TKT-3526 Processor Design

2011
5 ECTS credits
Periods III & IV (weeks 1-8 & 10-18)
Lectures & Seminars: Thursdays 12-14
Prerequisites - Mandatory

TKT-3206 Computer Architecture I
(Tietokonetekniikka I)
– TKT-1110 Microprocessors
(Mikroprosessorit)
  • TKT-1100 Basic Digital Circuits
    (Digitaalitekniikan perusteet)
or
  • ELE-1010 Basic Electronics I
    (Elektroniikan perusteet I)
Prerequisites - Recommended

TKT-3406 Computer Architecture II
(Tietokonetekniikka II)

&

TKT-3516 Signal Processors
(Signaaliprosessorit)
Processor Design: System-on-Chip Computing for ASICs and FPGAs

Jari Nurmi, Editor,
Springer Publishers, June 2007,
528 pages, hardcover,
1. Introduction
2. Embedded Computer Architecture Fundamentals
3. Beyond the Valley of the Lost Processors: Problems, Fallacies, and Pitfalls in Processor Design
4. Processor Design Flow
5. General-Purpose Embedded Processor Cores - The COFFEE RISC Example
6. The DSP and Its Impact on Technology
7. VLIW DSP Processor for High-End Mobile Communication Applications
8. Customizable Processors and Processor customization
9. Run-Time Reconfigurable Processors
10. Co-Processor Approach to Accelerating Multimedia Applications
11. Designing Soft-Core Processors for FPGAs
12. Protocol Processor Design Issues
13. Java Co-Processor for Embedded Systems
14. Stream Multicore Processors
15. Processor Clock Generation and Distribution
16. Asynchronous and Self-Timed Processor Design
17. Early-Estimation Modeling of Processors
18. System Level Simulations
20. Software-Based Self-Testing of Embedded Processors
21. Future Directions in Processor Design
Materials - Supplementary

Lecture Slides
- Book Chapters 1-5, 7-9 & 20

Web-Lectures with Self-Assessment Tests
- Assisting Distance Learning Material

Possible Seminar Presentation Slides
- Book Chapters 6 & 10-19
Materials - Web Lecture Contents

• Outline
• Introduction and Terminology
• Processor Design Stages
• Instruction Encoding
• Construction Principles of Arithmetic Units
• Control, Memory, and I/O Subsystem Basics
• Pipelining
• Other Speed-Up and Parallelization Techniques
• Processor Benchmarks and Performance
• Design Tools
• A Design Example
Assessment - Course Grading

Exam - compulsory - weight 75%
  - No bonus questions

Exercises – partly compulsory - weight 25%
  - Surplus points can be earned and they yield up to 10% (== 1 grade) overall course bonus

Seminar Presentation – voluntary
  - Up to 10% (== 1 grade) overall course bonus depending on slides and presentation
Guided Exercises – weight 25%

- **must be accepted before taking the exam!!!**
  
  - 0 points
    - late return accepted after correction
  
  - 1 point
    - late return, accepted at once
    - timely return, accepted after correction
  
  - 2 points
    - timely return, accepted at once
Special Bonus for Exercise 7
  + 1 point for excellent application acceleration

Bonus Exercises (No Guidance)
  + 2 points
    • timely return accepted at once
  + 1 point
    • timely return accepted after correction
    • late return accepted at once
There are 8 compulsory exercises
   – Max 16 regular points
There are 3 bonus exercises and 1 special bonus award for exercise 7
   – Max 7 bonus points
   – Absolute maximum of 23 points out of 16

Surplus points (> 16) improve the overall course grading up to 10% (==1 grade)
There are 11 course book chapters on basis of which a voluntary 45 minute seminar presentation can be given

– Bonus on overall course grading is awarded as follows:

• 5% for acceptable slides & presentation
• 7.5% for good slides & presentation
• 10% for excellent slides & presentation
1. Introduction
2. Embedded Computer Architecture Fundamentals
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http://www.tkt.cs.tut.fi/kurssit/3526/

Seminar presentation topics and timeslots are to be reserved by formatted e-mail:

- [Subject]
  - TKT-3526 SEMINAR RESERVATION

- [Body]
  - Name and student number
  - Number of the desired course book chapter
  - Preferred timeslot
    - also indicate if certain timeslot(s) is/are not possible
Persons Responsible

Lectures: Tapani Ahonen, room TG309, infrequently available
tapani.ahonen@tut.fi

Lectures & Exercises: Vladimir Guzma, room TG409
vladimir.guzma@tut.fi

Exercises: Roberto Airoldi, room TG311
roberto.airoldi@tut.fi