

Syllabus

INFSCI 2955 - Web Engineering

INFSCI 2955

Summer 2012 (2127)

CRN: 19172

Wednesdays 6:00-9:15

School of Information Sciences (SIS) Building, Room 406

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Office Hours: By Appointment

Course Description

Web applications are complex systems that are intended for use by diverse audiences. A thorough, systematic approach is required for the successful development of web application projects. Web Engineering introduces a structured methodology utilized in software engineering to Web development projects. The course addresses the concepts, methods, technologies, and techniques of developing Web sites that collect, organize and expose information resources. Topics covered include requirements engineering for Web applications, design methods and technologies, interface design, usability of web applications, accessibility, testing, metrics, operation and maintenance of Web applications, security, and project management. Specific technologies covered in this course include client-side (XHTML, JavaScript, and CSS) and server-side (PHP).

Course Goals

Introduction

The World Wide Web has become a major delivery platform for information resources. Many applications continue to be developed in an ad-hoc way, contributing to problems of usability, maintainability, quality and reliability. This course examines systematic, disciplined and quantifiable approaches to developing of high-quality, reliable and usable

web applications. The course introduces the methodologies, techniques and tools that support their design, development, evolution, and evaluation.

Goals.

The goals of the course are as follows:

- to be able to analyze and design comprehensive systems for the creation, dissemination, storage, retrieval, and use of electronic records and documents.
- to learn and use some of the client-side and server-side languages used to manipulate information on the World Wide Web – i.e. PHP, and Javascript.
- to learn techniques and evaluation metrics for ensuring the proper operability, maintenance and security of a web application.

Discussion

INFSCI 2955 is a special topics course in Web Engineering for students in the information sciences and related disciplines. Web Engineering focuses traditional software engineering to the design, coding, and deployment of web applications. The course is intended for students who are interested in developing or maintaining web applications in the roles of developers or project managers.

Being a graduate level course, INFSCI 2955 is not designed to be purely programming, although the course's assignments and projects do emphasize programming. The point of this class is to develop a broad understanding of engineering and maintaining web applications at a conceptual level, using programming as a learning tool by applying these concepts to practical assignments.

The first two weeks of the course will focus on the design stages of web application development. We will examine the web application development process, requirements gathering, and modeling applications. Coupled with previous coursework in system architectures and interactive design, the first part of the course lays the foundation for the remainder of the semester.

The focus of the next six weeks shifts to programming on both the client and server-sides. Languages and techniques include Javascript and CSS on the client side, and PHP on the server side. While .NET and Java technologies will be discussed contextually, PHP has been selected as a simpler, more transparent technology appropriate for a first introduction. Students will also have the opportunity to install and configure their own Apache web server and MySQL Community Edition database. Students with accounts

on SIS's web server, Paradox, also have the ability to create CGI or PHP scripts (and thus, do the assignments) without the overhead of having to install and configure their own development environment. Second, the main goal of the course is for students to learn (and experience) the entire web engineering process, not to focus purely on learning a larger enterprise solution.

The final four weeks are devoted to the latter stages of the web application development cycle. Topics include testing, performance measurement, operation and maintenance, and security. During this time, students will also focus their time on working on their final project, which ties together the concepts and techniques learned throughout the course.

Instruction

Prerequisites

Although there are no formal prerequisites for this class, students are expected to have some programming experience (e.g., C, Java). This course covers many of the topics in Web standards and technologies (INFSCI 2560), but it is different enough that it compliments that course. Students who have had usability and system design (LIBSCI 2635, INFSCI 2470) will be able to apply what they have learned in those courses.

Required Text

Kappel, G., Proll, B. Reich, S. & Retschitzegger, W. (2006). **Web Engineering, 1st ed.** Hoboken, NJ: Wiley & Sons. ISBN: 04700-1554-3.

Supplemental Text

In addition to the required text, we will examine material from several O'Reilly books, freely available online to all Pitt students through the University Library System. Links to the O'Reilly e-books will be provided on the Lectures page of the course website. Students may access these links from any machine connected to the Pitt network, or may access them off-campus using their Pitt account through Pitt's Instant Virtual Extranet (<http://sremote.pitt.edu>).

Please note that students are NOT REQUIRED to purchase any of the O'Reilly books. Please contact your instructor if you have problems accessing these books online through your Pitt's Instant Virtual Extranet.

Required Activities

Assignments

There will be four assignments, each counting for 15% of your grade. The due dates for the assignments are listed in the Course Schedule. Assignments submitted after the due dates are subject to a 10% penalty.

More details on each assignment will be available later in the semester, but here is an overview to give you an idea of what is expected:

Assignment 1: Modeling of a web-based application

This exercise is designed to give you practice developing various UML-compliant models. In this exercise, you will practice modeling requirements, content, and hypertext by developing use cases, a class diagram, and a hypertext access model for a document- or message-oriented system, such as a digital library or help-desk system.

Assignment 2: JavaScript Exercise

The goal of this assignment is to allow you to explore and use as many of JavaScript's objects, methods, and properties as possible in a small assignment. Some functions must be written from scratch. Other functions, appropriately attributed, may be downloaded from the web and used as a part of the system or as the basis for your own functions. Students using, without attributing, someone else's code will receive 0 on this assignment.

Assignment 3: PHP Exercise

Build a set of no fewer than three PHP scripts that perform some dynamic server side functionality. Two examples of such programs might be:

- Scripts that process and manage some kind of data store – e.g. an on-line bug report or a guest book.
- A search tool for an online book catalogue. The search tool should include the following pages and features:
 - A Search Form that allows users to search using different criteria.
 - A Results Page listing the resources that match the user's criteria. Each result on the search page should include a "More Info..." link that takes the user to the resource's full description.
 - A Full Description Page dynamically generated for each resource.

