



BROWN

FALL 2020

PROF. IRIS BAHAR

SEPTEMBER 9, 2020

LECTURE 1: COURSE INTRODUCTION

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INSTRUCTORS

- Iris Bahar
 - Prof. of Engineering, Prof. of CS
 - Office: CIT449
 - Research interests: energy-efficient computing, computer architecture, robotics, emerging computing technologies
 - Teaching interests: digital design, robotics, emerging technologies, VLSI, low power computing, design

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A LITTLE BIT ABOUT ME

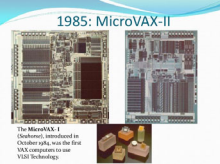
- B.S., M.S. in Computer Engineering from the University of Illinois, Urbana
- Needed to find out what a computer engineer really did...
 - Went off to work in microprocessor design industry after graduation



VAX Family: 1977 - 1992



1985: MicroVAX-II

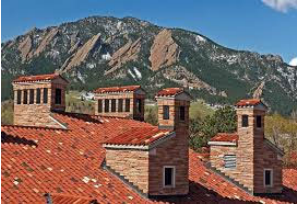


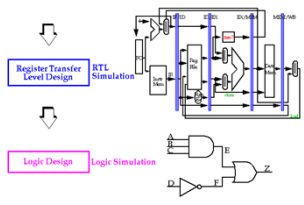
The MicroVAX-II, introduced in October 1985, was the first VAX computer to use VLSI technology.

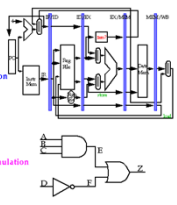
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A LITTLE BIT ABOUT ME

- Ph.D., in Computer Engineering from the University Colorado, Boulder
 - Strong group in electronic design automation
 - Dissertation: automatic logic synthesis for low power design







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SCOPE OF MY RESEARCH

- My research interests:
 - Energy-efficient and reliable computing, from the system level to the device level.
- Examples:
 - Energy-efficient data management across multiple computers
 - Enabling low-power and reliable computing in error-prone computing conditions
 - Efficient techniques for online error detection
 - Approximate computing (at the architecture and circuit level)
 - Accelerating image processing algorithms using specialized hardware
 - Efficient use of Machine Learning and computing in robotics

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ABOUT THIS COURSE

- This course will consider how emerging device technologies will affect our past assumptions about computing from both a hardware and software perspective.
- Class will include a mix of lectures and discussion on assigned reading of recent publications. Students will be responsible for leading and participating in these discussions.
- A final project of your choosing will allow you to delve deeper into a topic discussed in class

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COURSE FORMAT

- This course is officially being offered in a hybrid format
 - TBD: Percentage in-person vs. remote
 - This semester will be one big experiment, so we all need to be flexible...
- Class time will be primarily discussion based, so it is important that you participate during class (in person or zooming)
- Lecture will be *synchronous only*
- In addition, supplementary online discussion will be required via canvas (in teams or individually).

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COURSE GOALS

- Learn the physics and operating basics of several emerging technologies used in computing
- Understand and critically analyze research papers
- Extrapolate from current research and develop new research ideas
- Develop and implement a project in software or hardware that validates a new or previously published idea.
- Understand how ideas/concepts learned in this course can be applied to other research investigations.

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CLASS MEETING TIMES

- Lectures M,W 3:00-4:20pm, (zoom or McMillian 117)
- Office hours:
 - Mondays 4:30-5:30pm, ERC lobby (or zoom)
 - Tuesdays 10-11am, CIT449 (zoom)
 - by appointment

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MEETING TIME LOGISTICS

- I know some of you taking this course remotely
- I know some of you will be zooming in across many time zones
- I know that 3am is not a convenient time for some of you have class
- Depending on who is registered for the course and where you are physically located this semester, I will explore alternate meeting times
- Remember: this course is set up for synchronous lectures since class participation is essential.

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COURSE REQUIREMENTS

- Zoom.
 - It is preferable that you have your video on during class to encourage better engagement, so if you have the internet bandwidth, please use video during class time.
- VPN
 - You may need to access papers directly from publication sites, which may require to be on the Brown VPN.
 - download [F5 Desktop client](#) from software.brown.edu

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DIVERSITY AND INCLUSION

- It is my intent that students from all diverse backgrounds be well-served by this course.
- The diversity the students bring to this class is a resource, strength, and benefit.
- I aim to present materials and create an environment that is inclusive and respectful of diversity
- Likewise, I expect all students in class to be respectful of diversity and do their part in creating an inclusive environment.
- Your suggestions are encouraged and appreciated.

