

Research Paper

The ECE 485 research paper is a semester-long paper you will write on the Computer Architecture topic of your choice. At the end of the course you will also give a **25 minute** presentation on your topic to the class. You will also have a faculty member serve as the mentor for your paper, helping you with the various paper milestones throughout the semester.

Format

Most journal articles are two column and single spaced, which makes for nice reading, but poor reviewing. The final version of your paper will be this journal style in an IEEE format. However, the draft versions of your paper will be single column and double spaced to make it easier to review with your mentor.

Specifics of the Draft Format:

- Single column and double spaced
- Times New Roman, 12 pt,
- Page numbers on 2nd and following pages, in the top right corner
- No title page. No table of contents.
- Abstract does not have a section number. See the IEEE template for how to number (and format) the section headings.
- Table captions are similar, but placed above the table.
- Figures and tables should be used effectively. They should not take up any more space than is necessary. If you use a figure in your paper, you need to explain/discuss it. Don't reference the location of a figure in your text. For example, don't say "in the figure below, _____"; instead say "in Figure 5, _____"
- You must provide a reference for figures unless you created them yourself
- Equations should be numbered (see example), and any symbols used in the equation should be defined and discussed.
- Citations are made with square brackets and a number. References are listed in the order they appear in the paper, with a number that matches the citations. (if your mentor suggested another method of citation, I'm ok with that but this is the default). See the examples for the format for the citation.
- Target size: 4000 to 6000 words.

Specifics of the Final Format: We will use the IEEE journal format. See attached word template. Same requirements as the draft except:

- Double column and single spaced
- Font: Times New Roman, 10 pt

Bonus points will be given if you use LaTeX.

Suggested Structure

Abstract – should entice the reader with specifics on what you will talk about and significant findings (results or insights) resulted from your research.

Introduction – set up why this is an important research area. Last paragraph should be an overview of what will be discussed in each of the following sections.

Background – what does the reader need to know about the topic to understand the particulars you will be focusing on. Describe the entire area. This is often a review of "related work."

Cool thing #1 – the meat of the paper. Covers some intriguing aspect of the topic.

Cool thing #2/3/4 – more intriguing stuff.

Future work – what other cool things are happening in the area? Where do you think the field will be in 10 years?

Conclusion – should not introduce any new material

References – You **MUST** cite a minimum of 8 references, with at least 6 being technical journal article references. I do not want marketing info downloaded from the Web and used as your primary source of information. In rare cases, a whitepaper or website may be cited, usually in the context of a standards organization.

Research Paper Key Dates/Timeline

Lesson Number	Due
3	Library Day... Librarian will teach about various tools to find relevant papers
6	Select research topic (List your 3 top topics)
9	Find and summaries your first journal/conference article
13	Summary of four additional journal articles
15	Paper Outline and Mentor Meeting #1 due
27	Rough Draft and Mentor Meeting #2 due
33	Almost Final Paper and Mentor Meeting #3 due
34	Final Paper due
36-39	Oral presentations

Topics

Product papers tend to do poorly compared to concept papers. For instance, if you are discussing the Transmeta Crusoe chip, your paper will probably tend to be a marketing statement. However, if you discuss dynamic voltage scaling (possibly using the Crusoe as an example), your paper will more easily cover the technology, not the product.

Also, make sure to cover the Computer Architecture issues. A paper on technology used in computers might not touch on how it affects the designer. For instance, quantum computing is a troublesome topic. You spend too much time figuring out how to store a bit, and nobody has a good handle on how the design works anyway.

Finally, don't pick a topic that we will discuss to a great level of detail in class. You need to be adding knowledge to the course, not re-teaching.

Topic ideas

- Implementation of multiple CPUs using FPGAs
- Parallel programming
- Multiple processors
- SuperComputing Architectures
- Reconfigurable Computing (FPGA + CPU)
- Adaptable/Dynamic Computing (FPGA)
- Active Network Devices (Active Disks)
- Simulation techniques
- Advanced instruction scheduling (beyond Tomasulo)
- Memory Expansion Technology
- Architectural support for Hyperthreading/Multithreading
- Power sensitive computing
- Secure computing Architectures
- New Operating System Technology and how it affects Computer Architecture
- Fault Tolerance
- Real-Time computing
- Optimizing Compilers
- Neural Network computers
- Performance validation
- Asynchronous Computing (Data Flow Machines)
- General Purpose Programmable DSPs (Digital Signal Processing)
- Programmable DMA controllers for DSP (Digital Signal Processing)
- Graphics Accelerators or Graphical Processing Units (GPUs)
- Other Specialized Architectures to Support Targeted Applications
- Quantum Computing
- Internet-of-Things Architectures
- Architectures for Reliability in Space
- Computer architecture and network for Automobiles
- Analog Computing
- Asynchronous computers (versus synchronous)
- Specialized Network Processors to support Routers/Gateways/Bridges
- Storage Area Networks (SANs)
- Wireless Communications, Self-organizing networks
- DSL/ADSL
- Architectures for Cloud Computing

Potential Research Paper References

Journals under Association Name

- Association of Computing Machinery (ACM) {Abstracts on website}
- Institute of Electrical and Electronics Engineers (IEEE) {Abstracts on website}
 - IEEE Micro
 - IEEE Transactions on ... (Computers, Parallel and Distributed Systems)
 - IEEE Software, Etc.
- American Society of Civil Engineers

- American Society of Mechanical Engineers

Other Journals

- Computer
- Computer Design
- Computer Graphics
- Computer Networks
- Computers and Electronics
- Computer Surveys
- Control Engineering
- IBM Journal of Research & Development
- IEE Review
- Microprocessor Report
- ACM Computer Architecture News: Special Interest Group on Computer Architecture (SIG ARCH)
- Parallel and Distributed Computing
- Parallel Computing

Conference Proceedings

- MICRO
- ASPLOS
- CASES
- FPGA
- ISCA
- HPDC
- International Conference on Parallel Processing
- International Symposium on Computer Architecture
- Symposium on the Frontiers of Massively Parallel Computation
- International Conference on Supercomputing
- Symposium on Architectural Support for Programming Languages and Operating Systems
- Symposium on Parallel Algorithms and Architectures
- International Parallel Processing Symposium
- IEEE Symposium on Parallel and Distributed Processing