ECE381(CAD), Lecture 1:

Computer-Aided Design of Digital Systems (CAD)

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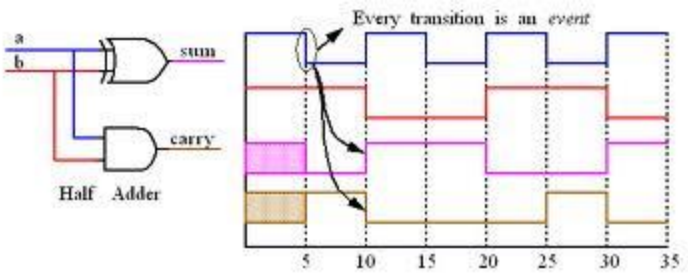
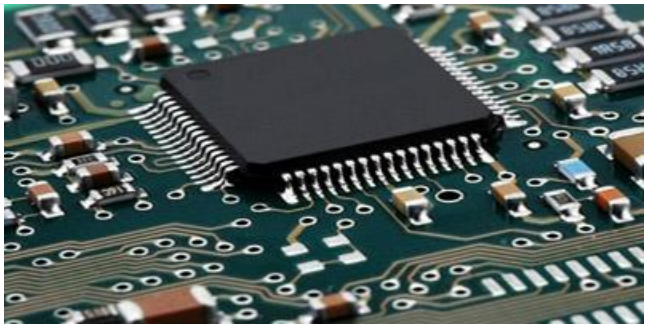
Organization

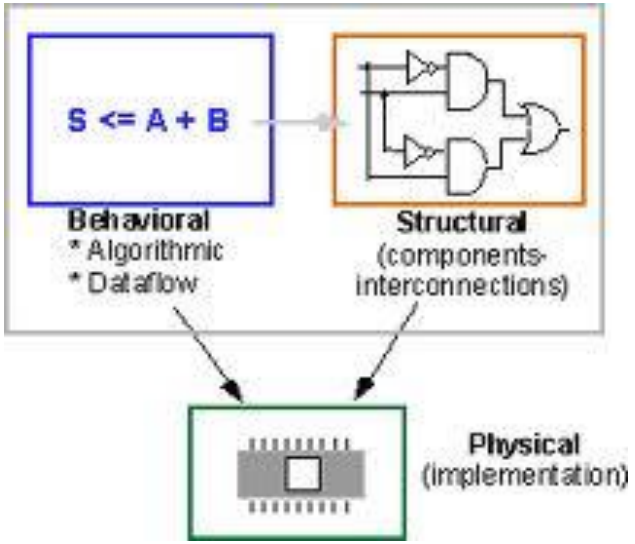
- Computer-Aided Design of Digital Systems (CAD)
- طراحی کامپیوتری سیستم‌های دیجیتال
- Instructor: Mehdi Modarressi
  - No. 510, New ECE Building
  - Office hours: Sunday-Tuesday 8-12
    - Extra individual appointments can be made if necessary; send me email.
  - email: *modarressi@ut.ac.ir*
- Find the lecture notes in the course page at CECM
- Teacher Assistant:
  - TBA

Course objectives



- The course covers three areas:
  - FPGA architectures
  - VHDL design and synthesis techniques
  - Design methodologies
  - Test and verification





Source of pictures: www.seas.upenn.edu and http://www.ece.unm.edu/~jimp/vlsi/slides/vhdl.html

Course syllabus

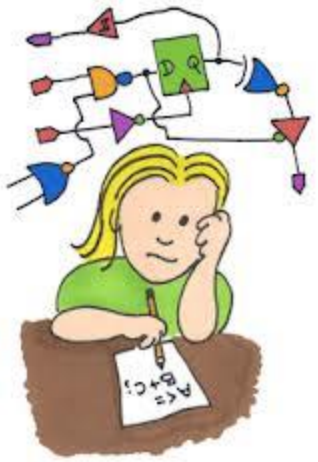
- VHDL:
  - VHDL basics: basic structures, timing,…
  - Structural, Dataflow, and Behavioral hardware design in VHDL
  - VHDL utilities: types, operators, and attributes, subprograms, packages, …
- Simulation
  - Simulation steps, timing analysis, back annotation,….
- Test and verification
  - Design verification
  - Testbench design techniques and issues, code coverage,…
- Design techniques and examples:
  - FSM, FSMD, and ASM chart, Markov model, Monte Carlo simulation, neural nets,…
- FPGA and synthesis:
  - PLDs and FPGA basics
  - VHDL coding for hardware synthesis
  - IP-Cores and design reuse

Grading

- Final Exam (45%)
- Midterm exam (30%)
- Homework and Computer Assignments (15%)
- Project (10%- up to 15% for outstanding projects)

Homework

- There will be several homework assignments throughout the course
  - Both written problems and small exercises with CAD tools
  - Cheating is not allowed!
    - Penalty for both sides!



Final project

- Requires people to work in groups of two or three
- Design and implementation of a simple embedded system on the FPGA boards
- Starts after the mid exam
- One progress report and one final report
  - Report is very important!

Tools and devices

- Software tools:
  - ModelSim
  - The Xilinx ISE tool set
- Hardware:
  - Xilinx Spartan-3 boards

References

- VHDL:
  - Required text:
    - P. Ashenden, *The Designers Guide to VHDL*, Morgan Kaufmann, 2008.
    - Z. Navabi, *VHDL: Analysis & Modeling of Digital Systems*, McGraw-Hill, 1998.
  - Further reading:
    - D. Perry, *VHDL: Programming by Example*, McGraw-Hill, 2002.
- System design techniques and Synthesis:
  - P. Chu, *FPGA Prototyping By VHDL Examples- Xilinx Spartan-3version*, John Wiley & Sons Pubs., 2008.
- FPGA:
  - C. Maxfields, "The Design Warrior's Guide to FPGAs", Elsevier, 2004.
  - Xilinx Spartan-3 datasheets