

LINKÖPINGS TEKNISKA HÖGSKOLA  
Institutionen för datavetenskap  
Petru Eles

**Tentamen i kursen**  
**Datorarkitektur - TDDI03**  
**2011-12-12, kl. 8-12**

**Hjälpmedel:**

Engelsk ordbok.

**Supporting material:**

English dictionary.

**Poänggränser:**

Maximal poäng är 40.  
För godkänt krävs sammanlagt  
21 poäng.

**Points:**

Maximum points: 40.  
In order to pass the exam you need a  
total of minimum 21 points.

**Jourhavande lärare:**

Petru Eles, tel. 0703681396

**Good luck !!!**

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Du kan skriva på svenska eller engelska!

1.
  - a) Why do we need special *write strategies* for cache memories?
  - b) We have discussed three write strategies: *write-through*, *write through with buffered write*, and *copy back*. How do they work? Which are their advantages and disadvantages?

(3p)

2. The Pentium 4 has an L1 instruction cache which is particular in several regards. In what consists the particularity and what is the reason behind it?

(3p)

3. Data hazards in pipelines can sometimes be avoided by a technique called *forwarding*. How does this technique work? Give an example in which forwarding produces an acceleration (draw a figure which illustrates the corresponding pipelined execution).

(3p)

4. Dynamic branch prediction with a two-bit scheme. How does it work? Illustrate with the case of a loop like the one below. Compare with one-bit prediction.

```
LOOP -----  
-----  
-----  
BNZ  LOOP  
-----
```

(3p)

5. The design of RISC architectures is based on certain characteristics of typical programs which are frequently used. Enumerate at least five such characteristics of programs.

(2p)

6.
  - a) What is the role of the page table in a virtual memory system?
  - b) The page table is very large, usually too large to be stored in main memory. Such a large size, at the same time, makes access to the page table very slow. How is this solved in current microprocessor architectures.

(2p)

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7.

- a) What is a superscalar architecture?
- b) Draw a block-diagram of a superscalar unit.

(3p)

8.

- a) Which are the types of data dependencies that have to be considered with an out-of-order superscalar? Give an example for each.
- b) Why do we call them “true” and “artificial”, respectively?
- c) What can be solved by *register renaming*? Give an example.

(3p)

9. Compare VLIW architectures with superscalar architectures:

- a) Show similarities and differences.
- b) Show the advantages and disadvantages of the two approaches.
- c) Why is a superscalar consuming more power, compared to a VLIW computer?

(4p)

10.

What is loop unrolling? How does it work? Why is it important with VLIW architectures? Illustrate by an example.

(3p)

11. What is trace scheduling? How does it work (remember the three steps)? Why is it important with VLIW architectures?

(3p)

12.

- a) What is branch predication (like in the Itanium architecture)?
- b) Compare with ordinary branch prediction.

(3p)

13. Formulate Amdahl's law and comment.

(3p)

14. What is hardware multithreading?

Why do multithreaded processors provide higher performance?

(2p)