Course Information

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- **Course website**
  - [http://www.qatar.cmu.edu/~srazak/courses/15122-s16/](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
Programing 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

15-213 Introduction to Computer Systems

15-150 Principles of Functional Programming

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
```c
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
```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
```