CSE 431
Spring Quarter 2002
Project Description

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Introduction

There are two avenues for the project:

1. Theoretical research investigation: In this project an interesting topic is chosen, a relevant important paper (or papers) is found, and the paper is read. A summary of the results and their importance is written up in a report.

2. Historical investigation: In this project a book on the history of the computer is chosen and read. A report comparing the book's version of computer history and Martin Davis' version of history is written.

Students are welcome to form small groups of up to 2 students per group to work on a project. Students may also work individually.

The Proposal

Each student or group of students should send me (ladner@cs.washington.edu) e-mail on or before Monday, May 13, 5:00 pm with their proposal. I recommend the proposal be sent as early as possible so that I can help judge its feasibility and give advice. All proposals will need approval and I will reply to each proposal within 24 hours of receiving it.

The proposal must contain the following:

1. Names of the students involved in the project.

2. Title of the project.

3. References (papers or books) to be used in the project. You should have these references in hand so that I know you won't get stuck finding them.

The Report

Students working individually turn in a 4 to 5 page paper. Students working in groups turn in a 8 to 10 page paper. The paper is due on or before Friday, June 7, 5:00 pm. The paper can be given to the secretary in Sieg 114 in an envelope with my name on it. The paper should contain the following components:

1. Title of the report.

2. Authors of the report.

3. Introduction which includes the purpose of the report.

4. Sections (with titles) giving the results of the investigation.

5. Conclusion giving the authors final comments.

6. References that were used in project.

The report must be typed in 11 or 12 point type. It should be checked for spelling and grammar. It should be well organized and address the appropriate issues described in the Introduction and other issues that you deem important. You should assume that your audience is students who have completed CSE 431 so they have some sophistication in computer science theory.

For help in writing students are encouraged to go to the Engineering Writing Center which is located on the second floor of the Engineering Annex building west of Loew Hall or can be found on the web at http://www.engr.washington.edu/ ewc/.

Suggestions for theoretical research topics

You may choose from any of these topics are choose one of your own. Look through Sipser's book for alternative topics that interest you or look at last years topics.

1. Context-free language membership can be solved in $O(n^3)$ time and faster. (page 146, Sipser)

2. Theory of the natural numbers with addition only is decidable. What is its time and space complexity? (page 207, Sipser)

3. Theory of the reals with addition and multiplication is decidable. What is its time and space complexity?

4. Testing for $LR(k)$-ness of context-free grammars is undecidable.

5. For k fixed, testing for $LR(k)$-ness requires exponential time.

6. Testing for primality is in random polynomial time. (page 336, Sipser)

7. Testing for primality is in NP.

8. Quantified Boolean formula validity is PSPACE complete. (page 283, Sipser)

9. The circuit value problem is P-complete. (page 371, Sipser)

10. First-order validity is Turing recognizable but not decidable.

11. Problems BPP have nonuniform polynomial size circuits. (pages 336 and 321m Sipser)

12. Nondeterministic space complexity classes are closed under complement. (page 300, Sipser)

Suggestions for historical research

You may select from any of the following books or choose one not on the list.

1. *Alan Turing: The Enigma*. Andrew Hodges. Walker and Company. 2000.
2. *Gödel: A Life of Logic, the Mind, and Mathematics*. John L. Casti, Werner Depauli. Perseus Books. 2000.
3. *The Computer from Pascal to von Neumann*. Herman H. Goldstine. Princeton University Press. 1972.
4. *The Universal History of Computing from the Abacus to the Quantum Computer*. Georges Ifrah. John Wiley and Sons. 2001 with earlier versions.
5. *Eniac*. Scott McCartney. Walker and Company. 1999.
6. *Before the Computer.* James W. Cortada. Princeton University Press. 1993.
7. *Computer: A History of the Information Machine*. Martin Campbell-Kelly and William Aspray. Basic Books. 1996.
8. *Engines of the Mind*. Joel Shurkin. W.W. Norton and Company. 1996.
9. *A Few Good Men from Univac*. David E. Lundstrom. Replica Books. 1997.
10. *Turing and the Computer (The Big Idea)*. Paul Strathern. Totem Books. 2001.