

Proposal for a tutorial at ITiCSE 2003

Teaching Computer Science Using MMIX

Title

Teaching Computer Science Using MMIX

Organizer

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Category

Half-day (three hours)

Description

Introduction

MMIX is the successor of Donald Knuth's famous MIX-processor introduced in "The Art of Computer Programming". Its clean RISC-design and easy to use tools (assembler and simulator) make it extremely suitable for use in introductory computer science courses. For advanced courses in Assembly Programming and Computer Architecture, a widely configurable pipeline simulator allows the inspection of internal details of a working RISC processor that are usually hidden by high level languages taught today.

Furthermore, as MMIX will be a basis for demonstration of the algorithms presented in "The Art of Computer Programming", a thorough understanding will open the door to that wonderful series of books.

Activities

Introduction to Architecture and Programming of MMIX: We will present the fundamental architectural concepts of this very cleanly designed RISC machine: Register Set, Instruction Set, and Memory Layout.

We will give hints on the critical points when using MMIX in class and share our experiences regarding teaching schedule and sequence of topics.

This part includes usage of the assembler `mmixal` and standard simulator `mmix` with its built-in debugging features.

Student Projects: We report on possible student projects that were tested in practice at our institution covering the basic features of MMIX. Participants of the workshop will have the opportunity to deepen their understanding of the material presented in the previous section and gain hands-on experience by experimenting with these sample problems.

Advanced Features of MMIX: The advanced features of MMIX discussed next are:

- Its register stack for a simple and efficient procedure call mechanism.
- Its TRIP and TRAP instructions for interrupt handling and operating system calls.
- Its MOR and MXOR vector instructions.

Background of the Presenters

The presenters are professors for computer science at the Munich University of Applied Sciences, where, already four years ago, MMIX has been established as an integral part of the curriculum.

The presenters are authors of the book “Das MMIX-Buch“, Springer-Verlag, 2002. This book discusses all aspects of MMIX in great detail and can serve as a technical reference.

Abstract for Publication

Donald Knuth uses MMIX to present algorithms in the new edition of “The Art of Computer Programming“. The clean RISC-design and easy-to-use tools make MMIX extremely suitable for computer science courses.

The tutorial explains the fundamental architectural concepts and continues to more advanced topics and tools. It shares experiences gained in class, e.g. using the pipeline simulator to analyze cache performance.

Participants can gain hands-on experience.

Equipment Needed

- Beamer (could also be provided by the presenters).
- For projects, participants should have access to either a personal laptop or computer facilities provided by the conference. Software will be provided by the presenters.