Computer Organization II

- Position: Intermediate (BSc) level course
- Prerequisite: Computer Organization I (TiTo)
  - Main hardware
  - Symbolic assembly language, machine instructions
  - CPU Instruction cycle
    - What happens in system during the cycle?
- Related to Operating Systems
  - Interrupts
  - Virtual memory
  - I/O Techniques

Course Material

- Course book (Make sure you have one!)
  - (7&6th ed.) possible, but MISSING a lot of material
- Lecture course home page (Spring 2012)
  - https://www.cs.helsinki.fi/en/courses/581365/2012/k/k/1
  - Schedule, slides, exercises, announcements, links, etc.
- Course home page
  - Link to list of old exams
  - Old courses, slides in Finnish and English, etc.

Schedule Spring 2012

  - Mon 12-14 C222 and Wed 12-14 D122, Tiina Niklander
  - In English when needed
- Practice sessions:
  - Thu 12-14 (C222), Tiina Niklander
  - General discussion in English
    - Table discussions allowed in Finnish (if everyone understands)
- Course Exam (tentative time)
  - Wed 29.2.2012, 16.00 - 20
  - All exams also in English, if requested in advance

Comp Org I (TITO)

Lowest Presentation Level

Functionality! What happens in the system?

Comp Org II (TIKRA)

Lowest Presentation Level

Implementation! How is the hardware composed of? What makes it tick? How do ticks translate to work?
Learning goals

- Digital logic: Combinatorial & Sequential Circuits
- 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
- Parallel Processing: types, cache coherence, multicore

More detailed learning goals are available from course page.

Course contents and schedule

- Week 1
  - Overview (Ch 1 – 8)
  - Digital logic (online Ch 20)
  - Bus (Ch 3)
- Week 2
  - Memory, Cache (Ch 4, 5)
  - Virtual memory (Ch 8.3-8.6)
- Week 3
  - Computer arithmetic (Ch 9)
  - Instruction sets (Ch 10, 11)
- Week 4
  - CPU struct. & func. (Ch 12)
  - RISC-architecture (Ch 13)
- Week 5
  - Instruction-level parallelism, Superscalar proc. (Ch 14)
  - Control Unit (Ch 15-16)
- Week 6
  - Parallel Processing (Ch 17)
  - Multicore (Ch 18)
  - Summary

Work during the course

- Combine the details together to form a larger picture
- 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 teachers but also from co-students.
  - Teamwork is allowed even with individual assignments.
    - However, own paper must be written by you, even if you co-operated in learning the content

Summary lectures

- All lectures are summary lectures
- Slides are just the “table of content” for summary lectures
- Students are expected to have studied lecture topic in advance
  - Read given chapters from the text book!
- Lecture consists of
  - Summary of central topics for this lecture
  - Small group discussions on given topics
  - General discussions, based on small group discussions and student questions

Practice Sessions

- Mark down homeworks done
  - Grade points based on marked homeworks and attendance
- Split into tables
  - Tables in English or Finnish
  - Discuss all problems in each table
- Ask questions if needed

Projects – write essays

- Three short essays during the course
  - Total 6 points from the essays
  - Each graded with scale 0-5 and then later converted to the course grading points
- Goals
  - Practise writing own text and scientific argumentation
  - Learn to present own ideas in written form
  - Based on new scientific articles
    - Current trends and latest research
Grading

<table>
<thead>
<tr>
<th>Course Component</th>
<th>Available points toward grade</th>
<th>Minimum points needed to pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice Sessions</td>
<td>6</td>
<td>1</td>
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<tr>
<td>Course Exam</td>
<td>30</td>
<td>15</td>
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<tr>
<td>Projects</td>
<td>6</td>
<td>0</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>42</strong></td>
<td><strong>20</strong></td>
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How much time do I need to invest for this course?

- Simple time estimations (for planning)
  - 1 year / 60 cu = 1600 h / 60 cu = 26.67 h / 1 cu = **107 hours / 4 cu**
  - 107 hours / 7 weeks = 15 hours each week
- **Motto:**
  - "It is not good exercise, if you do not sweat" (*"Kunto ei nouse, ellei tule hiki."*)

Enjoy the course!

Credits

- Teemu Kerola 1999-2003
  - Original slides (in English), Based on 5th edition
  - Updated to 6th edition 2002
- Auvo Häkkinen 2004-2005
  - Most slides translated to Finnish, orange layout
  - Updated to 7th edition 2005
- Teemu Kerola 2006
- Liisa Marttinen 2007
- Tiina Niklander 2008-2010
  - Translation to English from the Finnish slide set 2009
  - Updated most slides to 8th edition 2010
- Teemu Kerola 2010
  - Course update to 8th edition