributed among processors in the following way.

Input: $\{2, 4, 5\}$, $\{1, 4, 6, 6, 7\}$, $\{1, 2, 3\}$, $\{2, 3\}$

Step 1: The arrays are merged together and sorted.

$v = \{1, 1, 2, 2, 2, 3, 3, 4, 4, 5, 6, 6, 7\}$

Step 2: The array v is divided in p pieces.

Rule*: The difference between the size of any two pieces is at most 1.

If $p = 3$: $\underbrace{\{1, 1, 2, 2, 2\}}_{p_0} \mid \underbrace{\{3, 3, 4, 4\}}_{p_1} \mid \underbrace{\{5, 6, 6, 7\}}_{p_2}$

If $p = 5$: $\underbrace{\{1, 1, 2\}}_{p_0} \mid \underbrace{\{2, 2, 3\}}_{p_1} \mid \underbrace{\{3, 4, 4\}}_{p_2} \mid \underbrace{\{5, 6\}}_{p_3} \mid \underbrace{\{6, 7\}}_{p_4}$

Output:

If $p = 3$: $\{0, 1, 2\}$, $\{0, 1, 2, 2, 2\}$, $\{0, 0, 1\}$, $\{0, 1\}$

If $p = 5$: $\{0, 2, 3\}$, $\{0, 2, 3, 4, 4\}$, $\{0, 1, 1\}$, $\{1, 2\}$

Note: Because of Rule*, the following is not a valid division for $p = 5$.

$\underbrace{\{1, 1, 2\}}_{p_0} \mid \underbrace{\{2, 2, 3\}}_{p_1} \mid \underbrace{\{3, 4, 4\}}_{p_2} \mid \underbrace{\{5, 6, 6\}}_{p_3} \mid \underbrace{\{7\}}_{p_4}$

Challenge #6

Define the function

```
assignment [yourLastName] [arrays_, p_]
```

that solves the parallel assignment procedure described above.

- **No**: While, For, Do, Table.
- **Yes**: Map, MapIndexed, MapThread, Flatten, /., //., ...
- **Objective**: correct, clean (as much as possible) code.

Submission

- Individual or pair submissions.
If winner == pair, reward = .5 per person.
- Include your name(s) in the email and in the notebook.
- Prepare a Mathematica notebook named `<yourLastName.nb>`, containing the definitions for `assignment`, and for the auxiliary functions (if any).
- Submission by email to `pauldj@aices.rwth-aachen.de`
- Email's subject: `"LSC-17 Challenge6 <your last name>"`
- **Deadline: Monday, July 24, midnight.**