



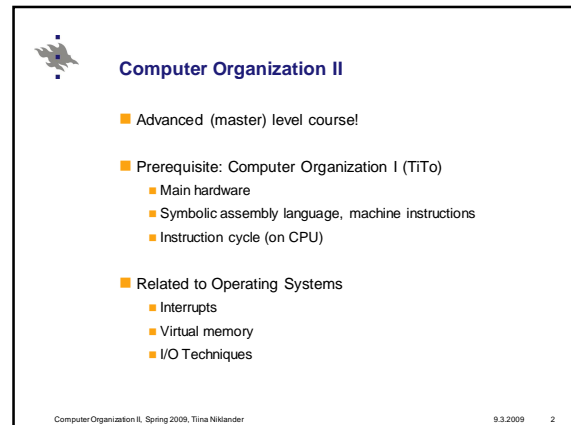
HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

**581365 Tietokoneen rakenne
Computer Organization II**

Spring 2009

Tiina Niklander

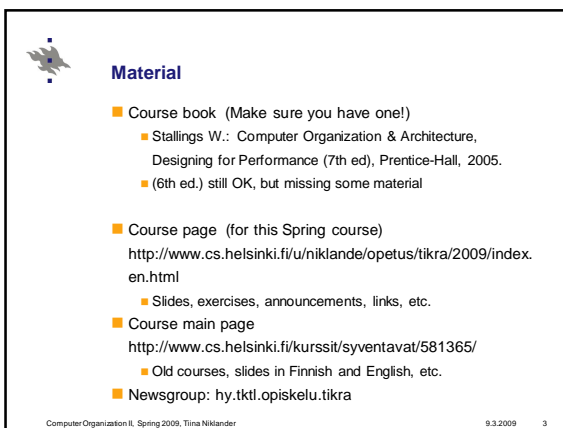
Matemaattis-luonnontieteellinen tiedekunta



Computer Organization II

- Advanced (master) level course!
- Prerequisite: Computer Organization I (TITO)
 - Main hardware
 - Symbolic assembly language, machine instructions
 - Instruction cycle (on CPU)
- Related to Operating Systems
 - Interrupts
 - Virtual memory
 - I/O Techniques

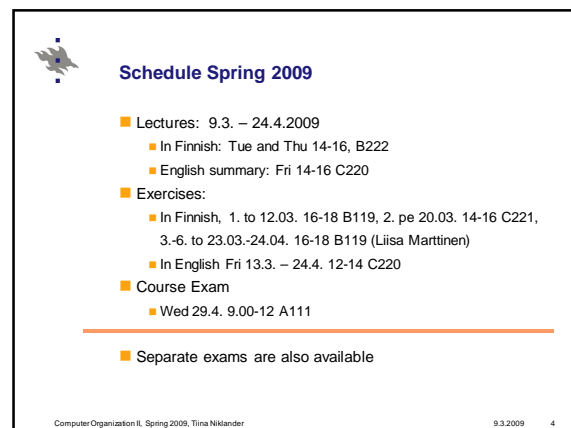
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Material

- Course book (Make sure you have one!)
 - Stallings W.: Computer Organization & Architecture, Designing for Performance (7th ed), Prentice-Hall, 2005.
 - (6th ed.) still OK, but missing some material
- Course page (for this Spring course)
 - <http://www.cs.helsinki.fi/u/niklande/opetus/tikra/2009/index.en.html>
 - Slides, exercises, announcements, links, etc.
- Course main page
 - <http://www.cs.helsinki.fi/kurssit/syventavat/581365/>
 - Old courses, slides in Finnish and English, etc.
- Newsgroup: hy.tkl.opiskelu.tikra

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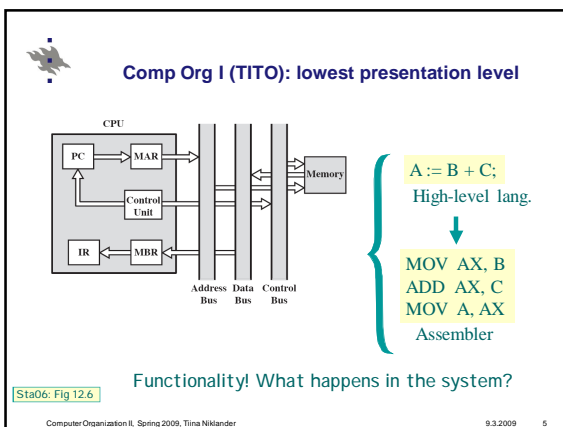


Schedule Spring 2009

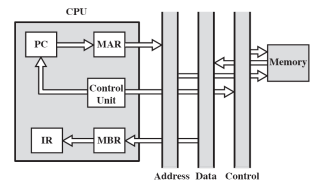
- Lectures: 9.3. – 24.4.2009
 - In Finnish: Tue and Thu 14-16, B222
 - English summary: Fri 14-16 C220
- Exercises:
 - In Finnish, 1. to 12.03. 16-18 B119, 2. pe 20.03. 14-16 C221, 3.-6. to 23.03.-24.04. 16-18 B119 (Liisa Marttinen)
 - In English Fri 13.3. – 24.4. 12-14 C220
- Course Exam
 - Wed 29.4. 9.00-12 A111

- Separate exams are also available

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Comp Org I (TITO): lowest presentation level



High-level lang.

