15-122 Principles of Imperative Computation

Lecture 1

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Course Information

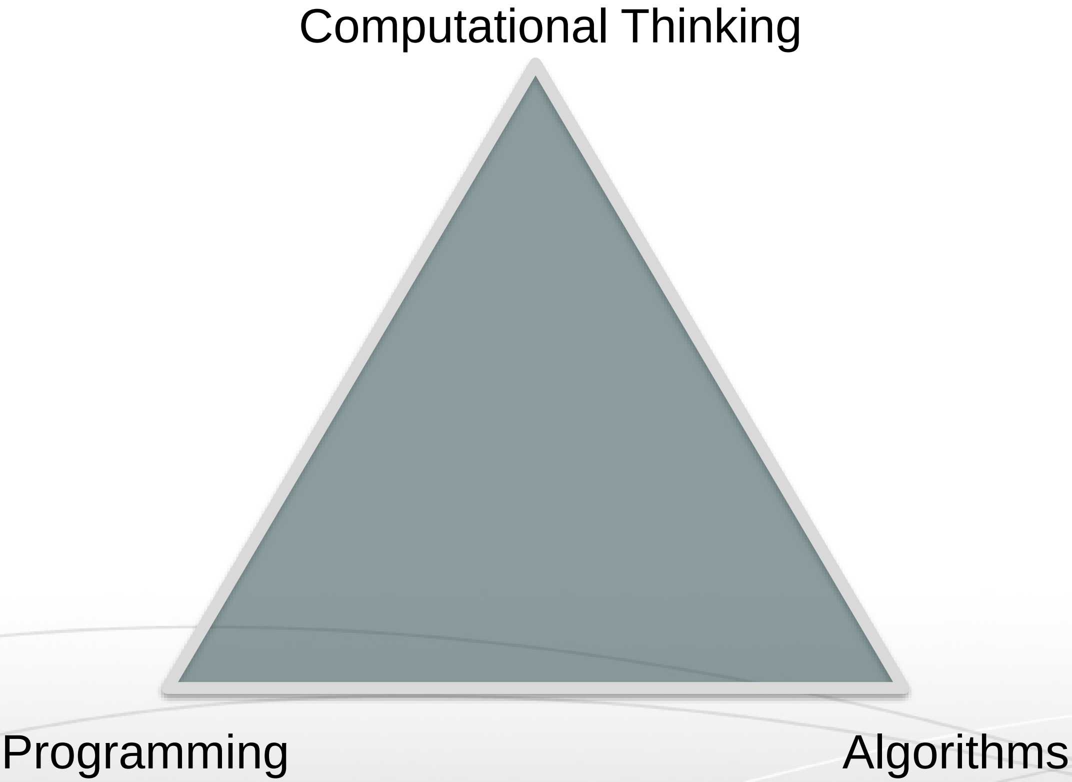
- ❑ Saquib Razak
  - Office: 1018
  - Office Hours: Sun, Tue 10:00-11:45
  - Email: srazak@cmu.edu
- ❑ Mohammad Hammoud
  - Office: 1006
  - Office Hours: Mon, Wed 3:30-5:00pm
  - Email: mhhamoud@cmu.edu
- ❑ Tamim Jabban (TA)
  - Office: 1005
  - Office Hours: Mon, Wed 10:00-12:00
  - Email: tjabban@cmu.edu

- ❑ Course website
  - http://www.qatar.cmu.edu/~srazak/courses/15122-s16/

Overview

- ❑ Goals of This Course
- ❑ Interactions
  - ▪ Lectures, Recitations, Office Hours
- ❑ Assessment
  - ▪ Labs, Quizzes, Homeworks, Exams
- ❑ A Mysterious Function

Goals



Computational Thinking

Programming

Algorithms

Programming Skills

- ❑ Program design in the small
  - ▪ Transforming algorithmic ideas to code
  - ▪ Unit testing
  - ▪ Specifying, writing, debugging, (re)factoring code
- ❑ Some familiarity with Unix tools

