# Theory of Programming Languages

CMPT 331 • SPRING 2024

## Background

| | |
|---|---|
| When and where | Wednesdays at 8AM and Fridays at 11AM in Hancock 1021 |
| Required Text | *Concepts of Programming Languages*, by Robert W. Sebesta, any recent edition<br>Published by Addison Wesley |
| Web site | http://www.labouseur.com/courses/tpl |
| Instructor | Alan G. Labouseur          Alan.Labouseur@Marist.edu<br>Hancock 3*007*          *Office hours are posted*. |

## Grades

Letter Grades

| F | D | C- | C | C+ | B- | B | B+ | A- | A |
|---|---|---|---|---|---|---|---|---|---|
| | 65% | 70% | 73% | 77% | 80% | 83% | 87% | 90% | 93% |
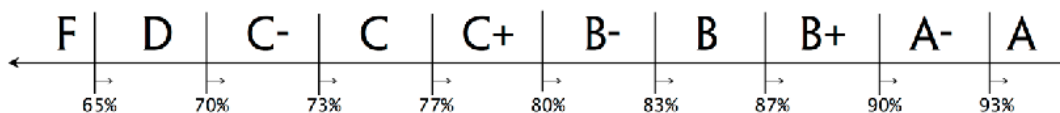
You can earn up to 1000 points, broken down as follows:

| | | | |
|---|---|---|---|
| Programming In The Past | 10.0% | 100 points | [1, 2] |
| Fun with Lambda Calculus | 10.0% | 100 points | [1, 2, 5] |
| Functional Programming | 10.0% | 100 points | [1, 2] |
| Mid-term Exam | 25.0% | 250 points | [1, 2, 5] |
| Final exam | 25.0% | 250 points | [1] |
| Language Design Project | 15.0% | 150 points | [1] |
| Attendance & Participation | 2.5% | 25 points - for quality and quantity | [1] |
| Laziness & Whining | 2.5% | 25 points - for not (lazy or whining) | [1] |

## Themes, Objectives, and Assessment

Assessment methods include assignments, quizzes, exams, discussions, presentations, peer review, and projects.

[References] refer to Department of Computing Technology Goals available at http://www.labouseur.com/courses/goals.pdf

In this course I hope that you will . . .
- learn about and practice programming language criticism based on four domain-independent categories and use this knowledge and practice to better understand today's software development environment. [1, 2]
- explore the concepts of many historical programming languages and their impact on the languages of today, remembering that those who forget the mistakes of history are doomed to repeat them. [1, 2]
- avail yourself of the opportunity to develop small programs in many historical programming languages. [1, 2]
- engage in the philosophy of programming languages. [1, 2]
- evolve critical debugging skills by developing programs in many languages. [1, 2]
- enhance your continuing education skills, realizing that capable problem solvers never stop learning. Additionally, preparation and presentation of the projects, as well as participation in class discussions and assignments, requires at least a little research, so there's that to look forward to. [1, 2, 5]
- have fun with programming. [1, 2]

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## —Schedule

| # | Wed | Fri | Chapters | Topics | Due Friday |
|---|-----|-----|----------|--------|------------|
| 0 | 17-Jan | 19-Jan | 1 | Introduction · Criteria for programming language evaluation<br>Issues and tradeoffs in prog. language design · Compiler Phases | — |
| 1 | 24-Jan | 26-Jan | 2 | A brief history of programming languages | — |
| 2 | 31-Jan | 2-Feb | 2 | A ~~brief~~ history of programming languages | — |
| 3 | 7-Feb | 9-Feb | 3 | Describing syntax · Fruit flies · Chomsky · Grammars · Sheep<br>Derivations · Parse trees · Grammar ambiguity | — |
| 4 | 14-Feb | ~~16-Feb~~ | 3<br>4 | Lex & Parse · Beginning semantics · The need for context-sensitive<br>grammars · Attribute grammars · Operational Semantics | — |
| 5 | 21-Feb | 23-Feb | 4 | Axiomatic Semantics | *Programming<br>In The Past* |
| 6 | 28-Feb | 1-Mar | 4 | Axiomatic Semantics | — |
| 7 | 6-Mar | 8-Mar | — | **Mid-term Exam** — part I **in HC 2023**; part II in HC 1021<br>Study sheet permitted; some restrictions apply. | — |
| 8 | ~~13-Mar~~ | ~~15-Mar~~ | — | *Spring Break* | — |
| 9 | 20-Mar | 22-Mar | 15 | Lambda Calculus, part $\lambda f\,x\,.\,(f\,x)$ | — |
| A | 27-Mar | ~~29-Mar~~ | 15 | Lambda Calculus, part $\lambda f\,x\,.\,(f\,(f\,x))$<br>*Easter Break* | — |
| B | 3-Apr | 5-Apr | 15 | Lambda Calculus, part $\lambda f\,x\,.\,(f\,(f\,x))$<br>Functional programming with LISP, ML, and Erlang | Fun with<br>λ Calculus |
| C | 10-Apr | 12-Apr | 15<br>16 | More functional programming with Erlang<br>Logic programming with Prolog | — |
| D | 17-Apr | 19-Apr | 5, 6<br>— | A tour through the final Language Design project<br>Static and Dynamic type · Type Systems | *Functional<br>Programming* |
| E | 24-Apr | 26-Apr | —<br>9, 10, 13 | Scope and Type checking<br>Subprograms · Parameter passing · Concurrency · Threads | — |
| F | 1-May | 3-May | — | Review for the Final Exam - come to class with questions<br>Show off your awesome new language designs. | *Language<br>Design Project* |
| ∞ | 8-May | | all<br>of it | **Final Exam** at 8ᴀᴍ **in HC 2023**<br>Study sheet permitted; some restrictions apply. | |