Course Summary / Modules: CMSC 250 is the first Theory course in the undergraduate curriculum of the Computer Science department at UMCP. It provides the mathematical backbone necessary for a solid understanding of various more advanced topics, including but not limited to Logic, Theory of Computation, Algorithms and Compilers. Through rigorous definitions and theorems, combined with sufficient practical exercises, students are expected to graduate from this course with a solid understanding of formal proofs, mathematical induction, set theory and counting / probability. Subjects that will be touched upon include:

- Describing the world **logically**. Most of the time.
  - **Propositional Logic**: Syntax, Semantics and Proof Theory.
  - Applications to **boolean circuits**: AND/OR/NOT gates, binary summation, number systems, 1’s and 2’s complement, simple adder circuits.
  - “**Predicate logic**”\(^1\): Syntax, Semantics and Proof Theory.

- **Proving** statements beyond reasonable (or unreasonable) doubt.
  - Types of **proofs**: Existential, constructive, universal, proof by contradiction or counterexample(s).
  - **Elementary Number Theory**: Prime and composite numbers, divisibility, “prime sieve”, modular arithmetic, Fundamental Theorem of Arithmetic\(^\text{TM}\)

- **Sets and functions**: Mathematical reasoning about a (potentially awful) lot of things.
  - Basic definitions (**subset, union, intersection**...).
  - Proofs with sets.
  - **Russel’s Paradox**.
  - **Injective, bijective, surjective and onto** functions.
  - (Generalized) **Pigeonhole Principle**.

- Mathematical **induction**: Playing domino with one, many, or no imaginary tiles.
  - Basic **series** and their sums (arithmetic, geometric, telescopic).
  - Simple (weak), **strong** and **constructive** induction.
  - Graphs, trees and **structural** induction.

- **Counting** and **Probability**: How to hack a person’s debit card 101.
  - **Permutations, combinations, r-combinations**
  - **Product** and addition rules.
  - Newton’s **Binomial Theorem**.

\(^1\)Enclosed within quotes for reasons that will be made clear in the relevant lecture.
Optional topics which we might have time to cover include:

- **Relations** (of the mathematical kind).
  - Basic definitions.
  - Reflexivity, transitivity, symmetry, equivalence.

- **Recursion**: Yo dawg I heard you like functions, so we put a function in your function.
  - Classic problems (Towers of Hanoi, Fibonacci series).

- Counting beyond **infinity** in one hour and a half.
  - **Countable** and **uncountable** infinity.
  - **Hilbert’s Hotel**.
  - The sets $\aleph_0, \aleph_1, \ldots, \aleph_\omega, \ldots$ (“Aleph null”, “Aleph one”, $\ldots$, “Aleph omega”, $\ldots$).
  - **Cardinals** and **ordinals**: amount vs position.
  - The **Continuum Hypothesis**.

**Prerequisites**: All students are expected to watch the full 4-episode *Charlie the Unicorn* saga on the YouTube channel “Secret Agent Bob” and submit a two-to-three paragraph text of what they got out of Charlie’s adventures through Candy Mountain, the Banana Cave, the depths of the ocean as well as the moon **by the end of the first week of lectures**.\(^2\) We will be using examples from those videos in the beginning parts of the course, to show how any particular world - not just the one we happen to inhabit - can be modelled logically (or illogically).

Since this is a CS theory course, a certain comfort with advanced highschool mathematics (calculus, probability, number theory) will undoubtedly be helpful, but under no circumstances required, since we will be providing all necessary definitions.

**Course Pages**:


2. Piazza: [http://piazza.com/umd/summer2016/cmsc250/home](http://piazza.com/umd/summer2016/cmsc250/home). Please make sure you register on Piazza from day one since all dynamic information, such as announcements or schedule changes, will be posted on that platform. Furthermore, Piazza will be tremendously useful for us to communicate in a many-to-many fashion, quickly and effectively!

**Teaching Assistants**:

- Parsa Saadatpanah (parsa.saadatpanah@gmail.com)
- Yancy Liao (yancy.liao@gmail.com)

**Office Hours**:

- Instructor: Mon, Tue 2-3pm, Wed 2-4pm, AVW 3217 (Office will change soon)
- TAs:

\(^2\)A 20-minute video containing all 4 episodes can be found [here](http://cs.umd.edu/class/summer2016/cmsc250/).
Textbook: There is no required textbook for the course. We have found the following textbooks to be worthwhile, so we recommend them:


The instructor has “adopted” both textbooks through the UMD “Faculty Enlight” system, so a small number of copies should be available for renting at the University Book Store.

