Exam, Introduction to Electronic System Design (DAT091, DAT092, DAT093)

Saturday Jan 3, 2015

Time and place: Saturday Jan 3, 14:00, V building

Examiner: Lars Svensson

Department: Computer Science and Engineering

Inquiries: Lars Svensson (ext. 1704); will visit the room at 15:00 and at 17:00

Solutions: To be posted on Mon Jan 5, in PingPong

Results: To be posted on or before Thu Jan 22, in LADOK

Grading review: Room and time to be posted in PingPong

Grade limits:

3: 30–39 points; 4: 40–49 points, 5: 50– points

Extra grade points earned during the lab course (the 2014 installment) will be added to the exam result before computing the final grade.

Allowable references and utilities: English dictionary; no other books or papers.

General: Submit your solutions, ***in English***, on the blank paper sheets provided. Write legibly; feel free to use figures to get your point across.

Please do not combine solutions to several problems on the same sheet. Please order your sheets in sequence with the problems solved. Please write on only one side of each sheet.

In some problems, it may be necessary to make assumptions. When you do, state your assumptions explicitly and motivate them. Reasoning and descriptions can give partial credit even if the end result is incorrect.

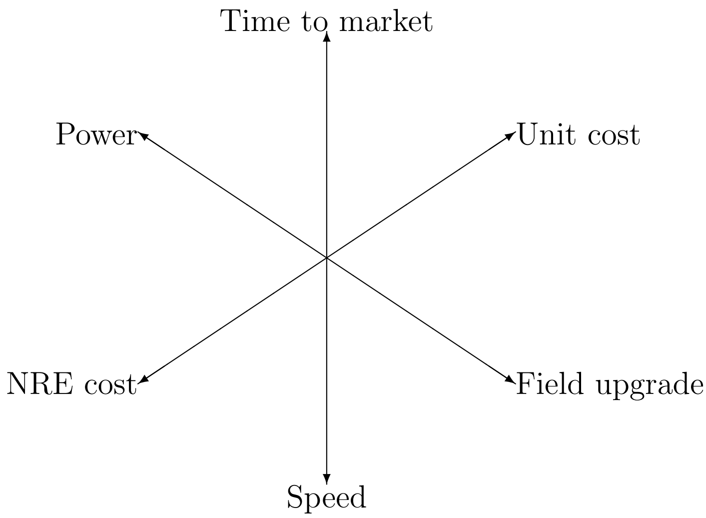
The maximum points for each problem is given in parenthesis after the problem text.

Be sure to write your identification code on each sheet!

Good luck!

Problems

1. (a) A diagram similar to the one below was shown in one of the lectures. Please *copy the diagram below to a numbered solution sheet* (you don't want your solution to be lost by mistake!) and mark approximate curves for an FPGA technology and an ASIC technology in the diagram. Use the "bigger is better" convention. (Note that the order of the axes has been changed with respect to the figure shown in the lecture.) (5p)



   (b) Under what cirumstances might it be a good idea to implement a processor in an FPGA rather than just use a processor off the shelf? Please give a cost-driven example and a performance-driven example. (5p)

2. Pick *any three* of the following challenging trends for future electronic system design, and suggest possible approaches to managing or handling them. (10p)

   - Growing complexity
   - Increasing performance requirements
   - Shrinking development time
   - Stricter power requirements
   - Reduced manufacturing cost

3. (a) Compare and contrast a hard deadline and a soft deadline in a real-time system. (2p)

   (b) A multi-chip package, such as an MCM, may offer an alternative both to a single-chip solution and to a "traditional" multi-package assembly of the same chips. List some benefits and drawbacks of MCMs compared with each of the other alternatives. Two points per acceptable list item, up to a maximum of four items. (8p)

4. (a) In VHDL, what is the difference between signals and variables? (3p)
   (b) In VHDL, what is the difference between ports and generics? (3p)
   (c) In VHDL, what would you use constants for? Would you consider some other construct instead of a constant, and what might the benefits be? (4p)
5. (a) PCBs are central components in most electronics systems, and system-level requirements often cause or motivate requirement for the PCB design. Briefly descibe three PCB-level requirement types, together with corresponding system-level requirements. Two points per acceptable pair. (6p)
   (b) The lecture on PCB design brought up *time-of-flight ringing*. Briefly describe the phenomenon and suggest how to handle it. (4p)
6. (a) Please state the fundamental equation for dynamic power dissipation in digital CMOS circuits. (2p)
   (b) The equation from task 6a suggests several ways to reduce the dynamic dissipation. List three *concrete* examples of design approaches that can be expected to reduce dynamic dissipation. (6p)
   (c) The approaches given in the previous task will not guarantee an overall low dissipation. Give at least two reasons why not. (2p)

THE END