

The CS555 Term Paper

General

During the semester you will be writing a term paper that will afford you the opportunity to study an operating systems topic in detail and to present the results of your study in a written form. The paper is intended to be an academic paper, similar to the ones that we discuss in class, although the paper is not required to be of publication quality.

There are two major goals of the paper, and they are the basis on which the paper will be graded. I want to see that you have:

- Mastered the literature on one or more areas of research
- Had a new insight in that area of research

This is a class, and I don't expect each student's new insight to be a field-changing idea. It can be as simple as a new way of organizing the major ideas in the field so that they make more sense, or a gap in the assumptions of the practitioners of the area that is promising for new research.

The goal is to encourage each student to have the experience of researching an area and understanding it to the point where their understanding can yield new insight. As you pick your topic and compose your paper, keep these goals in mind.

Process

The writing process consists of a proposal, which must be accepted before 1 Apr 2011, and writing the paper itself. The proposal outlines the topic and scope of the paper, and we will use a formal proposal system this year. Once the proposal is accepted, a full term paper must be produced by the end of the semester. That ordering is not intended to indicate that you cannot begin working on your paper before your proposal is accepted, but both hurdles must be cleared according to their own deadlines.

Proposal

The proposal is a short document, about page long, that describes the paper you intend to write. It should clearly state the topic and scope of the paper, and must include at least 2 references to published papers. One of the two references must not be in the class reading list.¹ Note that unpublished references do not count toward your reference requirements.

There is an example proposal² available.

There are no format requirements for the proposal. In particular an ASCII e-mail message is fine. Although there is no requirement to typeset the proposal, take some care in writing it. It will be the basis for your paper and the metric for grading it.

Getting a proposal accepted is a process of stepwise refinement of the proposal, and students should expect to iterate more than once with me. There are two deadlines for the proposal, one to ensure that the process starts and one as a final cut off. A very thin outline is enough to pass the first hurdle, but that implies more work before the final cut-off. While it is possible to have a proposal accepted on the first submission, it is common to have to iterate a few times. Plan to accommodate this in your proposal submissions. Missing a

¹ <http://www.isi.edu/~faber/cs555/syllabus.html>

² <http://www.isi.edu/~faber/cs555/proposal.html>

proposal deadline – either proposal deadline – is equivalent to missing a paper deadline and has significant implications on a paper's grade.

The difficult part of choosing a topic is scoping it properly. You need to pick a topic that covers enough ground to be interesting but that is tightly enough constrained that it is manageable. For example, a proposal to do a taxonomy of cryptographic algorithms would be too broad. Books have been written on the topic, which makes it too broad for this exercise. Conversely, a topic can be too constrained. A proposal to study modula compilers that ran under AmigaDOS would not turn up many papers.

Because the purpose of this paper is to reflect some of your insight into the topic, you should include your intended contribution in the proposal. For example, you could propose to provide an organization or taxonomy of related systems or algorithms. A study of distributed filesystems that organizes them according to parallelism is that sort of paper. Another choice is to take more complete systems and compare them across a range of functionalities. Comparing Mach, Amoeba, and Linux in the areas of file systems, virtual memory, and interprocess communication would be a paper of this type.

Bear in mind that this paper is an academic paper, and academic sources are important. A paper that is based only on unpublished white papers or documents that have not been peer-reviewed will not be approved.

There are other choices for the layout of the paper, but the proposal should include the intellectual contribution you intend to make.

A completed proposal is due 11 Mar 2011. The proposal should be e-mailed to <csci555@usc.edu>. The proposal must include the text of the proposal and 2 references, one of which is not on the class reading list.³ There is no required format for the proposal, although references must be complete and correct. If a student does not have a proposal submitted on or before 11 March 2011, each day that the submission is late counts as a day that the paper is late, and incurs late grading penalties. If you are uncertain if your proposal has been received, ask me.⁴

A proposal must be *accepted* by 1 April 2011. Acceptance will be indicated by a PGP-signed e-mail from me that clearly states “this is accepted.” If a student does not have a proposal accepted on or before 1 April 2011, each day that the acceptance is late counts as a day that the paper is late, and incurs late grading penalties. If you are uncertain whether a piece of e-mail constitutes an acceptance, ask me.⁵

Paper

The paper is a 12 page manuscript on the topic accepted in the proposal. Although the paper may be shorter, it cannot exceed 12 pages. A precise format appears below. It must contain at least 6 references, 4 of which must not appear in the reading list.⁶ Note that unpublished references do not count toward your reference requirements.

Pages containing only references are not counted against the 12 page limit. All other pages are; no title pages or tables of contents are required and including them will count against your page count. Students will read many conference papers this semester and should use them as a format guide.

Failing to follow the formatting standards can reduce a paper's score, but they will be primarily graded on how well they accomplish the goals set out in your proposal. Clarity of expression, organization, and completeness are all important, as well as pointing out your contribution.

