Comp-4400 Principles of Programming Languages (Fall 2019)

1 Teaching Staffs

The instructor of this course is Professor Jianguo Lu, School of Computer Science, University of Windsor. His contact details are:

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- Course web site: `http://cs.uwindsor.ca/~jlu/440`, also in Blackback site.
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- Office: 5111 Lambton Tower

2 Times and places

- Lecture time and place: Monday and Wednesday 10:00-11:20. Essex Hall 186.
- Office hours: Monday and Wednesday 12:00-1:00.
- Midterm exam: October 23, class time.

3 Course Overview

The goal of this course is to provide an exposure to important concepts and principles in programming languages and their implementation techniques. The focus is to explore different programming paradigms, such as functional programming, logic programming, object-oriented programming, aspect-oriented programming, and new developments in programming such as XML-based programming languages. We will also introduce formalisms for describing program- ming languages, in particular axiomatic semantics.

4 Course prerequisite

The prerequisite of this course is minimum grade of D- in 60-212, 60-214, 60-231, and 60-254.

5 Course contents

The tentative main components of this course are:

- Week 1: Overview, Programming language classification and history, paradigms of programming languages;
- Week 2-5: Functional programming. Functional programming is a programming paradigm where the computation is the evaluation of mathematical functions. We will introduce both the theory and the practice of functional programming, including:
  - Lambda calculus: the foundation of functional programming;
  - Scheme programming language: a simple functional programming language;
  - Functional programming applications in XML programming: XSLT (eXtensible Stylesheet Language Transformations)
  - Map-reduce programming: It is a language independent framework that supports distributed computing on big data. The techniques are often used in industry such as Google and Yahoo.
  - Week 6: Logic programming. Logic programming is a programming paradigm where the computation is treated as the derivation of logic formulas. We will introduce Prolog, a logic programming language, and the evaluation mechanisms of Prolog.
- Week 7: Advanced topics in Object Oriented Programming, including abstract data types, distributed programming, object persistency, object-relational mapping. We will use Enterprise JavaBeans to explain object persistency and object-relational mapping.
- Week 8-9: Aspect-oriented programming. It is a language independent programming paradigm that allows the separation of cross-cutting concerns or aspects in large scale programming. AspectJ will be the language we will use.
- Week 10-11: Languages description methods, formal semantics of programming languages, axiomatic semantics (Hoare logic).
- Week 11-12: Some language implementation techniques. Attribute grammar, type checking, garbage collection. Review.

6 Assignments

There will be three assignments to help you consolidate the concepts introduced in the classes. Those assignments are:

- Functional and logic programming: Use Scheme and Prolog to write several programs;
- XSLT: Use XSLT to transform XML documents;
- AspectJ: Use AspectJ to produce a calculator from a parse tree of a simple language;

There will be a TA to help you with those assignments.

7 Reference book(s)

There are no required text books. However, our course web site lists required online documents and sample book chapters that we will follow.

8 Marking Scheme

We will have three assignments, one midterm exam and one final exam. The weights for assignments and exams are listed below:

Component	Assignments	Midterm exam	Final exam	Total
Percentage	15%	35%	50%	100 %

Before deciding whether you will take the course, you should make sure that you will be able to take the exams on those dates. The only valid excuse for missing an exam is a documented medical emergency. A missed exam without medical documentation will result in a mark of zero. All examinations are closed books and closed notes.

9 Teaching Evaluation

Student Evaluation of Teaching (SET) forms will be administered during the last two weeks of the class schedule.

10 Important Note

Please note that no student is allowed to take a course more than two times without permission from the Dean. If missing a test on medical ground, you must submit the Student Medical Certificate that is filled in and signed by a qualified medical doctor.