Algorithmic Ideas

- Asymptotic complexity
  - time/space/amortized
  - worst case/average case
  - important classes: O(1), O(log n), O(n log n), $O(n^k)$, O(2n)
- Divide-and-conquer
- Self-adjusting data structures
- Randomness
- Fundamental Data structures

Computational Thinking

- Assertions and invariants
- Specification vs. implementation
- Logical vs. operational reasoning
- Abstraction and interfaces
- Reasoning about resource bounds

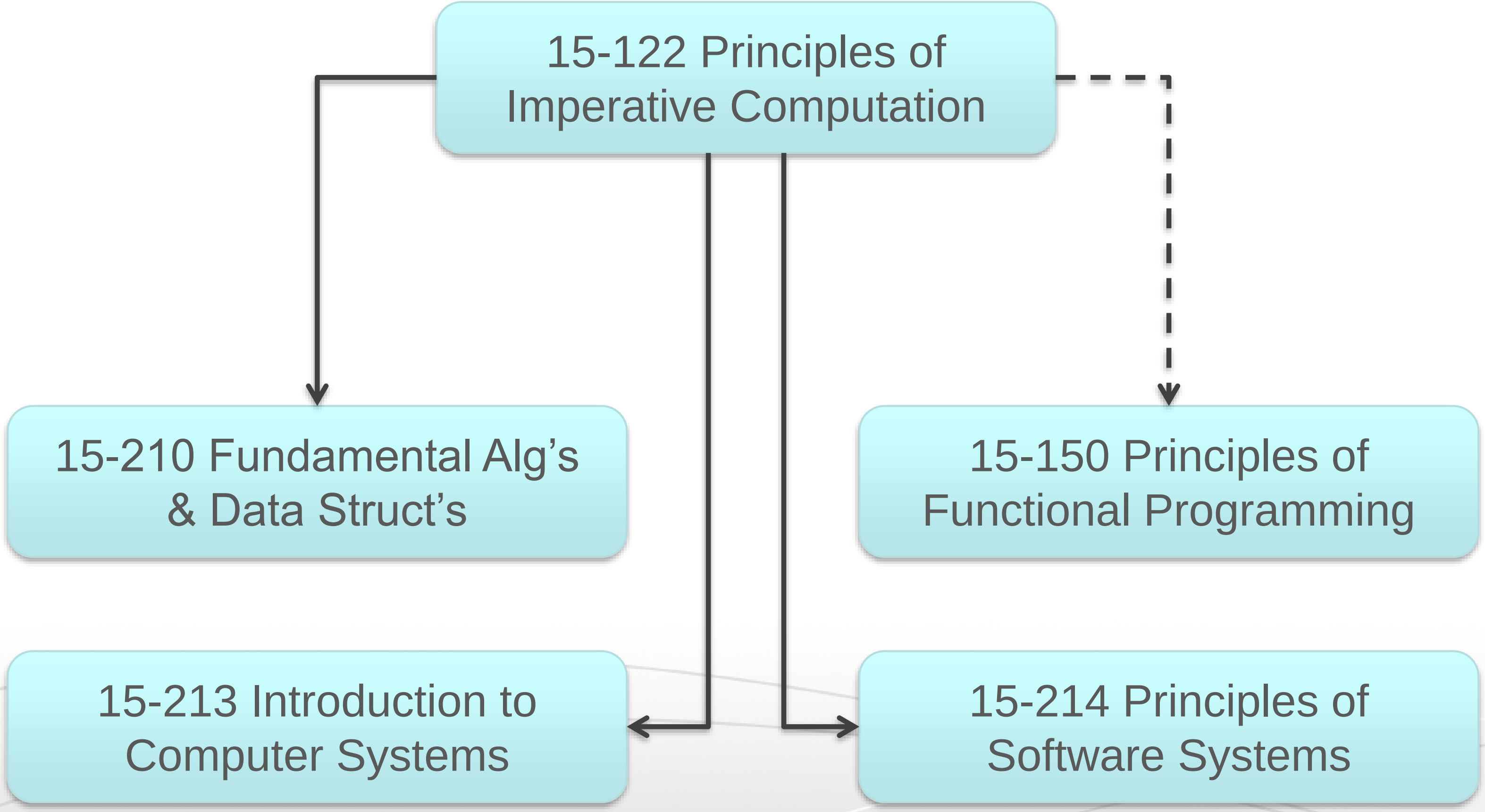
Programming Language

- C0: a small safe subset* of C
  - int, bool, char, string, arrays, pointers, structs
- Essential algorithmic and programming ideas
- Relatively close to machine (imperative)
- Sound reasoning with contracts
- Transition to C near end of course

Concrete Algorithms

- Basic arithmetic
- Binary search, sorting
- Stacks and queues, priority queues (heaps)
- Binary trees, dictionaries, maps, sets, tries
- Hashing, hash tables
- Graph traversal, minimum spanning tree

Role in Curriculum



15-122 Principles of Imperative Computation

15-210 Fundamental Alg’s & Data Struct’s

15-150 Principles of Functional Programming

15-213 Introduction to Computer Systems

15-214 Principles of Software Systems

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Lectures

- ❑ Mon, Wed 1:30pm – 2:50pm
- ❑ Please be here, please be active
  - ▪ Ask and answer questions, pay attention
  - ▪ Lecture notes after lecture
- ❑ No Computers, Laptops, cellphones, etc.
  - ▪ No surfing, email, games…
  - ▪ If you want to work on your homework, do so elsewhere

Recitations and Labs

- ❑ Tue, Thu 1:30pm – 2:20pm (50 minutes)
- ❑ Reinforce lecture material
- ❑ Problem solving
- ❑ How-to on programming and tool support

Unix/Tools Tutorial

- Tuesday, 1:30pm – 2:50pm, Room 2035
- Get set up using the C0 tools with Linux at unix.qatar.cmu.edu

Online communication

