Independent Study and Thesis Information
Prof. Morgan McGuire

This document describes the requirements and structure of undergraduate independent studies and theses in Computer Science that I advise at Williams College. (*If you found this on the web—Williams does not have a graduate program in Computer Science, although I do collaborate with graduate students and their advisors at other schools*.)

Additional documents for advisees can be found on my website at http://cs.williams.edu/~morgan/

Note that each faculty member has his or her own requirements for independent study students, so this document only applies to my students. You could perform a project on an identical topic in a very different way with another professor.

Background:
An independent study is a one-semester, single-student course that is run by that student but advised by a professor. The professor provides evaluation and guidance but does not structure the course. Seniors wishing to qualify for honors or high honors may undertake a 3-course sequence of fall independent study, winter study 99, and spring thesis on a single topic. At the end of each of the fall and winter study periods the student and professor jointly determine whether the project may proceed. Independent studies may not be on topics covered by existing offerings in the department, even if they are not offered that particular semester. Theses are generally on open research problems. However, unlike a graduate thesis, students are not required to obtain a positive result. Students may not receive research assistant funding for their projects, although a project may continue on one begun as a research assistant. Thesis projects do not count towards elective credit.

Registering:
You must obtain my approval of your project proposal before registering for an independent study. This means that Add Date is the latest you can get that approval. Talk to me the semester beforehand to see if I'm going to be available and interested, and if I am, then we'll agree on a topic. Note that this is not yet a commitment for either of us.

Submit your written proposal at least a month before Add Date so that there will be time for several revisions. If the proposal is not in acceptable form by Add Date, I will not approve the project. This is for your benefit—I will not let you embark on a project unless I believe that you will succeed.

Proposal:
The independent study or thesis proposal is a research proposal structured in the form of a course syllabus. You can see my standard for a syllabus at:

- http://www.cs.williams.edu/~morgan/cs334/#schedule
- http://graphics.cs.williams.edu/courses/cs371/f08/reading/index.html

You can see how I discuss problem motivation, related work, and methodology in my own papers, e.g.,

- http://graphics.cs.williams.edu/papers/PhotonHPG09/ISPM-HPG09.pdf
- http://graphics.cs.williams.edu/papers/SplittingTreesCGA07/

With those standards in mind, your proposal must contain:

1. Description of a scientific problem, and why people care about it
2. Thesis statement—what do you think the solution will be?
3. Description of related work, including citations. You need not have read these in depth yet.
4. Description of methodology:
    a. **Experiments to be performed**
        i. Apparati to be developed, including software
        ii. Tools and materials required
        iii. What steps will be taken during the experiment
        iv. Sources of error
        v. How will you interpret the results
    b. How the course will change based on the outcome of the experiments
5. Any domain-specific evaluation criteria I should use in grading your work
6. **Schedule** of topics/work covered every day. Plan on having at least three work sessions by yourself per week in addition to our meeting, and schedule them for specific times.
7. **Deliverables and deadlines** for
    a. Review of specific published works
    b. Code
    c. Text
    d. Results, including specific images you plan to produce
    e. Presentations
8. Your background
    a. Why do you want to do this project?
    b. Grades from all CS, and physics, math, and art courses as relevant
    c. Any special skills or experience that will help you to succeed
    d. A phone number at which I can reach you

If you are proposing a non-thesis independent study, for your topic it may suitable to de-emphasize the research aspects of the proposal. I will not approve a pure

software development project, however. There must be a scientific component, whether it be survey, derivation, proof, or experimentation.

I recommend writing the proposal in LaTeX for two reasons. First, you will re-use large portions of it for your final report or thesis document and LaTeX is the most portable scientific publishing format. Second, LaTeX handles equations and references much better than other packages (unfortunately, it is painful for figures). For best results, use the ACM SIGGRAPH LaTeX template from http://www.siggraph.org/publications/instructions/acmsiggraph.zip, compile it with pdflatex, and store your images as PDF, PNG, or JPG.

Writing a proposal is hard. As a guideline, it takes me about three weeks to write a syllabus or research proposal on a topic for which I'm already expert. Take time to make the proposal as good as you can. A solid proposal increases your chance of acceptance, your chance of success during the semester, and provides your best defense in the unlikely event that we later disagree about your progress and your grade is in jeopardy.

I will not grant extensions on deadlines—it's your own schedule. However, it is impossible to anticipate the path of a research project. So, if you fall behind schedule or need to change the direction of your inquiry, I invite you to submit a revised proposal for the *remaining* part of the course at any point. If you do so, we'll discuss it until we mutually agree on the new written proposal. Until we agree, the old proposal and schedule remain in effect.

Meetings:

I will meet with you for *at least* half an hour each week, on average. Depending on the nature of your project and our schedules we might meet more frequently or for longer periods. In order to give you clear guidance, I will assign a grade evaluating your progress within one week of each meeting. Your final grade will be a combination of those grades, the effectiveness of your methodology, and the quality of your work products.

You're in charge of the meetings, so come prepared to present your progress and ask questions on anything for which I can help. We can meet in lab and look at code if that works better for you. If you have nothing to report, cancel the meeting ahead of time and I'll assign a "D" for that week's progress (if you simply don't show up, you'll get an "F".)

Maintain a log book of your progress and always keep it with you when working by yourself or meeting with me. I enjoy explaining something the first time but am very frustrated when I have to explain it again because a student didn't write it down (but if you didn't understand it, that's ok.) Keep all of your notes during debugging, preliminary results, and plans in the log book so that there's a record of your

process. Print out and paste in result images or particularly valuable code snippets. Personally, I have a terrible memory. I write everything down so that I never lose track of what is going on with each of my projects.

I'd appreciate it if you give me hardcopy of any documents you want me to review during the semester. For example, if you're struggling with a research paper, print a copy and leave it my mailbox so that I can read it before our next meeting.

I require you to submit all of your code and documents in electronic form so that I can easily archive them at the end of the semester.