Tentative Course Outline:

<table>
<thead>
<tr>
<th>Week 1 (Tuesday 05-31 to 06-03, Memorial Day holiday on Monday):</th>
<th>Propositional Logic, Boolean Circuit applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 2 (06-06 to 06-10):</td>
<td>“Predicate Logic”, introduction to proofs.</td>
</tr>
<tr>
<td>Week 3 (06-13 to 06-17, 1st midterm on Friday, no hw or quiz):</td>
<td>Number Theory (intertwined with more proofs), intro to sets.</td>
</tr>
<tr>
<td>Week 5 (06-27 to 07-01):</td>
<td>Mathematical (weak &amp; strong) induction.</td>
</tr>
<tr>
<td>Week 6 (07-05 to 07-08) (4th of July holiday on Monday, 2nd midterm on Friday, no hw or quiz):</td>
<td>More practice on mathematical induction. Structural and constructive induction.</td>
</tr>
<tr>
<td>Week 8 (07-18 to 07-22, Final on Friday, no hw or quiz):</td>
<td>Leftovers from Counting and Probability, choice of elective topic (countability/uncountability, relations, etc) and/or guest speaker.</td>
</tr>
</tbody>
</table>
Important Dates:

- Memorial Day (1 day before class starts) .................. Monday, 05-30
- Religious observance notification due .................. Monday, 06-13
- 1st Midterm (in-class, 1.5 hours) .................. Friday, 06-17
- Independence Day (no class) .................. Monday, 07-04
- 2nd Midterm (in-class, 1.5 hours) .................. Friday, 07-08
- Final (in-class, 2 hours) .................. Friday, 07-22

Grading policy (subject to minor changes): 5 homework assignments (3% each for 15% total), 5 in-class quizzes (2% each for 10% total), 2 in-class Midterms (20 and 25% respectively), 2-hour comprehensive Final (30%). Homeworks will be posted (online) on Mondays and will be due the following Monday, with the exceptions of: (1) The 1st homework, which will be posted Tuesday 05-31 and will be due Tuesday 06-07, since Monday 05-30 is Memorial Day and (2) The 4th homework, which will be posted on 06-27 but will be due Tuesday 07-05 because of Independence Day. Students will print the homeworks and will bring their hardcopy solutions to the instructor in class on the day that they are due, before lecture. Please staple your solutions to the question sheet before giving them to us.

Quizzes will be handed out (in hardcopies) by the TA who manages the relevant discussion section and students will have 25-30 minutes to complete them. They will then hand them back to the TA in charge of the relevant lecture. No quizzes will be accepted by the TAs or the instructor after the end of the relevant discussion section. If we do not receive your quiz by the end of a discussion section, we will assume that you didn’t sit for it, and unless you document an absence (see “excused absence policy” below for details), you will receive a 0 for that particular quiz.

The CS department’s “grade server” (https://grades.cs.umd.edu) can be used to let you know how you’re doing in the course after every assignment. It is the student’s responsibility to maintain possession of graded assignments through the end of the semester.

Policy on laptops and other electronic devices: Experience has shown the course staff that portable electronic devices, such as laptops, tablets and smartphones are almost always a source of distraction for both the student using them as well as the surrounding students. For this reason, this course follows a no open electronic device policy, i.e no such devices are allowed to be used during a lecture or discussion section. The Instructor and TAs reserve the right to confiscate such devices and return them to the students at the end of the relevant lecture or discussion.

Students who require the use of electronic devices because of a disability are, of course, allowed to use the relevant devices (see section “Students with Disabilities” below for more information on facilitation of any disabilities).

Excused Absence Policy: (The midterms and final for the course will be collectively referred to as “Major Scheduled Grading Events” or simply “Events” in this and all subsequent sections.)

Medically necessitated absence: Any student who needs to be excused for an absence from a single discussion day when a quiz is offered, or who did not submit a homework exercise at or before the time it was due, with either one of those facts being a result of a medically necessitated absence, has to follow the following steps:

- Within 24 hours of the missed discussion or homework submission, the student must inform the instructor by using e-mail and by using the “Report Absence” button on the grades server. Each note must contain an acknowledgement by the student that the information provided is true and correct. We refer to this as “self-documenting” an absence. Providing false information to University staff is prohibited under Part 10(j) of the University of Maryland Code of Student Conduct V-1.00(B) and may result in disciplinary action.
- This absence will mean that the student’s final letter grade will be re-calculated over the rest of his assignments. The course staff is under no obligation to provide a make-up homework assignment or
quiz. In order to make up for the material they lost, the student has to follow up with the instructor and/or the TAs appropriately.

The self-documentation may not be used for any Major Scheduled Grading Events and it may be used for only 1 discussion where a quiz and/or homework assignment exercise was due during the entire summer section. Any student who needs to be excused for a prolonged absence (2 or more consecutive class meetings), or for additional quizzes or homework assignments, or for a Major Scheduled Grading Event, must provide signed and notarized documentation regarding the nature of the illness from the health care provider who treated the student. This documentation must verify dates of treatment and indicate the timeframe that the student was unable to meet academic responsibilities. In addition, it must contain the name and phone number of the medical service provider to be used if verification is needed. The student should contact the instructor via e-mail at the beginning of the prolonged period and this documentation must be given to the instructor within a week of the student’s return to classes.

Absence due to other reasons (emergencies, interviews, etc): Our policy with respect to absences due to other reasons is similar to that of the medically necessitated absences above: if a person misses the submission of a homework or a discussion section where a quiz was offered, they can self-document within 24 hours. However, for a Major Scheduled Grading Event, self-documentation is not possible, as is the case with the medical absence. The student will have to furnish signed (and, if applicable, notarized) documentation from a relative or a person knowledgeable about the student’s circumstances, as well as a callback number such that the teaching staff can verify the validity of the student’s absence.

Religious observance: When it comes to religious observances that conflict with coursework, it is the University’s policy to provide accommodations for the students. It is, however, the student’s responsibility to provide the course staff with written notification in advance of anticipated absences. In particular, in the case of religious observance conflicts with a quiz or with an Event, written notice must be provided by Monday 06-13, to facilitate the logistics of offering a quiz/exam with alternative content to the students affected.

Major Scheduled Grading Event make-ups: When an absence has been verified as properly excused, the teaching staff shall accommodate the affected student(s) with a make-up examination. This examination will always be offered after the “regular” examination offered to the rest of the class and may be arbitrarily altered to maintain academic integrity. The student(s) will be called to one of the staff members’ offices or a quiet classroom with sufficient time to complete the examination (85 minutes for the midterms, 115 for the Final, with DSS students that require extra time accommodated accordingly).

Students with Disabilities: Students who have been certified by Disability Support Services as needing any kind of accommodation should be talking to the Instructor as soon as possible. Students should provide the Instructor with hardcopy notification of their disabilities, detailing any kind of accommodations that they would need for a Major Scheduled Grading Event, a quiz or a homework, such that the teaching staff can accommodate their needs in a timely manner. In particular, we request that any student who requires special accommodations for a Major Scheduled Grading Event notifies us at least 3 days prior to the Examination, so that we can make proper arrangements for added time or other special support. If time and space constraints are not sufficient for a DSS student to sit for an Event at the same time as the rest of the class, that particular student is obligated to sit for the exam at most one day after the Event (10pm on the following day) and never before the Event.

Academic (Dis-)Honesty: All work should be your own. Copying another student’s response to a homework assignment, quiz or Major Scheduled Grading Event is a violation of the University’s Honor Pledge. Any kind of cooperation during quizzes or Events, as well as the use of electronic devices, textbooks or any kind of notes also constitute violations of the Honor Code and Pledge.

The teaching staff takes any case such as the aforementioned very seriously. The default penalty for any violation of the Honor Code is a grade of XF (“Failure due to Academic Dishonesty”) for the course and a referral of the student to the Student Honor Council.

Bottom line: If you are having trouble with your homework, we are here for you, physically or on Piazza.
Please, do not engage upon any form of cheating; by doing so, you jeopardize all of the work you’ve done up to that point in the semester and you will be left with an XF in your transcript.

**Contesting grades:** Students who would like to find out the process through which the staff arrived at a particular grading of an assignment (Major Scheduled Grading Event, homework assignment or quiz) should follow the approaches detailed below:

- For quizzes, homework assignments, or the midterms, students are requested to come by our office hours with the original, graded, unaltered assignment stapled with a sheet of paper where they clearly mention the reasons for which they believe they are eligible for a regrade. The staff will then receive those materials, examine the claim and come back to the student over the course of 2 business days. This can only happen within **one week** after the assignment was due.

- For the Final, since the Instructor is obligated by the Dean of CMNS to publish the course letter grades within 2 (two) working days after the exam’s date, students that would like to contest their grade are urged to come talk to the Instructor on Monday 07-25 (results will have been published on the grades server over the weekend). If necessary, additional office hours will be held by the Instructor during that day in order to accommodate students.³

Note that in *all* cases of a regrade request, the teaching staff reserves the right to re-grade the *entire assignment* for which a re-grade request exists! For example, if upon examining their regrading of question 3 of the 4th quiz assignment, a TA discovers that question 2 had an error that had slipped their attention, it is within their rights to deduct the relevant points from question 2.

**Teaching evaluations:** The instructor, TAs and the CS department as a whole take course evaluations very seriously. Your decision influences, among others, the continuation of instructors’ contracts, the assignments of instructors and TAs to courses, as well as the selection of suitable textbooks. Please submit your course evaluations on CourseEvalUM once the system is available for summer evaluations.

**Copyright:** All course materials (explicitly defined below) are copyright of their respective owners, who reserve the entirety of their rights on them. Students are permitted to use course materials for their own personal use only. Such course materials may not be distributed publicly or provided to anybody who isn’t a registered student in the course in any manner or format.

“Course materials” refers to: (1) The lecture slides, (2) The hardcopies of the Major Scheduled Examination Events, (3) The hardcopies of the quizzes and (4) Any additional documents furnished by the Instructor or TAs in either electronic or hardcopy form in order to promote the understanding of a particular subject.

---

³Please note that, as per University regulations, the Instructor is obligated to keep onto the Final hardcopies for 6 months after the course ends.