Philosophy

CPSC 121 promotes an "interactive engagement" lecture approach to facilitate your learning. For this approach to work best, you should prepare before the lecture as best suits your learning style, possibly by reading the appropriate sections of the text or working through sample problems. During class, the instructor will review some of the more difficult concepts or examples from the readings, and lead you through discussions and exercises. After class, you will want to review the text and any notes you took.

It also is *essential* that you ask questions whenever there is a concept that you don't understand.

If you miss a lecture, catch up on what you missed from a classmate and in office hours. If you are out of class for an extended period of time, contact your instructor as soon as possible to determine how to catch up. It is your responsibility to be aware of any announcements that may have been made in your absence.

Textbook and iClicker

The textbook for the course will be:

- Epp, Susanna. *Discrete Mathematics with Applications*, 4th edition, Nelson Education, 2011, ISBN 0-495-39132-8

The 4th edition is our "authoritative" edition (and should be available at the bookstore). However, we include roughly comparable page numbers for many other texts below.

While purchasing the textbook is optional, you *will* require an iClicker device to earn participation grades during lectures.

Lecture Notes

Running notes containing some of the highlights of each lecture are available.

Slides about the Mux glitch, verbatim taken from Dr. Steve Wolfman, and based on slides from Dr. Patrice Belleville.

Lecture Schedule

Lecture time during the semester is divided into 36 lecture "slots", plus two slots for the midterms. Given the condensed nature of the summer term, that equates to roughly two and a half lecture slots per day that we are together.

What follows is a tentative breakdown of the topics that will be covered in each lecture slot.

Lecture	Date	Topic	Details
1	Monday 15 May 2017	Introductions and Logic Games	• Dragons and trolls

2	Monday 15 May 2017	Forms of Proof	• Fundamental theorem of arithmetic • Direct demonstration of truth / falsehood • If-then proofs • Proof of falsehood by contradiction
3	Monday 15 May - Wednesday 17 May 2017	Propositional Logic I	• Conjunction, disjunction, negation, XOR • Truth tables • Circuit versions of those four operations
4	Wednesday 17 May 2017	Propositional Logic II	• NAND, NOR, XNOR • Disjunctive normal form (DNF) • Tautology, contradiction, and contingency • Multi-stage truth tables
5	Wednesday 17 May 2017	Real-World Problems	• Christmas lights: in series or in parallel • Seven-segment display • Traffic lights and detecting intersection safety
6	Friday 19 May 2017	Logical Equivalence	• Demonstration through truth tables • Equivalence rules
7	Friday 19 May 2017	Propositional Logic III	• Conditionals • Difference between "if", "only if", and "iff" ("if and only if") • Translation between propositional logic and English
8	Friday 19 May - Wednesday 24 May 2017	Multiplexers	• Implementing a multiplexer (mux) • Fixing a timing error with an equivalent implementation
9	Wednesday 24 May 2017	Number Representation I	• Different number bases • Two's-complement representation,

			and the motivation for using it
10	Wednesday 24 May 2017	Number Representation II	• Fixed-point representation • Adders: half-adders, full-adders
11	Friday 26 May 2017	Modular Arithmetic	• Ripple-carry adders • Relationship between ripple-carry adders and modular equivalence classes
12	Friday 26 May 2017	Valid Arguments	• Valid forms of argument • The validity and soundness of arguments • Contrapositive reasoning, versus the converse and inverse errors
13	Friday 26 May - Monday 29 May 2017	Midterm I Review	• Open question-and-answer
14	Monday 29 May 2017	Flaws in Rhetorical Arguments	• The *Onnagata* problem
15	Monday 29 May 2017	Set Theory I	• Elements, subsets, cardinality • "Set builder" notation
Midterm 1	Wednesday 31 May 2017		• Covers topics until the end of Friday 26 May 2017
16	Wednesday 31 May 2017	Set Theory II	• Set operations (union, intersection, difference, complement) • Equivalence rules, and their relation to propositional logic • Power sets
17	Friday 2 June 2017	Function Theory I	• Properties of a valid function • Domain, codomain, and image
18	Friday 2 June 2017	Function Theory II	• Injectivity, surjectivity, bijectivity • Relationship of those three

			properties to cardinality of sets
19	Friday 2 June - Monday 5 June 2017	Predicate Logic I	• Relationship between predicate logic and function theory • Quantifiers • Domain limiting
20	Monday 5 June 2017	Predicate Logic II	• Counting / translating "at least", "exactly", and "at most"
21	Monday 5 June 2017	Predicate Logic III	• Universal instantiation, universal modus ponens, and universal modus tollens • Generalized de Morgan's law
22	Wednesday 7 June 2017	Proofs in Predicate Logic	• Order of quantifiers: the challenge method • Using "without loss of generality" (WLOG) versus picking a specific element
23	Wednesday 7 June 2017	Big-O Notation	• Definition of O(f(n)) • Proofs of inclusion in O(f(n))
24	Wednesday 7 June - Friday 9 June 2017	Comparing Proof Methods	• Proof by contrapositive • Contrast proof by contrapositive and proof by contradiction • General proof structure
25	Friday 9 June 2017	Induction I	• The simplest form of induction ("weak induction")
26	Friday 9 June 2017	Midterm 2 Review	• Open question-and-answer
27	Monday 12 June 2017	Induction II	• The general form of induction ("strong induction") • The coin / chicken nugget problem

