CMSC 341

Spring 2010

Section 1466

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Course Website

`www.cs.umbc.edu/courses/undergraduate/341/fall10`

- Instructors office hours
- TA names and office hours
  - TAs grade projects
- Syllabus
- Class schedule including project and exam dates
- Grading
- Lecture slides
- Projects

Student Honor Code

UMBC Student Honor Code

By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, ***but is not limited to***, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the Faculty Handbook, or the UMBC Policies section of the UMBC Directory.

http://www.umbc.edu/provost/integrity/index.html

Textbook

- Data Structures and Algorithm Analysis in Java, 2/E
- **Mark Allen Weiss**, *Florida International University*

- ISBN: 0-321-37013-9
- Publisher: Addison-Wesley
- Copyright: 2007

Prerequisites

- We will assume that you have mastered the material from CMSC 201, CMSC 202, and CMSC 203.
- We will not review material that has been covered in the prerequisite courses.
- We do cover a few of the concepts from CMSC 202, but from a deeper point-of-view.
- We assume prior experience with Java, but will review Java briefly in the first few lectures and will have more intense reviews outside of class hours early in the semester for those who are a little rusty.

Data Structure

- What is a “data structure”?

- How are they implemented?

Abstract Data Type

- What is an ADT?

What is a Proof?

- Given a collection of
- assumptions or hypotheses
- statements that are already known to be correct

- Use general principles of logical reasoning for deriving a statement

Proof by Direct Construction

- Assume p is true to show that q is true.
- Example: For any integers a and b, if a and b are odd then ab is odd.
- Proof hint: if n is an odd integer n=2x+1

Proof by Contradiction

- Prove p by contradiction
- Show that if p is not true then some contradiction arises

  $\neg p \rightarrow \mathit{false}$

- Note that $p \rightarrow q$ implies $\neg p \vee q$

Example

- *To prove:* For any sets A, B, and C, if $A \cap B = \emptyset$ and $C \subseteq B$ then $A \cap C = \emptyset$
- Assume if $A \cap B = \emptyset$ and $C \subseteq B$ then $A \cap C \neq \emptyset$
- $\exists x \;\; x \in A \cap C; \;\; \text{So } x \in A \cap B;$
- Contradiction $A \cap B \neq \emptyset$

Mathematical Induction

- Statements involving a natural number *n* is often needed to prove.

- Example:
  $1+2+3+\ldots\ldots + n = n(n+1)/2$

Proof by Mathematical Induction

- P(n) is a statement involving a integer n.
- Prove that P(n) is true for every $n \geq n0$

- Show:
  - P(n0) is true
  - For any $k \geq n0$ if P(k) is true, then P(k+1) is true.

Strong Induction

- P(n) is a statement involving a integer n.
- Prove that P(n) is true for every $n \geq n0$

- Show:
  - P(n0) is true
  - For **all** $n0 \leq n \leq k$ if P(n) is true, then P(k+1) is true.

Geometric Series

- $1 + x + x^2 + \ldots + x^n = (x^{n+1}-1)/(x-1)$
- Prove it.

Why Java?

- Java contains a Collections framework that consists of system classes that emulate many of the data structures that you will learn about in this course.
- Easier to program in Java than C++
- Popular industry standard
- More similar to C# than C++
- Platform Independent
- Easy to do GUI Programming