CSE 720 SYLLABUS

DESCRIPTION

While the success of app marketplaces has made it easier to distribute mobile apps, global distribution has made it harder to write them. To achieve good performance on billions of devices around the globe, mobile apps must run efficiently on a wide variety of hardware, cope with constantly changing network conditions, conserve limited energy resources, and deal with varying availability and accuracy of core services such as location, all while satisfying a diverse community of users. This diversity creates development-time uncertainty for app programmers, who may be unsure how to adapt their app to achieve good performance at all times, for anyone, anywhere.

My research group is working on a new system, maybe which addresses the challenge of mobile systems adaptation by allowing programmers to expressrather than suppressdevelopment-time uncertainty. A new language construct allows programmers to indicate where they are uncertain about what to do, what legitimate options are available, and what constitutes success or failureall things that can be determined at development time. Post-deployment testing and machine learning are then used to resolve the uncertainty by crafting effective data-driven adaptation strategies once more information is known.

In this seminar we will both explore other approaches to mobile systems adaptation (through paper reading) and continue to develop, evaluate, and use the maybe system (through implementation). Students will also work in teams on several projects related to the course content. Our goal will be to begin projects which may lead to full-length publications in the spring.

COURSE INFORMATION

- **Prerequisites:** Permission of the instructor. Preference will be given to current PhD students and Masters students currently applying for a PhD. **I am hoping that several students from this seminar will join my research group as PhD students starting as early as Spring 2016.**

- **Website:** `http://piazza.com/buffalo/fall2015/cse720/home`. We will use the Piazza forum for online discussions and to distribute information about assigned papers.

- **Instructor:** Geoffrey Challen (`challen@buffalo.edu`). It is unlikely that you will need to contact me directly. Instead, please use the Piazza forum. Also never call me "Professor", or "Dr" (worse), or "Sir" (even worse). Never.

- **Times and Locations:** To be determined.

- **Exam and Midterm:** There will be no exam or midterm.

- **Auditing**: No auditors are permitted.

APPROACH

Graduate seminars exist to fulfill a variety of ends: some introduce students to published research in a specific area, or walk them through a particular set of ideas or solutions to a particular problem. CSE 720 is different, mainly because there *isn't* much research in this area and not many solutions to this problem. We're right out there on the cutting edge, which is fun but can be a bit disorienting. We'll have to do a lot of thinking for ourselves about how to solve this problem, which is the fun part.

Unfortunately, because of the dearth of material specifically addressing how to use uncertainty to adapt mobile systems, some of the papers may seem off-topic at first. However, my goal is to

introduce you to aspects of existing efforts to adapt mobile systems that are important to understand as we design the maybe system. Viewed in this way, the following topics become potentially relevant to our challenge:

- Previous attempts to build adaptive mobile systems
- Point solutions to specific adaptation problems, such as network selection and computation offloading
- Machine learning techniques required to process and understand our data as well as do prediction
- Pre-deployment simulation and monkey testing
- Software development strategies such as context- and aspect-oriented programming.

My hope is that as we begin reading papers and discussing programming with uncertainty several new research directions will emerge naturally within our group. While I have a few of my own projects that may be a good fit for our objectives, I am eager to allow students in the seminar to develop their own ideas along these lines and start new projects as well as collaborating with students in my group on existing efforts. Choosing the maybe system as our focus provides a broad purview for work on a variety of different types of computer systems, and I hope that whatever your specific interest we can find a project that excites you.

STRUCTURE
I will assign two papers per meeting, which we will roughly break into two 45-minute intervals. For each paper, I will assign a single student to briefly present a 5–10 minute overview of the the paper. Please don't feel the need to prepare slides or notes unless you feel that this is helpful. We are looking for a broad overview to help guide our discussion. For the next 15 minutes of class we will break into pairs to continue discussing the paper, followed by a group discussion for the remainder of the class.

The goal of this structure is to help develop your ability to read and discuss papers. Too many seminar courses end up dominated by only a few voices, and the pair-wise structure is intended to ensure that everyone gets a chance to (or has to) speak during each meeting. It also makes preparation essential, since there is nowhere to hide during the one-on-one discussion. **If you did not have time to read the paper, please do not attend class.** It is fine if this happens a few times during the semester. My goal is to keep the reading level manageable, but also to help you develop the ability to rapidly read and absorb research manuscripts on a variety of topics.

LEARNING OBJECTIVES
The primary goal of this course is to begin several research projects that improve the maybe system or help programmers express and use uncertainty more effectively. CSE 720 attempts to address the following learning objectives defined for doctoral students by the University at Buffalo Graduate School:

- Ability to conduct independent research
- Ability to communicate effectively
- Ability to understand fundamental principles of field
- Ability to publish in a peer-reviewed venue

To these I would add:

- Ability to critically read and discuss a research paper

- Ability to formulate a research problem

- Ability to develop a plan to investigate a research problem, including collecting evidence and presenting a compelling conclusion

- Ability to write a short research paper

PROJECT

The project is the heart of this course. Working with a small group of students, you will perform research on a topic related to the `maybe` system. Given the broad nature of our theme, a variety of projects are possible that will hopefully appeal to many different students, as well as students with different abilities.

We will work together to develop project topics and assemble project teams. Each project group will submit a single six-page report at the end of the semester formatted in the style of a submission to a typical computer science workshop. My goal is that some of these papers *will be* submitted to workshops, specifically to HotOS'15, whereas others may eventually develop into full-length conference submissions. We may also decide to write a single position paper as a group. I will be more than happy to continue working with CSE 720 students after the semester ends on projects of mutual interest. In fact, this is what I hope will happen.

GRADING

Only satisfactory (S) and unsatisfactory (U) grades will be given. To earn a satisfactory grade, you must attend and contribute to in-class discussions and work together on a project team to perform research and prepare a report.

TEXTBOOK

There is no required textbook for this course.

ACADEMIC INTEGRITY

Please review the CSE Department's policy on academic integrity. As this is a graduate seminar with the aim of preparing work to submit to the broader research community, any violations of academic integrity will be taken extremely seriously. Students will receive a U for the course, and the violation will be reported to the department which will result in the cessation of any and all departmental support, according to the department's academic integrity policy:

> It is the policy of this department that any violation of academic integrity will result in an F for the course, that all departmental financial support including teaching assistanceship, research assistanceship or scholarships be terminated, that notification of this action be placed in the student's confidential departmental record, and that the student be permanently ineligible for future departmental financial support.

STUDENTS WITH DISABILITIES

Please register and coordinate with the Office of Disability Services. Let the course staff know when accommodations need to be made. We are committed to helping you learn!