28	Monday 12 June 2017	Memory I	• The single light-button problem • Two-button solution (SR latch) • Switch-and-button solution (D latch)
Midterm 2	Wednesday 14 June 2017		• Covers topics until the end of Friday 9 June 2017
29	Wednesday 14 June 2017	Memory II	• Failure of one D latch to solve the single light-button problem • D flip-flops as a solution
30	Friday 16 June 2017	Deterministic Finite Automata	• Set theory: Cartesian products • Definition of DFAs, using Cartesian products • Building and tracing the execution of a DFA
31	Friday 16 June 2017	Sequential Circuits	• Converting DFAs to sequential circuits
32	Friday 16 June - Monday 19 June 2017	The Model Computer	• von Neumann architecture, and the six stages of execution • Overview of the ALU of the model computer
33	Monday 19 June 2017	Set Theory III	• Russell's paradox • Countably infinite sets, and the cardinality aleph-naught
34	Monday 19 June 2017	Set Theory IV	• Diagonalization proofs, and the uncountability of the real numbers
35	Wednesday 21 June 2017	Decidability	• Limitations of DFAs, relative to modern computers • The undecidability of the halting problem (the *Entscheidungsproblem*)

36	Wednesday 21 June 2017	Final Exam Review	• Open question-and-answer

Readings

While Epp 4ed is the official textbook for CPSC 121, we have included here equivalent section and page numbers for both the earlier edition of Epp, as well as for earlier editions of Rosen:

- Rosen, Kenneth H. *Discrete Mathematics and its Applications*, 7th edition, McGraw Hill Book Company, 2012, ISBN 0-07-338309-0.
- Rosen, Kenneth H. and Grossman, Jerrold. *Student Solutions Guide for Discrete Mathematics and its Applications*, 7th edition, McGraw Hill Book Company, 2012, ISBN 0-07-735350-1.

We do not have the equivalent section and page numbers for Rosen 7ed, but we suspect that they are similar to those for Rosen 6ed.

The topics in the following table are listed in the order in which they are presented in Epp 4ed, not necessarily in the order in which they will be covered in lecture.

Topic	Epp (4th edition)	Epp (3rd edition)	Rosen (6th edition)	Rosen (5th edition)	Rosen (4th edition)
Propositional Logic	2.1, 2.4 + supplement	1.1, 1.4 + supplement	1.1, 11.3 + supplement	1.1, 10.3 + supplement	1.1, 9.3 + supplement
Conditionals, Logical Equivalences	2.2	1.2	1.1, 1.2	1.1, 1.2	1.1, 1.2
Proofs	2.3	1.3	1.5	1.5	3.1
Number Representation	2.5 + supplement	1.5 + supplement	3.6 + ex + supplement	2.5 + ex + supplement	2.4 + ex + supplement
Predicate Logic	3.1, 3.3	2.1, 2.3	1.3, 1.4	1.3, 1.4	1.3
Rewriting Predicate Logic Statements	3.2, 3.4 + "Challenge Method" on pg 118–119	2.2, 2.4 + "Challenge Method" on pg 98–99	1.3, 1.4	1.3, 1.4	1.3
Proof Techniques	4.1, 4.6, 4.7, Thm 4.4.1	3.1, 3.6, 3.7, Thm 3.4.1	1.6, 1.7, 3.4 theorem 2	1.5, 3.1, no matching theorem	3.1
Mathematical Induction	5.1 - 5.4	4.1 - 4.4	2.4, 4.1 - 4.3	3.2 - 3.4	1.7, 3.2, 3.3
Sets	6.1	5.1	2.1	1.6	1.4
Functions	7.1, 7.2, 7.4	7.1, 7.2, 7.3	2.3	1.8	1.6
DFAs	12.2	12.2	12.3, 12.4	11.3, 11.4	10.3, 10.4
Sequential Circuits	12.2 pp 791 - 799	12.2 pp 745 - 747, 752 - 754	12.2 pp 796 - 798, 12.3	11.2 pp 751 - 752, 11.3	10.2 pp 640 - 641, 10.3

Recorded Lectures

Dr. Steve Wolfman has made available archived recorded lectures from the January-April 2011 term.

Note the following:

- These are *only accessible* from ubcsecure wireless or a UBC VPN
- They're labeled only by date; so, you'll have to estimate how far in to go and check what the slides have to say
- These are old videos; the course may have shifted since they were made in ordering, structure, and material; however, there is usually very high overlap