Exam 1 Review

AUBURN UNIVERSITY

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1. Two key notions: Correctness & Efficiency
2. Computational problems: How to write a well-defined problem specification
3. Computational problems: estimating inherent complexity (Ω notation) from the problem specification
4. Coming up with more than one computational strategy for solving a problem
   1. The notion of problem decomposition
   2. Recursive strategies
   3. Iterative strategies
   4. Thinking about correctness and efficiency of strategies
5. Turning strategies into algorithms
   1. Recursive algorithms
   2. Divide & conquer recursive algorithms
   3. Avoiding duplicated work
   4. Avoiding tail recursion
   5. Iterative algorithms
   6. Divide & conquer iterative algorithms
   7. Removing recursion
6. Reading, Writing and Understanding algorithms
   1. The language of algorithms: Pseudocode
   2. Understanding the mechanics of recursive algorithms: Recursion Trees of the algorithm solving a problem instance
   3. Understanding the mechanics of non-recursive algorithms: by working out the loops etc. of the algorithm solving a problem instance
7. Hypothesizing and proving correctness/incorrectness of algorithms
   1. Proof by counterexample (incorrectness proof)

- Specify a problem so that it is well-defined with the three components of a well-defined problem explicitly stated
- Estimate the inherent complexity of a problem
- Develop computational strategies to solve a problem
- Translate strategies into algorithms
- Design algorithms using the design techniques of recursion, iteration and divide-and-conquer
- Write algorithms in pseudocode
- Understand and explain the mechanics of algorithms
    - Mental simulation
    - Explaining the operation of iterative algorithms
    - Explaining the operation of recursive algorithms (Recursion Tree)
- Make an informed determination of algorithm correctness
    - Check for boundary conditions of inputs, loops and recursion
- Prove algorithm incorrectness using Proof by Counterexample

How to Prepare

1. Review lecture slides and any notes you took in class
2. Read the assigned readings from the text:
    1. All of Chapter 1
    2. Chapter 2 p. 20-23
    3. Chapter 2
        1. Section 2.1: Omit (for the time being) the discussion of loop invariants (p. 18-20); read the rest
        2. Section 2.3: Omit (for the time being) Section 2.3.2 and the discussion of loop invariants (p. 32-33) ; read the rest
    4. Chapter 32 p. 988-989
3. Refresh your knowledge about sorting algorithms from COMP 2210: Selection & Bubble in addition to those discussed in class: Insertion and Merge
4. Review homework solutions and ensure that you are able to solve similar problems
5. Work out thinking assignments from the slides with your friends

- 75 minutes: **Time limit strictly enforced – exam will end sharp at 10:45!**

- 5 problems, each with 5 multiple choice questions; 50 points

- No need to memorize anything. Any mathematical results or algorithms you need will be provided with the exam.

- Download and install Respondus Lockdown Browser on your labtop

- Make sure you can access the course Canvas via the Lockdown Browser and able to take Canvas quiz by taking the Lockdown Browser Practice Quiz
  - If you experience a problem, reach out to the Respondus Help Center as soon as possible!
  - If you failed to prepare the Lockdown Browser before the exam, you will NOT be compensated for any time spent installing/troubleshooting it during the exam.

- Bring an ID (AU ID, driver's license, passport, etc.)
  - You will NOT be allowed to take the exam if proctor cannot verify your identity

- Resist the temptation to peek at your neighbor's answers
  - If we see you engage in any kind of cheating, YOU WILL FAIL THE COURSE and the case will be reported

- A basic calculator is built into the exam. You are NOT allowed to use a physical calculator
- NO ELECTRONIC DEVICES ALLOWED except the one with which you are taking the exam
- Any other electronic device in your possession must be turned off and kept off from the desk

- Closed text and notes
- Read and follow instructions on the exam carefully
- Manage your time carefully
- Do not get stuck on any single problem; else you will run out of time

- Ask proctor for sheets if you need sheets for scratch work

- Turn in the exam AND the scratch papers

- BEFORE LEAVING, record your name and the time of completion on the sign-off paper
  - If you fail to sign your name or we see you accessing the exam past the recorded time of completion, then you will receive a grade of ZERO