Exam, Introduction to Electronic System Design (DAT093)

Wednesday Dec 20, 2017

Time and place: Wednesday Dec 20, 14:00, SB 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 Dec 21, in PingPong

Results: To be posted on or before Jan 16, 2018, in LADOK

Grading review: Room and time to be posted in PingPong

Grade limits:

3: 24–39 points; 4: 40–49 points, 5: 50– points

Extra grading points earned during the lab course (the 2017 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 write on only one side of each sheet. Please do not combine solutions to several problems on the same sheet. Please order your sheets in sequence with the problems solved.

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

Read through all problems before starting on the solutions.

1. (a) Production cost is an important design target in almost all electronic-system projects. List three design parameters that will affect the cost of a "bare" PCB, that is, before adding the components. (6p)
   (b) Compare and contrast through-hole mounting and surface mounting. When would you consider each of these alternatives? (2p)

2. (a) State the standard formula for dynamic power dissipation in CMOS circuits, and explain what the formula parameters mean. (4p)
   (b) Based on the formula you just gave, discuss how *clock gating* and a *variable supply voltage* may help reduce power dissipation. What extra design considerations arise when using these techniques? (4p)

3. (a) The choice of technology platform is usually determined by a combination of several design requirements. Briefly discuss requirements that would cause you to consider an FPGA platform and an ASIC platform, respectively, and compare and contrast the two cases. (6p)
   (b) The ASIC/FPGA consideration need not be a strict either/or choice. Briefly discuss how the two technologies can be used to complement eachother in the same project. (2p)

4. (a) How can pipelining help improve the performance of a microprocessor? May pipeline length be usefully extended indefinitely? Why or why not? (4p)
   (b) The Tensilica "Xtensa" and Mentor "Catapult-C" design systems were discussed in class, and overview descriptions were included in the reading material for the course. Both these design systems make it possible to describe behavior in C or C++ rather than VHDL; but there is a major difference in how they approach the task. In what situations might each approach be preferable? (4p)

5. Design margins are introduced in order to ensure that a larger percentage of products meet the specifications, even though component performance may vary.
   (a) How do larger design margins contribute to the cost of a product? (Be explicit about what you consider to be a cost.) (2p)
   (b) In the context of design margins, describe what each of the letters "PVT" means, and exemplify how you might reduce the necessary design margin associated with each letter. (6p)

6. The future-looking lecture at the end of the series explored several design challenges which are expected to be important for the forseeable future. For the challenges of *reduced development time* and *increased power dissipation*, discuss why each of them pose problems, and how the challenges may be met. (8p)

THE END