`A := B + C;`

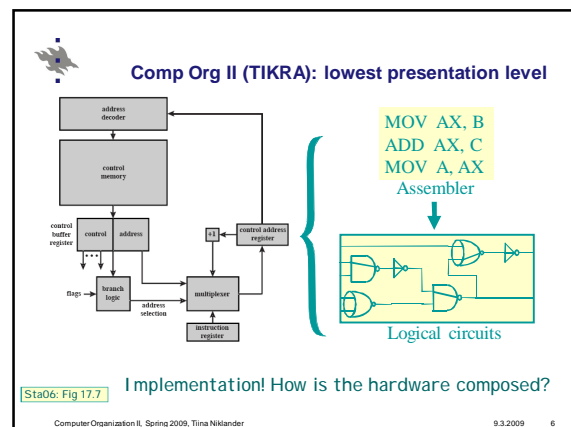
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Assembler

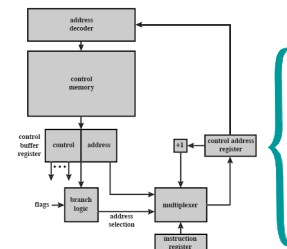
`MOV AX, B
ADD AX, C
MOV A, AX`

Functionality! What happens in the system?

Sta06: Fig 12.6 9.3.2009 5



Comp Org II (TIKRA): lowest presentation level




Assembler

`MOV AX, B
ADD AX, C
MOV A, AX`

Logical circuits

Implementation! How is the hardware composed?

Sta06: Fig 17.7 9.3.2009 6




Learning goals

- **Digital logic:** truth table, Karnaugh-maps, flip-flop, ...
- **Bus:** multiplexing, signaling
- **Memory hierarchy:** cache, TLB
- **Arithmetics:** Booth algorithm, representations
- **Instruction set:** operands, operations, memory reference
- **Processor structure and functions:** pipelining, RISC,CISC
- **Control:** micro-operations, micro-programmed control, clock pulse

More detailed learning goals (at the moment only in Finnish) are available from course main page


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Course content and schedule

<ul style="list-style-type: none"> ■ Week 1 <ul style="list-style-type: none"> ■ Overview (Ch 1 – 8) ■ Bus (Ch 3) ■ Week 2 <ul style="list-style-type: none"> ■ Digital logic (App B) ■ Memory, cache (Ch 4, 5) ■ Week 3 <ul style="list-style-type: none"> ■ Virtual memory(Ch 8.3-8.6) ■ Computer arithmetics (Ch 9) 	<ul style="list-style-type: none"> ■ Week 4 <ul style="list-style-type: none"> ■ Instruction set (Ch 10, 11) ■ CPU struc.& func. (Ch 12) ■ Week 5 <ul style="list-style-type: none"> ■ RISC-architecture (Ch 13) ■ Instruction-level parallelism, superscalar processor (Ch 14) ■ Week 6 <ul style="list-style-type: none"> ■ IA-64 and other architectures (Ch 15) ■ Control Unit (Ch 16-17)
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Motto

"It is not good exercise,
If you do not sweat"

"Kunto ei nouse
ellei tule hiki."


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Work during the course


- Combine the details together to form a larger picture (in your mind!)
 - Try to continuously understand and analyse the connections
 - Stay awake!
- **Make notes**
 - Write down own ideas and questions immediately
- **Ask questions**
 - Question are never too simple. (If you missed the point, then somebody else missed it also)
 - Ask from teacher, assistant, but *also from co-students*.
- **Teamwork is allowed** even with individual assignments
 - However, own paper must be written by you, even if you cooperated in learning the content

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Be active!

- Do all exercises in advance!
 - On your own / in small teams.
- Think about the problem during several days
 - at least before giving up
- **Learning by doing!**
- Ask about the problematic parts
 - While solving the questions
 - When solutions are presented
 - Afterwards from instructors
 - Beginning of next meeting



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Note!

- These slides are just the "table of content"
 - ~ notes of the lecturer
- **Read the book!**
 - ~ just following the lectures or summary is not enough
- Spend enough time in learning the content
 - Simple time estimation (for planning)
 - VERY OLD: ~ 6,5 weeks*(2*(4+2)) = 78 hours
 - OLD: 4 op = 2 ov: 2 * 40 = 80 hours
 - CURRENT: 1 year / 60 op = 1600 t / 60 op = 26.67 t / 1 op = 107 hours / 4 op

Enjoy the course!

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Credits

- Teemu Kerola 1999-2003
 - Original slides (in English), blue layout
 - Based on 5th edition
 - Updated to 6th edition 2002
- Auvo Häkkinen 2004-2005
 - Most slides translated to Finnish, orange layout
 - Figures integrated to slides
 - Updated to 7th edition 2005
- Teemu Kerola 2006
- Liisa Marttinen 2007
- Tiina Niklander 2009
 - Translation to English from the Finnish slide set

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