Assignment 4: Responsive Web Design Exercise

The goal of this assignment is to allow you to explore solutions for presenting user-friendly web applications on multiple devices. With the proliferation of Web-enabled

devices, namely smartphones and tablets, web developers face the challenge of optimally presenting their site's content on screens of varying sizes and capabilities. In this assignment, you will use the principles of "responsive web design" to redesign the user interface of a small website to improve its usability in a desktop browser, a smartphone, and a tablet. Your instructor will provide you with one or more HTML pages from the website, and you will use responsive design techniques (CSS3, HTML, and perhaps some optional JavaScript) to produce an improved, adaptive interface.

Final Project

In addition to the four assignments listed above, students will complete a final project that counts for 30% of the course grade. About mid-way through the semester, students will submit a brief final project proposal to the instructor (5% of the course grade.) The final project requires each student to apply all of the concepts and techniques learned throughout the course while developing a functional prototype of a system. Students may work together in pairs (recommended) or individually to complete the final project. More details will be given throughout the semester, but here are a few potential project ideas students may consider:

- Help Desk system (builds off of Assignment #3)
- Blog system, including both public and admin pages.
- Small social network system

Any other ideas are welcome, provided their nature and scope is appropriate for the final project.

Grading

- Assignments: 60% (4 assignments, 15% each)
- Final Project Proposal: 5%
- Final Project: 30%
- Class Participation: 5%

Final grades will be assigned as follows:

<i>Grade</i>	<i>Points</i>	<i>Grade</i>	<i>Points</i>
A	93-above	B-	80-82
A -	90-92	C+	77-79
B+	87-89	C	70-76
B	83-86	D	60-70
		F	0-59

Course Schedule

May 16 - Overview of the Course.

Introduces Web Engineering, a sub-discipline of Software Engineering whose methods and techniques are adapted to the special characteristics of Web-based applications. Also discusses the critical initial stage of the Web application development process – gathering requirements – and adapting traditional practices to the unique challenges of the Web.

- *Chapter 1: An Introduction to Web Engineering*
- *Chapter 2: Requirements Engineering for Web Applications*

May 23 - Modeling Web Applications.

Introduces modeling techniques inspired by object-oriented design models found in traditional software engineering, but are adapted to the particular needs of web engineering. Topics include content, hypertext, and customization modeling; use cases, class diagrams, and sequence diagrams

- *Chapter 3: Modeling Web Applications*

May 30 - Client-Side Technologies

****ASSIGNMENT 1 DUE****

The lecture provides a brief review of CSS, cookies, and the Document Object Model. The majority of the lecture is devoted to introducing JavaScript, the language reference, and how JavaScript can be used to manipulate the DOM.

- *Chapter 6: Technologies for Web Applications (skim over)*
- *Other readings to be provided*

June 6 - Client-Side Technologies (continued), Usability, and Accessibility

Continues the discussion of client-side technologies. Discusses the concepts and techniques for engineering and evaluating user interfaces appropriate for a Web application's intended audience. Explores the interaction between users and the application's user interface. Special attention will be paid to Web technologies and standards available for audiences with special needs.

- *Chapter 11: Usability of Web Applications*

June 13 – Developing Web Applications

******ASSIGNMENT 2 DUE******

In this lecture we discuss the web application development process, as well as common web application architecture patterns. Iterative development, development cycles, Rational Unified Process (RUP), Extreme Programming (XP).

- *Chapter 4: Web Application Architectures*
- *Chapter 10: The Web Application Development Process*

June 20 & 27 – Server-Side Technologies

Introduces the PHP5 scripting language. Syntax, language reference, libraries, file access, DBMS access (esp. MySQL), form processing, and other techniques will be presented/demonstrated. Walks through the installation and configuration of MySQL, the Apache Web Server, and PHP5 for a development environment.

- *Readings to be provided*

July 4 - No Class – Independence Day Holiday

******ASSIGNMENT 3 DUE ******

July 11 – Responsive Web Design & Testing

******FINAL PROJECT PROPOSAL DUE******

In this lecture we discuss techniques utilized by the responsive web design approach, revisit CSS and introduce key elements of CSS3, and install an Android emulator for testing purposes. The remaining time will be used to discuss various testing techniques for web applications as a whole.

- *Chapter 7: Testing Web Applications*

July 18 – Security

******ASSIGNMENT 4 DUE ******

This lecture provides a discussion of the various aspects of web application security. Topics include encryption techniques (digital signatures, certificates, PKI), securing client/server interactions, vulnerabilities at the client (desktop security, phishing, etc.) and the server (cross-site scripting, SQL injections, etc.)

- *Chapter 13: Security for Web Applications*

July 25 – Operation, Maintenance, and Project Management

In this lecture, we will discuss issues and challenges related to web application operation and maintenance, including more detail about search engine optimization, PageRank, and Google AdWords. Concludes with tasks and challenges in project management, managing teams, and risk management.

- *Chapter 8: Operation & Maintenance of Web Applications*
- *Chapter 9: Web Project Management*

August 1 – Introduction to AJAX

******FINAL PROJECT DUE Sunday, August 5 at 11:59PM******

This lecture introduces and demonstrates Asynchronous Java and XML (AJAX), a technique for combining JavaScript, the HTML DOM, and server-side scripting for building highly interactive web applications.

- *Readings to be provided*