Linköping University
Department of Computer Science
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August 14, 2012

Exam

Computer Architecture

TDTS10

August 20, 2012 - 08:00-12:00

Jour: Dimitar Nikolov(0700794983, 281970)

Hjälpmedel/Admitted material:

- Engelsk ordbok
- Dictionary from English to your native language

General instructions:

- Read all assignments carefully and completely before you begin.
- Use a new sheet for each assignment.
- You may answer in either English or Swedish.
- Write clearly. Unreadable text will be ignored.
- Be precise in your statements. Unprecise formulations may lead to a reduction of points.
- Motivate clearly all statements and reasoning.
- Explain calculations and solution procedures.
- The assignments are not ordered according to difficulty.
- The exam is designed for 40 points.
- Grading: U, 3, 4, 5. The preliminary threshold for passing is 22 points.

- For ECTS, LiU make use of: 5=A, 4=B, 3=C, and UK=Fx.

1. Pipelining (10 points)

   - How many cycles would the following sequence of instructions take
     if they are executed in a 6-stage pipeline (assume one cycle per
     stage in the pipeline (FI-fetch instruction, DI-decode instruction,
     CO-calculate operand, FO-fetch operands, EI-execute instruction,
     WO-write operand).

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     Instructions
     ADD R1, (R2)
     ADD R2, R1
     ```

   - Suggest ways to overcome the problems above.

2. Cache (5 points)

   - Locality of reference is an important feature of programs, in the
     context of memory hierarchies. Create an example that explains
     what locality of references means, and explain why locality of
     references is important

   - Assume a main memory of size 64 bytes and a cache memory of size
     16 bytes. The cache memory is organized as direct mapping and
     a cache line is of size 4 bytes. Explain what happens (decoding
     and memory read) when the CPU makes the following memory
     requests: (a) read at address 000000, (b) read at address 100111,
     and (3) read at address 111001.

Cache line	Tag	Byte address			
		00	01	10	11
00	00	A	B	C	D
01	10	E	F	G	H
10	01	I	J	K	L
11	00	M	N	O	P

3. Operating system (10 points)

   - A process may be in different states (such as running); list and explain the states in which a process can be, and explain how, when and why a process moves between states.

   - In the process model, how many processes can be in state running?

   - What is time sharing used for?

   - What is a process control block and what is it used for in general and in particular at a context switch?

4. I/O (5 points)

   - Programmed I/O is one alternative to handle I/O operations. How does programmed I/O work? What alternatives exist (discuss and explain)?

5. Amdahl's law (5 points)

   - State Amdalh's law

   - Describe Amdalh's law

   - Give an example that illustrates Amdalh's law

6. Execution (5 points)

   - Make an example to illustrate the difference between output dependency and antidependency?

   - Which data dependency/dependencies occurs/occur at in-order issue with in-order completion?

   - Give advantages and disadvantages of VLIW