CS 422 - Discrete Mathematics 2

K. Subramani
LDCSEE,
West Virginia University,
Morgantown, WV
{ksmani@csee.wvu.edu}

1 General Information

(a) Instructor: K. Subramani.

(b) Meeting Times: MWF 9:00 am - 9:50 am.
Location: 251 ESB-E.

(c) Contact Information: 749 ESB, ksmani@csee.wvu.edu.

(d) Office Hours: By appointment.

(e) Textbook - [BM07] will be the main book, although [KS08] is highly recommended as a supplementary text.

(f) URL - `http://www.csee.wvu.edu/~ksmani/courses/sp13/dm2/dm2.html`.

(g) Assessment:

(a) Homework Assignments - You will be handed four homework assignments. These assignments constitute 80% of your grade. Table (1) details the homework schedule.

Assignment Date	Submission Date
01/31	02/07
02/28	03/07
04/03	04/10
05/02	05/09

Table 1: Homework Schedule

(b) Presentations - You will be required to present allotted material. The presentations will be graded on the basis of clarity, comprehensiveness and effectiveness. The presentations will be worth 20% of your grade.

A maximum of 5 bonus points will be awarded for class performance.

(h) Grade Boundaries:

Grade	Boundary
A	80 and up
B	$65 - 79$
C	$50 - 64$
D	$45 - 49$
F	$0 - 44$

Table 2: Grade Boundaries

(i) Grading policy - If you have any questions about the grading, you must contact the instructor within two days of your paper being returned.

(j) Makeup Policy - If for some reason, you are unable to attend a test or an exam, please meet me at the earliest and I will set an alternate date.

(k) **Course Objectives** - The objectives of this course are as follows:

(a) To reintroduce students to concepts from propositional and first-oder logic.

(b) To reinforce the notion of semantics in first-order logic.

(c) To introduce the notions of decidability and complexity.

(d) To introduce the notion of a first-order theory.

(e) To formally introduce the concept of program correctness.

(l) **Learning Outcomes** - Upon successful completion of this course, students will be:

(i) Able to reason using propositional logic.

(ii) Able to propose and prove meta-theorems in propositional and first-order logic.

(iii) Familiar with first-order theories.

(iv) Familiar with different forms of induction.

(v) Able to formally check the correctness of programs using inductive strategies.

1.1 Propositional Logic

Syntax, Semantics, Satisfiability and Validity, Equivalence and Implication , Substitution, Normal Forms, Decision Procedures for Satisfiability. This material will be covered from Chapter 1 of [BM07].

1.2 First-Order Logic

Syntax, Semantics, Satisfiability and Validity, Substitution, Normal Forms, Decidability and Complexity, Meta-theorems of First-Order Logic. This material will be covered from Chapter 2 of [BM07].

1.3 First-Order Theories

First-Order Theories, Equality, Natural numbers and integers, Rationals and Reals, Recursive Data Structures, Arrays, Decidability and Complexity, Combination Theories. This material will be covered from Chapter 3 of [BM07].

1.4 Induction

Stepwise Induction, Complete Induction, Well-Founded Induction, Structural Induction. This material will be covered from Chapter 4 of [BM07].

1.5 Program Correctness: Mechanics

pi: A simple imperative language, Partial Correctness, Total Correctness. This material will be covered from Chapter 5 of [BM07].

1.6 Program Correctness: Strategies

Developing Inductive Annotations, Extended Example: Quicksort. This material will be covered from Chapter 6 of [BM07].

I would like to reiterate that this is a sketch of the topics that we will be covering. For various reasons, I may choose to drop a mentioned topic or cover a new topic. In such cases, advance notice will be given.

2 Academic Integrity Statement

The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code at `http://www.arc.wvu.edu/admissions/integrity.html`. Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me before the assignment is due to discuss the matter.

3 Social Justice Statement

West Virginia University is committed to social justice. I concur with that commitment and expect to foster a nurturing learning environment, based upon open communication, mutual respect and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type accommodation, in order to participate in this class, please advise me of the same and make appropriate arrangements with Disability Services ($293 - 6700$).

If you feel that you are being treated inappropriately or unfairly in any way, please feel free to bring your concerns to my attention; rest assured that doing so will not prejudice the grading process. In return, I expect you to behave professionally and ethically.

References

[BM07] Aaron R. Bradley and Zohar Manna. *The calculus of computation - decision procedures with applications to verification*. Springer, 1^{st} edition, 2007.

[KS08] Daniel Kroening and Ofer Strichman. *Decision Procedures - An Algorithmic Point of View*. Springer, 1^{st} edition, 2008.