Spring 2020

**CS 635-102: Computer Programming Languages (Revised for Remote Learning)**

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CIS 635
Concepts of Programming Languages

Textbook: Programming Language Pragmatics
by Michael L. Scott
Publisher: Morgan Kaufmann
ISBN-13 978-0-12-374514-9

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Grading: There will be a midterm and a final examination. There will be several programming projects. Final grade will be computed as:

Due to the corona virus crisis, the grade will be determined by the programming project posted on canvas.

Schedule of Topics:

1 Review: Formal Grammars
2 Parsing, LL and LR languages
   - Top down, recursive descent
   - Bottom up shift-reduce parsers
   - Attribute grammars, synthesized/inherited attributes
   - CFG, BNF, EBNF
   - CFG examples for common language features of C++, Java, Python etc.
3 Binding times, Scope, Referencing environment
   - Storage classes, Non-local references
   - Comparison of languages that do/don't allow nested function definitions
     ie Java vs Javascript
Function parameter passing methods
   - Parameter passing in modern languages
     Java, C#, C++, Python, Javascript etc.
   - Stack implementation of functions,
   - Activation Record Instances (ARI), Recursion
4 Arrays. Arrays implementation in C++, Java, Python
   - Pointers and arrays in C, C++, dynamic array allocation using pointers
   - C++ pointers vs Java references
Order of operations in arithmetic statements, Side effects
   - Short circuit boolean evaluation,
5 Functions as parameters:
   - Referencing environment, deep/shallow/ad-hoc binding
   - Implementation of deep binding using static chain/display
   - Functions as parameters comparison for modern languages
Non-local references, Resolution of non-local references
using static chain pointers and displays
Implementation of dynamic scope:
Shallow access/Deep Access/Central table

6 Computer Architecture and its Relation to Compilers and Language Design
Memory Hierarchy
Data Representation
Instruction set architecture
Register allocation
Parallelism
Pipelining
Multi-core

7 Midterm Examination

8 Object Oriented Programming (OOP),
   Abstract Data Types (ADT), classes
   Public/Private members, Data/Method members,
   Class (static)/Instance members

10 Implementation of virtual methods, vtables
   Non-local references in OOP, inner classes

11 Container classes, C++ multiple inheritance
   Problems with multiple inheritance, Java Interfaces

12 Advanced issues in OOP:
   Why Derived * can be converted to Base * but cannot
   convert Derived ** to Base **
   Why Derived * to Base * conversion in C++ makes
   C++ arrays/pointers unsafe in OOP
   Problems with dynamic allocation/de-allocation in code
   that can throw exceptions and solutions

13 Concurrency, Semaphores, Monitors
   Multithreading, Java monitors, synchronized methods

14 Event driven/multithreading programming
   Inner classes for event handling
   GUI construction and thread safe programming

15 Final Examination

The Provost has asked that we include the following statement:

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Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu”