University of California, Berkeley
College of Engineering
Computer Science Division
Electrical Engineering and Computer Science Department

CS 150 R. H. Katz
Spring 2001 Po Yan

FINAL PROJECT GRADING CRITERIA AND REPORT FORMAT

A critical aspect of your final project is to document what you have done in a final report. A perfectly working design is worthless unless it can be duplicated and built upon, and this is the role of proper documentation. Long after the components are returned and the wiring is torn up, your report will remind you of the design experiences that you had and the many things that you learned. It is not uncommon for students to bring their CS 150 Final Report to job interviews (be sure to make a copy for each project partner). This course has long had an excellent reputation among corporate recruiters from such companies as AMD, Compaq, HP, IBM, Intel, Sun Microsystems, etc.

We understand that you have worked hard on your project. We don't want the final report to represent too much of an additional burden. The key thing is for you to evaluate your design and to document your extra credit features and lessons learned. The report sections and suggested lengths are described below. The typical report will be around 5 pages with quite a few additional pages dedicated to additional appendices, to hold your block diagrams, schematics, state diagrams, etc.) and tables (register transfer operations, microoperations, ROM contents, etc.). Use the following page lengths as guidelines, though we do want to keep written descriptions short and crisp.

The overall report outline is as follows:

1. **Introduction**
2. **Theory of Operation**
3. **Control Description**
4. **Datapath Design**
5. **Control Design**
6. **Evaluation**
7. **Lessons Learned and Conclusions**

Appendix A: Control State Diagram
Appendix B.1: Game Controller Interface Schematics
Appendix B.2: Audio Interface Schematics
Appendix B.3: Video Interface Schematics
Appendix C: Controller Schematics
Appendix D: Project Checkpoint Check-off Sheets

In more detail, the following describes in more detail the expectations for each subsection:

1. Introduction (0.5 Page)

What is the function of your project, in general terms? We know what it is—we assigned it to you!—so it is not necessary to go into details. This is to make the report able to stand on its own. Concentrate on how you differ from the original specification, especially in terms of extra credit work

and special game features. What aspects of your implementation make you particularly proud (e.g., few control states, able to run at a fast clock rate, unusual datapath or control organization, cool user interface, etc.)? Why did you choose to implement that aspect of your design in that way?

2. Theory of Operation (0.5 page)

Describe how your project would be used by someone not intimately familiar with its detailed implementation. What do you do on power up? How do you reset it? What is the detailed procedure for getting it going? What assumptions about the supporting hardware environment are you making, e.g., memory system organization? What are the detailed timing constraints on your processor, e.g., clock frequency or period and duty cycle? Include a diagram that shows the layout of your prototyping board's switches and LEDs and the functions and indications they provide.

3. Control Description (1 page)

Describe the basic control sequencing of your system, including your proto-board user interface. Attach a state diagram, a program-like description, or similar method for describing your control as Appendix A. In this section, the output of the control should be described in high-level register transfer operations, not detailed control signals.

4. Datapath Design (1 page)

The major subsystems of your design map onto the three checkpoints we gave you: (1) Game Controller Interface, (2) Audio Interface, and (3) Video Interface. The purpose of this subsection is to document these components in terms of their control signals and their timing behavior, and to describe any changes you may have made to the original checkpoint specifications. Include block diagrams with documented input/output signal names for each subsystem in Appendix B.1, Appendix B.2, and Appendix B.3, one section for each of the three checkpoints.

If you made significant change to a subsystem, include in this section a short description of its theory of operation. Include a high-level register transfer diagram showing busses, registers, and functional units. Focus on how you have interfaced the three checkpoint components.

Include in Appendix B a more detailed schematic, showing all library components and the detailed implementation of interconnections such as tri-state buffers or multiplexers. The detailed diagram should show all microoperation control signals. Appendix B should include a table that correlates the register transfer operations of Section 3 with the microoperations in your datapath. Very briefly describe the function performed by each register transfer operation.

5. Control Design (0.5 Page)

Give a short description of your controller's theory of operation. Did you use random logic, shift register "one hot" design, counter-based state register, a ROM-based design, or some other strategy, such as multiple communicating state machines? Describe your approach for state assignment, if any. In Appendix C, (1) give a block diagram description showing the controller inputs, state register, and outputs, (2) describe any equations or microcode formats, and (3) for ROM-based designs, include a table showing the ROM contents in terms of your chosen format. Briefly describe what is happening in each ROM word.

6. Evaluation (1 Page)

Describe the overall system timing considerations for your design. What is your critical path? What is the maximum speed you believe you can transmit and receive data? Justify your answer based on identifying your critical path and determining its speed. In addition to time, consider space. Include in your answer the number of Xilinx CLBs used in your design. What percentage of the Xilinx component did your design consume?

7. Lessons Learned and Conclusions (0.5 Page)

What have you learned from you experience implementing your project? What would you do differently if you had the ability to start over from scratch? Include suggestions on how to improve the project specification, checkpoints, and process for future CS 150 offerings.

Notes on Extra Credit:

We are limiting it to no more than 33% of the final project grade. First and foremost, *you must have a working base design before you can obtain any extra credit points*. Furthermore, there is no such thing as partial credit on extra credit: either you get the extra credit feature to work completely or you receive no extra credit.

You can get 10 of 33 extra credit points simply by making the early demo deadline of 20 April. If you have made the early checkpoint deadlines, you can get an additional 3 of 33. Some of the bells and whistles for extra credit are included in the Revised Final Project Specification that has been posted on the course web page (or you can invent your own, but consult the Head TA or the Instructor before you endeavor to pursue it).

Don’t forget, you must have a strategy for demonstrating your optional extra to convince us that it works.

University of California, Berkeley
College of Engineering
Computer Science Division
Electrical Engineering and Computer Science Department

CS 150 — R. H. Katz
Spring 2001 — Po Yan

Final Project Grading Template

Name Partner #1: _____ Teaching Assistant: _____

Name Partner #2: _____ Lab Section: _____

Design & Demonstration (50 pts. + 10 extra credit pts.) Points Awarded: _____

Exceptional	(50 pts.)
Outstanding	(40 pts.)
Very Good	(30 pts.)
Good	(20 pts.)
Fair	(10 pts.)
Poor	(0 pts.)
Early Demo Bonus	(+ 10 pts.)

Checkpoints (15 pts. + 3 extra credit pts.) Points Awarded: _____

- Checkpoint #1 (5 pts. plus 1 pt. early bonus)
- Checkpoint #2 (5 pts. plus 1 pt. early bonus)
- Checkpoint #3 (5 pts. plus 1 pt. early bonus)

Oral Project Debrief (25 pts.) Points Awarded Partner #1: _____

Points Awarded Partner #2: _____

Written Project Report (10 pts.) Points Awarded: _____

Exceptional	(10 pts.)
Outstanding	(8 pts.)
Very Good	(6 pts.)
Good	(4 pts.)
Fair	(2 pts.)
Poor	(0 pts.)

Extra Credit (NOT TO EXCEED +33 pts. TOTAL) Points Awarded: _____
+33 pts. max includes early bonuses and additional functionality

Total Points Partner #1: _____

Total Points Partner #2: _____