LUT University

LUT Computational Engineering 2022-03-16

BM40A0202 Foundations of Computer Science

Olli-Pekka Hämäläinen

Exercise 9 (week 12): Using computer resources

Tasks (1 p/task)

1. Task in Moodle.
2. Alongside the lectures, read the following link https://www.intel.com/content/www/us/en/developer/articles/technical/memory-performance-in-a-nutshell.html and then answer the questions.
   a) What is the main difference between cache and main memory?
   b) Explain what is meant by terms latency and bandwidth when it comes to memory technology.
   c) In one of the previous exercises we investigated the execution times of a GNU Assembly code for different calculation operations. In this exercise, the variables were stored in main memory. How much the execution times would improve if the variables would have been stored in registers? (Give an estimation.)
3. A computer CPU uses main memory (RAM) for its operations. Computers that are used for gaming have separate graphics cards that have a graphics processing unit (GPU) and their own memory.
   a) Compare the specifications of some modern-day GPU memory to some modern-day RAM memory. How do the specifications differ, and what would be the reason for these differences?
   b) Two largest CPU manufacturers in the world (regarding PC's) are AMD and Intel. How have these manufacturers advanced caching technology?
4. On memory management.
   a) What is the difference between dynamically converting memory addresses and dynamic memory allocation?
   b) Two memory management techniques that allow both of these are paging and segmentation. Explain these techniques and compare them to each other.
   c) What is the difference between internal and external fragmentation?
5. Types of data transfer.
   a) How programmed I/O, interrupt-driven I/O and direct memory access (DMA) differ from each other?
   b) Completion of an I/O request can take time, so the system must wait for it. What is the difference between short and long I/O wait?

PO BOX 20, FI-53851 LAPPEENRANTA, FINLAND
E-mail: Olli-Pekka.Hamalainen@lut.fi