AALTO UNIVERSITY
CSE Department
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Exam
T-106.6200

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T-106.6200 Special course / HPEC

The exam contains four questions. The maximum points for each question are listed in the beginning of the questions. Read the questions carefully. Give clear and compact answers. Remember to write the name of the course and your own personal information on each of your answer papers. No extra appliances are allowed in the exam.

1 (6p) Describe compactly the following concepts.

   a) A manycore processor.
   b) Cache coherency.
   c) Occupancy in GPUs.
   d) Heterogeneous System Architecture (HSA).
   e) Amdahl's law.
   f) Workstealing in scheduling.

2 (6p) Below is a sketch of a task farm in Haskell.

```
taskFarm :: (a -> [b]) -> Int -> [a] -> [[b]]
taskFarm f nWorkers tasks = concat results
where results = parmap id (unshuffle nWorkers (map f tasks))

unshuffle :: Int -> [a] -> [[a]]
unshuffle n xs = [ takeEach n (drop i xs) | i <- [0..n-1] ]
where takeEach :: Int -> [a] -> [a]
          takeEach n [] = []
          takeEach n (x:xs) = x : takeEach n (drop (n-1) xs)
```

A workpool is similar to a task farm. However, tasks are allocated dynamically to workers as each task completes.

How would you implement a workpool? Explain how would your workpool operate on a multicore system?

3 (6p) Consider a typical modern PC having a CPU and a GPU. Explain the physical memory system of the computer and review usage of the memory system (both explicitly and implicitly) when OpenCL is used in programming the system.

4 (6p) Write an essay that is not longer than 50 lines on synchronization. Focus on synchronization in OpenCL code for GPUs – when explicit synchronization is needed and how it can be used into improve performance.