You are required to conduct a study on a computer architecture topic of your choice, and submit one term paper describing your analysis, opinion, and conclusion. You may work alone or with a partner to complete the work. You will be graded on a) the completeness of your survey, b) the accuracy of your summaries, c) the supporting evidence for your opinions, and d) the quality of your report.

Three milestones on your study:

1. [10 pts] A preliminary report: *"What is the problem statement? Why is it interesting and challenging?"*
2. [10 pts] A detailed progress report: *"What are your sources, initial findings, and comparisons?"*
3. [80 pts] The final report. Report: *"What is your opinion and conclusion?"*

Possible areas for the term paper/project, (but not limited to):

1. **Benchmarking:** New applications, scientific applications benchmarking. Performance modeling. Graphics benchmark design and implementation.

2. **Instruction Set Design and Measurement:** Condition codes. Explore the similarities and differences. Explore the cost, performance, programming, and compatibility issues of segmentation and 64-bit architectures.

3. **Instruction Level Parallelism:** Pipeline structures, branch prediction, etc. Limits to ILP. Evaluation of dynamic branch prediction schemes for deeply pipelined superscalar machines.

4. **Next generation microprocessors:** System-on-chip processors, multi-core processors, chip multi-processors. Smartphone architectures. GPU-based architectures. Brain-inspired devices and infrastructure.

5. **Memory Systems:** High-performance memory systems. The processor to cache and cache to processor bandwidth requirements. Interleaving techniques. Cache policies.

6. **Special purpose HW:** Embedded systems. HW support for PL. Cache compression and decompression on the fly. Accelerating the RISC processor using FPGAs. Implementing cryptography on FPGAs. VLIW architectures for embedded processors.

7. **Low power architectures and systems:** Quantitative analysis of network interface power management in portable computers. Low power design for microprocessors. Quantum computing.

8. **Multithreading:** Multithreaded processor, cache design. New technologies and their architectural implications. Power efficiency.

9. **Multi processors/computers:** Shared memory – Distributed memory. Evaluate and compare current representative architectures.

10. **Large computers:** Clusters. Cloud Computing. Cognitive computing and augmented intelligence. Data-centric systems.

Reference Sources

1. IEEE Computer Magazine
2. IEEE Transactions on Computer
3. Communications of ACM
4. IEEE Tutorials, such as Tutorial on computer architecture, on supercomputing, etc.
5. Proceedings of Int'l Conf. on Parallel Processing
6. Proceedings of Int'l Symposium on Computer Architecture: available in the volumes of Computer Architecture News
7. Journal of Parallel and Distributed Computing
8. ACM Transactions on Computer Systems
9. IEEE Transactions on Parallel and Distributed Systems
10. ACM Computing Surveys
11. ACM Transactions on Modeling and Simulation
12. IEEE Transactions on Knowledge and Data Engineering
13. IEEE Transactions on VLSI
14. IEEE Transactions on Neural Networks
15. IEEE Micro
16. Journal of Supercomputing

and others.

Paper Review Form (for your own review):

Full reference to conference or journal:

Problem addressed:

What is the main idea of the paper?

What are the advantages, disadvantages, and limitations of the approach described?

What experimental results are used to back up the ideas of the paper? Is the experimental procedure clearly described? Are the results reasonably complete?

Term Paper - Preliminary Report:

Name:

Are you working on the project alone or with a partner?

What is the general area of project you are considering working on?

What is your draft project title?

Have you identified papers that will assist you with your project?

Term Paper - Progress Report:

Name (if with a partner, both names):

Project/Paper Title:

A short abstract:

References:

Term Paper - Final Report:

Possible elements of your final project paper (like a research conference paper):

1. **Title and Abstract** (0.5 page): A descriptive title communicating what your project is about and a broad overview of the paper, ending with a short statement of its major outcomes.
2. **Introduction and background** (3-5 pages): Sets the motivation behind (and stage for) the paper. Starts out broad and then gets specific about your project. End this section with description of what you did and key results and/or observations.
3. **Analysis** (as long as necessary; about 10-12 pages): Documents the process you followed and discuses your research findings. Alternative approaches/systems are presented with their pros and cons. Visuals such as figures/tables/flow charts/block diagrams are appropriate here.
4. **Future work and conclusion** (1 page): Things you wish you had time to do but could not due to time limitation and things that can be based on this study.
5. **References:** A complete bibliography of the references you used for your research.
6. **Appendix:** Include (6-10) power point presentation slides that summarize/presents your paper.

Report Evaluation:

Basic Requirements: All papers that satisfy all the following basic requirements will have a base score of 60 points. The maximum points deducted for noncompliance is indicated in parentheses.

- Paper is at least 5,000 words long, including title page and bibliography (10)
- At least 6 sources properly listed on references page per APA or MLA format, and all sources listed in the bibliography are cited correctly in the text. (5)
- Paper guide instructions followed, i.e. sections labeled, pages numbered (5)
- Paper adheres to basic standards of grammar and spelling (5)
- Paper adheres to chosen topic (5)
- Abstract section identifies topic, controversy of topic, and goal of paper (5)
- Introduction and Background sections outline the basis for the paper (5)
- Discussion sections provide enough details (5)
- Conclusion section summarizes arguments in support of goal (5)
- At least 6 Power Point slides sufficiently summarize the paper (10)

Quality Points: (0 = Minimal, 3 = Average, 5 = Excellent)

- Quality and clarity of abstract (goal statement)
- Quality of research (books, magazines, online)
- Quality of organization of discussion sections
- Persuasiveness of arguments, accuracy of conclusions