# Implementation of Fast Radix-Sort in Futhark
# (or whatever other GPU-efficient Sorting Algorithm)

Your task for this project is to implement as fast sorting algorithm in Futhark aimed at GPU execution.

You are welcome to try whatever algorithm you wish, but the idea is to get as close as possible to the performance of the radix-sort-like implementation supported by the CUB library.

At PMPH, the group formed by your fellow colleagues Marc Raffy and Marko Milić managed to submit a radix-sort based implementation that is competitive with the one of CUB (even a bit faster).

We received their permission to share their code and report with you. A quick glance at the code suggest that this can be mapped into Futhark, where care should be taken for incremental flattening to produce an intra-group code version (that executes in CUDA shared memory).

Marc and Marko's report also contain the link to the paper that lays the foundation to their implementation. Of course, beside building the Futhark implementation, you are supposed to read and fully understand the algorithm, and give credit to both the underlying paper but also to Marc and Mark's report, by properly citing them.

Key things that your report should contain are:

1. A section that presents at high level the algorithm you chose to implement.

2. A section that presents how that high-level algorithm is translated to a Futhark implementation. Please do not forget to reason about the work-depth complexity.

3. An experimental evaluation that compares your Futhark implementation with that of CUB, but also with the Futhark implementation of the classical radix-sort algorithm, which is available in the Futhark package [github.com/diku-dk/sorts](github.com/diku-dk/sorts).

4. We suggest you start by sorting unsigned integers (or floats), and after you make it work, if time permits, you may generalized your implementation to work with whatever datatype (for the array element). You may take inspiration of how this is achieved from the Futhark library.

5. If time permits, a literature survey of various sorting algorithms that were found useful in the context of GPU execution.

You may get the Futhark package by the following simple command:

```
$ futhark pkg add github.com/diku-dk/sorts
```
followed by
```
$ futhark pkg sync
```