Clarity of expression relates to how you present your individual ideas. They should be presented logically and completely to show you have understood them and to communicate the ideas to the reader. Although

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⁴ <mailto:csci555@usc.edu>

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beauty of expression is appreciated, it is not a grading criteria. One point that should be clear is the student's insight to the area.

The paper as a whole must be organized logically. Themes should develop naturally, or comparisons set up to be comprehensible. Papers that ramble or that do not arrange the ideas well will not be graded as well as those that do.

Finally, discuss everything that you propose to discuss. If in the course of writing the paper it becomes clear that there is not enough information to completely cover the topics you proposed, it is up to you to negotiate a change to the proposal. To prevent last minute change requests, the last day to change the scope of a proposal is 15 April 2011.

Doing the Work

For many of you, this will be your first academic paper. There are three aspects to this process: research, understanding, and writing. The first step, research, consists of exploring your topic by reading the published literature in the area. Your goal is to become expert on a topic, so you'll need to explore this area extensively. You will need to read and understand papers in the area, and develop an understanding of trends in the area. As you read more, the process of assimilating new papers will get easier, but there is a learning curve to master. You will be looking for the most influential ideas and how that has affected research in the area. Do not hesitate to explore a field's past or recent publications. There are papers on worms and viruses from the 1980's and on hypertext from the 1950's. Both of those areas are active areas of publication today.

Finding those papers is the first step, and can be a difficult one. Web search engines are a fine technology for getting a foothold in the literature and finding those first few strong papers one needs to cover a topic. As you find sources on the web, be sure to view the sources critically. Papers that have been peer-reviewed and published in journals with solid reputations are best. Some strong Operating Systems journals include the ACM Symposium on Operating Systems Principles (SOSP), the USENIX Symposium on Operating Systems Principles and Design (OSDI), and any number of USENIX-sponsored conferences. Beware of unpublished white papers and marketing hype that has minimal technical content or review. Also note that ACM SIGOPS's Operating Systems Review (OSR) is *not* peer-reviewed. If you have questions about a conference or journal's reputation or a source's suitability, feel free to contact me.

Another method of finding literature on a given topic is to scan the tables of contents of the proceedings and publications discussed above, either electronically or by going physically to the library. This can be extremely valuable if you have a broad area of interest that you would like to narrow down or if you want to know what the major subfields of a given area are. For example, someone interested in security could find out a lot about the directions of security research by looking at the contents of the last several proceedings of the USENIX Security Symposium.

Once you have found a paper or two, the references in those papers may also be helpful in finding more papers. Hopefully you will begin to see patterns in the references, noting which papers are seminal and what sub areas are important.

Once you have gathered and read enough to begin understanding an area, you need to begin working on structuring the knowledge you have. Some good questions to ask at this time are:

- what are the major systems in this area?
- what aspects do the systems have in common and where do they differ?
- are there common themes or underlying theories that drive the research?
- are there aspects of this area that are similar to another discipline I know?

- have design tradeoffs changed in this area? are they due to change?

Any one of these questions can lead to an insight that may help you better understand the area and even suggest new directions in it.

Once you decide what principles will organize your paper, even fairly prosaic ones, you need to begin designing the paper. You have reached some conclusions or gained some understanding, and now need to transfer that to me, your reader. You need to present what you have learned logically so that I can share your ideas. I may not agree with them, but I want to understand what they are and where they came from. I may also agree with them completely.

Start by asking what conclusions you have reached. Write a couple sentences saying where your thoughts have ended up. Now work backward to help your reader reach those conclusions. Arrange what you have learned to lead one to those conclusions, including evidence that supports your conclusions and any that detracts from it.

You will probably want to start by explaining (some of) the systems you have studied, their goals and function. You will also need to discuss how they are related and what ideas are embodied by them. It may be appropriate to talk about the environments each was designed for and how well they met their goals in that environment. Your goal is to let the reader understand the ideas and show how your conclusions naturally follow.

The design of the paper can take many forms; an outline is a common useful format, but different people's minds work differently. You will not be graded on any outlines or other organizing documents you produce, but I encourage you to produce them. Having a plan and sticking to it can significantly improve your paper. Depending on how comfortable you are with writing, you may want to outline the paper into sections or even right down to the paragraph level.

Once you know what you want to say and how to say it, writing the actual text is time-consuming, but straightforward. Write clearly, simply, and avoid the temptation to create suspense. By the end of the introduction, a reader should know the basic conclusions that the paper will defend and the basic outline of the argument. The rest of the paper should supply background, lay out the specific details of interest and make the relationships between those details clear, leading the reader to the conclusions.

Once you have completed a draft, let someone else read it and give you feedback. If possible, find a native speaker or strong writer to do so. You are allowed to take that person's input without fear of violating the academic integrity requirements. Use good sense, though - this person may not edit your paper or provide you with notes from their own research, for example. If you have questions about if a particular action is acceptable, contact me⁷ and confirm that it is acceptable.

