Assignment 1

Opgave

Assignment I:

TASK 1:

Prove by applying the List Homomorphism Promotion Theorem(s)
the following invariant, (see also lecture notes L1-Trends-and-LH for Hint).

```
(reduce myop e) . (map f)

            ==

(reduce myop e) . (map ( (reduce myop e) . (map
f) ) ) . distr_p
```

distr_p distributes the original list into a list of p sublists,
each sublist having about the same number of elements.
Hint: you may start by composing the first term with
identity == (reduce (++) []) . distr_p
i.e., `(reduce myop e) . (map f) . (reduce (++) []) . distr_p == ...`

TASK 2:

Implement the Longest Satisfying Segment Problem in file `LongestSatSegm.hs`, which can be found in archive pmph-haskell-lh-flattening.tar.gz attached in Absalon under TeachingMaterial/AdditionalMaterial/ListHom-Flattening/HaskellCode.
See lecture notes L2-LH-Flattening for more details and hints.
You need to write about 4 lines of code after doing some thinking.

Oplysninger

Udgivet: 3. september 2015 af Oancea, Cosmin Eugen

Deadline: 13. september 2015 23:59

Obligatorisk: Ja

Bedømmelse: Points 0-10

Anonym: Nej

Brug grupper: Brug ikke grupper

TASK 3 (I think this is by far the most difficult task of the assignment):

Implement in provided file `PrimesQuicksort.hs` the function named `segmSpecialFilter`.
The file can be found in archive pmph-haskell-lh-flattening.tar.gz attached in Absalon under TeachingMaterial/AdditionalMaterial/ListHom-Flattening/HaskellCode.

```
segmSpecialFilter :: (a->Bool) -> [Int] -> [a]
-> ([Int],[a])
```

The function takes three arguments: (i) a predicate, (ii) a flag array indicating the segments of a 2-dim irregular array, and (iii) a flat array of values. The function is supposed to apply parFilter, discussed in lecture notes L2-LH-Flattening for more, to every segment of the array and to return
a.) a new array of flags and
b.) a new data array in which the elements of each (original) segment are permuted accordingly
(inside that segment).

For example:
`segmSpecialFilter odd [3,0,0,2,0] [4,2,3,2,1]`

1. `odd` is the Haskell function that returns true for an odd integer and false for an even integer.
2. `[3,0,0,2,0]` is the flag array. It indicates the 2-dim array has two segments: the first segment has 3 elements and the second one has 2 elements
3. `[4,2,3,2,1]`is the flat data array. Using the flag array we can deduce that the elements of the first segment are `[4,2,3]` and of the second segment are `[2,1]`.

Filtering the first segment `[4,2,3]` should result in two segments: the first of size `1` (one odd element: `3`) and the second of size `2` (two even numbers: `4` and `2`). Hence the resulting flag array should be `[1,2,0]` and the data array should be `[3,4,2]`, i.e., first the odd number than the even numbers in the same order as in the original.

Filtering the second segment `[2,1]` should result in two segments, both of size `1`. Hence the resulting flag array should be `[1,1]` and the data array should be `[1,2]`, i.e., first the odd number than the even number.

Hence the result should be (by concatenating the result of the two segments):
a.) flag array: `[1, 2, 0, 1, 1]`
b.) data array: `[3, 4, 2, 1, 2]`

TASK 4:

CUDA exercise (see lab notes: Lab1-Simple-Cuda-Program)

Write a CUDA program with two functions that both map the function `(x/(x-2.3))^3` to the array `[1,...,753411]`, i.e., of size `753411`. The first function should implement a serial map performed on the CPU; the second function should implement a parallel map in CUDA performed on the GPU. Check that the result on CPU is equal to the result on GPU, and print a VALID or INVALID message. Also print the runtime taken by the sequential and cuda implementation.

Submit a zip-file containing a directory with a the code and a Makefile so its possible to compile by typing "make compile" and to run by typing "make run".Measure the time taken for both functions and write a max 5 line explanation why one is better than the other.
(Play with the size of the array and find out whether there is a sweetpoint, i.e., when the GPU starts being faster than the CPU.)

Svar Deadline 13. september 2015 23:59