- ❑Autolab for homework and grades
- ❑Piazza for announcements, questions, and communication with course staff. Get help, help each other!
- ❑Cluster Linux machines and SSH to shared machines for assignments

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Assessment

- ❑ 25% - Midterms (two of them – 12.5% each)
- ❑ 25% - Final
- ❑ 45% - Homework
  - ~10 programming
  - ~11 written theory
- ❑ 5% - Quizzes and Labs
  - Pop Quizzes whenever we feel like it
  - Labs during recitation – Check the schedule!

Midterm

- ❑Test functional understanding of material
- ❑On Tuesdays – check schedule (80 mins)
- ❑Closed book, closed laptop, 1 sheet of notes
- ❑Total of 2 * 125 = 250 pts

Final

- Testing cumulative mastery of material
- Three hours during final exam period
- Closed book, closed laptop, 1 sheet of notes
- Total of 250 points

Assignments

- ❑Weekly assignment (see on-line schedule)
- ❑Apply material in problem solving context
- ❑11 written and 10 programming
- ❑Total of 450 points
- ❑Written homework due on Mondays
- ❑Programming homework due on Wednesdays – Check the schedule

Academic integrity

- Quizzes, exams, homework *must be your own*
- OK: discussion of course material, practice problems, study sessions, going over handed-back homework in groups
- Not OK: copying or discussing answers, looking at or copying code (even parts)
- Not OK: talking through the assignment as you code with a classmate
- University policy will be applied rigorously!

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Bug Report!

C0

```
int f (int x, int y) {
    int r = 1;
    while (y > 1) {
        if (y % 2 == 1){
            r = x * r;
        }
        x = x * x;
        y = y / 2;
    }
    return r * x;
}
```

Python

```
def f (x, y):
    r = 1
    while (y > 1) :
        if (y % 2 == 1):
            r = x * r
        x = x * x
        y = y / 2
    return r * x
```