If it seems like this is a time consuming process, I have given you the correct impression. Set aside time to do the work; do not expect to turn in a paper written overnight and expect a good grade. Research should be done steadily throughout the semester and could take 2 weeks or more of reasonable attention - say 2 hours a day on every other day. The outlining step can take another couple days of 2 hour effort. Finally writing the paper can take several days of concentrated effort, more if you are not a proficient technical writer. Do not be surprised to spend a week. Those numbers are just guidelines, you may be slower or faster.

You may discuss your outline or topic coverage with me, and in general terms with other students. I will not read your full paper other than to grade it, however. You can show me paragraphs or excerpts if you have questions. If you have questions about proper citation of work or plagiarism, *please* bring those questions to me⁸. I will read larger excerpts for the purposes of avoiding plagiarism. Sooner is much better than later for such questions.

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Plagiarism and Academic Integrity

It should go without saying that the term paper is subject to the USC code of Student Conduct.⁹ In particular, should a paper be plagiarized, the student who “wrote” it will be subject to the harshest penalties.¹⁰ The least that will happen to you if you are caught violating the code is that you will fail the course.

There are *many* resources that can guide you in avoiding plagiarism. They include the Office of Judicial Affairs and Community Standards' publications,¹¹ especially *Trojan Integrity: A Guide for Avoiding Plagiarism*¹²; speaking to the people in the Office of Student Judicial Affairs and Community Standards;¹³ and speaking to me.¹⁴

Even if you are certain you understand what plagiarism is, I encourage you review the documents above. Ignorance will not be accepted as an excuse for plagiarism; it is your responsibility to know what plagiarism is and not to commit it.

Bear in mind that even general reference works such as Wikipedia and encyclopedias must be properly cited if their words are used verbatim. If this is a surprise, that is an indication that you need to read and understand the plagiarism information referenced above.

Also bear in mind that the proposal, though informal, is subject to the same academic integrity standards as the final paper. A plagiarized proposal is grounds to fail the class.

Despite the repeated warnings to the contrary, every semester students plagiarize papers or proposals. Some get caught. Without exception those caught fail the class. Do not expect to talk your way out of an F in csci555 if you are caught plagiarizing a paper.

Format

There are two acceptable formats for the paper:

Parameter	Format 1	Format 2
Font	12 pt	12 pt
Columns	1	2
Left/Right Margins	1 inch	0.75 inch
Top/Bottom Margins	1 inch	1 inch
Gutter width	n/a	0.5 inch
Pages	12	12
Spacing	single	single

Text beyond the prescribed maximums will be ignored.

Papers must be submitted electronically to <csci555@usc.edu>. Postscript, PDF, and ASCII are acceptable formats. If you submit Postscript or PDF, you need to get a confirmation from me that the paper can be printed. *Your submission is not complete until you get such a confirmation.* Papers received on time, but not confirmed until later will incur no penalty.

⁹ <http://web-app.usc.edu/scampus/university-student-conduct-code/>

¹⁰ http://web-app.usc.edu/scampus/wp-content/uploads/2008/07/appendix_a.pdf

¹¹ <http://www.usc.edu/student-affairs/SJACS/pages/students/publications.html>

¹² <http://www.usc.edu/student-affairs/SJACS/forms/tig.pdf>

¹³ <http://www.usc.edu/student-affairs/SJACS/>

¹⁴ <mailto:csci555@usc.edu>

It is wise to send a short submission from your document preparation system to me well in advance of the paper due date to confirm that your software can produce printable output and that you are capable of doing so. I'm happy to provide this feedback. Debugging remote printer problems under a deadline will prematurely age you.

Citation Requirements

The most important aspect of citing others' work is that the citation be present, however, there are some basic standards to follow in making a citation clear. Any citation must include:

- The author or authors of the work
- The title of the work
- Where it appeared (journal, conference proceedings, book title)
- Date of publication

Notice that a title and a URL are insufficient. Incomplete citations are not counted against your requirements and adversely affect your grade.

Some resources are only available on line, and if you choose to use those references, you need to fill in as many of the required fields as possible to make it as easy as possible to find the reference. If the reference has not been formally published, for example an online FAQ, you should include the date you consulted it. Unpublished resources do not count toward your minimum reference requirements.

Deadlines

What	When
Proposal Submission	11 Mar 2011
Proposal Accepted	1 Apr 2011
Proposal Changes (discouraged)	15 Apr 2011
Paper Due	29 Apr 2011

All deadlines are at 11:59:59 PM Pacific time on the date given - the last second of the day. It is unwise to push those limits if it can be avoided. One example of a potential problem is that I will not necessarily be reading my e-mail until midnight on a due date to let you know if there is a problem.

Missing any of the deadlines above means your paper is subject to the late penalties outlined below. In particular late submissions or acceptances of proposals will reduce your final paper grade.

Late Policy

A late paper is subject to the following penalties:

One day late	-15%
Two days	-30%
Three days	-50%
Four days	-50%
Five days	-75%

I will not accept papers more than 5 days late.