

**Tentamen i kursen**  
**Datorarkitektur - TDDI 68**  
**2001-04-24, kl. 08-12**

**Hjälpmedel:**

Inga.

**Supporting material:**

No supporting material allowed.

**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.

**Resultat anslås:**

Senast 2001-05-09 på IDAs  
anslagstavla för tentamensresultat.

**Results available:**

Results will be available latest  
2001-05-09 on IDA's board for exams.

**Jourhavande lärare:**

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**Good luck !!!**

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**Du kan skriva på svenska eller engelska!**

1. What is a replacement algorithm? Why is such an algorithm needed with cache memories?  
With which of the following strategies is a replacement algorithm needed:

- a. Direct mapping.
- b. Set-associative mapping.
- c. Associative mapping.

(3p)

2.

- 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.

(3p)

3. Consider the following sequence:

```
SUB    R4,R3      R4 ← R4 - R3
SUB    #2,R1      R1 ← R1 - 2
BEZ    TARGET
MOVE   R1,R6      R1 ← R6
```

```
-----
TARGET -----
```

Transform this sequence for a machine with delayed branching.

Show how the original sequence and the transformed one are executed in a six stages pipelined CPU, and illustrate the reduction of the delay (draw a figure which illustrates the corresponding pipelined execution).

(3p)

4. Define the three types of pipeline hazards. Give an example for each.

(3p)

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5. Branch history table: what does it contain and how is it used?

(2p)

6. The design of RISC architectures is based on certain characteristics of currently used programs. Enumerate at least five such characteristics of programs.

(2p)

7.

- a) What is the “instruction window” in a superscalar architecture. Why is it important?
- b) Why should the instruction window be large and what are the main problems in this context?

(2p)

8. What is register renaming? How does it improve the performance of superscalar computers? 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 speculative loading with the Merced/Itanium architecture? How does it work?

(3p)

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11.

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

(3p)

12. What is a vector processor? Draw a block diagram.

(3p)

13. Enumerate at least five factors which limit the achievable speedup that can be obtained using a parallel computer.

(3p)

14. Code morphing is an essential feature of the Crusoe processor. What does it mean and how does it work?

(3p)