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COURSE ASSIGNMENTS

- **Discussion:** Most classes will consist of discussion of 1-2 papers on a particular emerging technology topic.
 - All students expected to read papers before class and come prepared to discuss them.
 - Student teams meet to review paper before class and must post comments to online discussion board (via Canvas)
 - Summarize key aspects, raise questions, discuss open issues, ideas for future work.
 - 1-2 designated discussion leaders assigned for each class. Start by reviewing comments. Discussion leaders generally get to select the reading for that class.
 - It is expected that *ALL* students be involved in active discussion of the papers.
- **Homework:** Expect 1-2 homeworks (not a major component of this course)
 - Use of open source tools to evaluate some emerging technology.
- **Final Project:** Last 6 weeks of course. Investigate some aspect of emerging technologies or non-conventional computing. Group projects (typically groups of two) are possible.

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MORE ABOUT PAPER DISCUSSION

- **Online discussion:** Managed through the Canvas discussion board
 - Paper evaluations will be done in teams of 2 people.
 - Everyone on the team is responsible for making sure he/she understands the essence of the work.
 - What are the most innovative components and weaknesses?
 - Do you have follow-up ideas to develop into extended research projects?
 - What are some relevant related works?
 - Team members are responsible for setting up their own zoom/hangout sessions to have these discussions.
 - **Etiquette:** Posts should be substantive, professional in content, and discussion provoking. No inflammatory statements (but disagreeing with another student, or the instructor is perfectly fine).
- **Class discussion:**
 - Online discussion posts will be our starting point for class discussion.
 - 1-2 students from class will be designated as scribes during class time discussion. Scribe notes will be compiled in a shared google document.

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GRADING

- Following is a *tentative* breakdown for the course grading:
 - **Discussion Leader Presentations:** 20%
 - **Online Discussion Participation:** 25%
 - **Class Participation:** 10%
 - **Final Project:** 35%
 - **Homework:** 10%

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DISCUSSION #0: INTRODUCTION

1. Log on to Canvas and select this course: CSCI2952J
 - Go to Modules → Course Orientation and read through the course Welcome & Overview
 - Set up your Profile and Notification preferences, then click Next at the bottom of the screen to view Assignment #0
2. **Self introduction:** share with the class something about yourself
 - Where is your hometown? What year are you in your studies?
 - What research topics are you working on?
 - Why are you interested in taking this course?
 - What are your hobbies?
 - Add a fun photo or video clip
3. Click **Reply** to post your response to the questions posed above.
4. After a few of your peers have posted their introductions, click **Reply** and respond to 2-3 posts.
5. Please **complete by Sept. 18** (the sooner the better)

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WEEK #1 ASSIGNMENTS

Under Modules → Week #1 you will find links to today's assignments:

1. Complete Discussion #0 introducing yourself
 - Find under the orientation module
2. Submit a [list of topics](#) about which you are most interest in learning.
3. Read the following 2 papers:
 - [Computing's Energy Problem \(and what we can do about it\)](#)
 - [The era of hyper-scaling in electronics](#)
4. Complete the [online discussion](#) for the papers

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SUBMIT TOPICS OF INTEREST

- Find under Modules→Week #1
 - Click on [list of topics](#)
 - Also find under Assignments→Assignment #1
- Think of topics you are most interested in learning about this semester. They may or may not relate to your own research.
- Submit as a text entry with a list of 2-4 topics you would like to cover this semester.
- This will help me plan paper topics for the semester and pair up people with mutual interests.
- **Due by Sept 16**

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OVERVIEW OF EMERGING TECHNOLOGIES

Read and comment on 2 survey papers on emerging technologies

- Find under Modules→Week #1
 - Read the following 2 papers:
 - [Computing's Energy Problem \(and what we can do about it\)](#)
 - [The era of hyper-scaling in electronics](#)
 - Click on [online discussion](#)
- For the first reading assignment, please complete evaluation alone. Post 1-2 comments that related to the following (or something similar that sparks your interest):
 - What big new idea did you learn?
 - How does this relate to your own research interests?
 - What topics were you most familiar with?
- Post your comments by the end of **Monday, Sept. 14.**

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COMING UP FOR WEEK #2

- Many emerging technologies focus on replacements for silicon-based memory design
- Before we jump into research papers, I will spend a week reviewing computing memory hierarchy design
- Recommended textbook:
 - Hennessy, Patterson, *Computer Organization and Design: The Hardware/Software Interface*, Morgan Kaufmann

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COMING UP FOR WEEK #3

- We will start our paper discussion during the 3rd week of class:
 - *Emerging NVM: A Survey on Architectural Integration and Research Challenges*
 - *Memory that never forgets: emerging nonvolatile memory and the implication for architecture design*
- I will post papers for week #3 some time next week
 - I will assign teams for reviewing the papers
 - Expect different team assignments weekly
- I will also assign discussion leaders for the week
 - If you want to volunteer, let me know
 - We will rotate discussion leaders throughout the semester. Expect to lead 2-3 times
- Starting the 5th or 6th week of class, students will be able to choose papers to review

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QUESTIONS?

- Send me email if you have questions
- I will stay on zoom for my office hours today

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