CSC 245 – Introduction to Discrete Structures

Location: Gould-Simpson, Room 701
Day and Time: Monday, Tuesday and Thursday 12:00 PM – 1:50 PM

Description of Course
An introduction to mathematical concepts for Computer Science. Topics include first-order logic and logical arguments, proof techniques with an emphasis on mathematical induction, sets, relations and functions, properties of integers, counting methods, probability, and recurrences.

Course Prerequisites or Co-requisites
Major: PRCS or Bioinformatics or Minor: COSC. Student must have earned a C grade or higher in (CSC 120 or CSC 127B or CSC 227).

Instructor and Contact Information
Chinmai Basavaraj
Office: GS 733B (GS 725)
Email: chinmaib@email.arizona.edu
Office Hours:

<table>
<thead>
<tr>
<th>Monday</th>
<th>2:00 pm – 3:00 pm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday</td>
<td>2:00 pm – 3:00 pm</td>
</tr>
</tbody>
</table>

Please keep in mind that it is possible to meet with each of us outside of office hours, too. Contact us to make an appointment.

Teaching Assistants:
Sophia L Wang
Email: rxnsp689@email.arizona.edu
Office Hours: TO BE DETERMINED

Connor Brent Richardson
Email: cbrichardson6@email.arizona.edu
Office Hours: TO BE DETERMINED

Required text and recommended readings

Recommended reading:
- Several proof-centric books have been published, including:
Some mini-discrete-structures books exist on-line, including:

- **How to Write Proofs** (Larry W. Cusick, undated)
- **An Introduction to Proofs and the Mathematical Vernacular** (Martin Day)
- **An Active Introduction to Discrete Mathematics and Algorithms** (Charles A. Cusack, David A. Santos, 2014)
- **Introduction to Higher Mathematics** (Patrick Keef, David Guichard, undated)

**Final Examination:**

**Date:** August 7th, Wednesday  
**Time:** 12:00 pm to 2:00 pm

Final exam is required and is comprehensive.

Regulations, [https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information](https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information), and Final Exam Schedule, [http://www.registrar.arizona.edu/schedules finals.htm](http://www.registrar.arizona.edu/schedules finals.htm)

**Grading and Policies**

University policy regarding grades and grading systems is available at [http://catalog.arizona.edu/policy/grades-and-grading-system](http://catalog.arizona.edu/policy/grades-and-grading-system)

**Grading Scale:**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Minimum Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 and up</td>
<td>A</td>
</tr>
<tr>
<td>80-89</td>
<td>B</td>
</tr>
<tr>
<td>60-79</td>
<td>C</td>
</tr>
<tr>
<td>50-59</td>
<td>D</td>
</tr>
<tr>
<td>49 and below</td>
<td>E</td>
</tr>
</tbody>
</table>

It's possible that final grade cutoffs will be lowered a little (from 90% to 88.5% for the bottom of the 'A' range, for example) but they will never be raised. I make such determinations only at the end of the term, after the final exam has been graded.

**Grade Composition:**

**Homework assignments: (50% of total grade)**

Homework assignments help you get more hands-on experience with the material.

**Quantity and Frequency:**

Expect to complete six homework assignments during this course. Homeworks are typically due a week from the date on which they are assigned.

**Facilities:**

For the most part, the homework assignments in this class are "written" (which includes electronic composition) and a little bit of programming exercises.

**Legibility:**
We expect your written work to have your answers clearly marked, to include sufficient detail to enable us to follow your reasoning, and to be legible so that we can easily read your words, understand your explanations, and decipher your diagrams. Difficulties in any of these areas will likely result in a loss of points.

You are encouraged (but, at least initially, not required) to learn and use the scientific document preparation package LaTeX 2e to typeset your homework submissions. Not only will this help you produce readable answers, you will be ready for future classes and research papers that may require the use of this tool. LaTeX 2e tutorials and samples will be provided.

Incomplete or Incorrect Homeworks:
On the due date, turn in what you have accomplished, whether or not it is complete. If you feel that you deserve an extension of the due date based on exceptional circumstances, contact me and I will consider your request.

We will award partial credit to incomplete and/or semi-legible answers when appropriate. If you feel that your homework was graded improperly, please contact me or TAs to discuss your concerns.

Late Assignment Policy:
No late assignments will be accepted (although accommodations may be granted in exceptional circumstances).

Quizzes: (10% of total grade)
We will have around 8 quizzes. The date and time will be announced in advanced.

The use of electronic devices (e.g., calculators) is NOT permitted on quizzes unless warranted by special circumstances.

Mid-term Exam: (15% of total grade)
Date: July 2\textsuperscript{nd}, Tuesday
Time: 12:00 pm to 2:00 pm

Midterms will focus on the material covered in class and on the assignments since the time of the previous midterm (or the start of the term in the case of the first midterm).

Class and Piazza Participation: (5% of total grade)
Participation in class discussions and activities (Does not apply to online students).

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments</td>
<td>50</td>
</tr>
<tr>
<td>Final exam</td>
<td>20</td>
</tr>
<tr>
<td>Mid-term exam</td>
<td>15</td>
</tr>
<tr>
<td>Quizzes</td>
<td>10</td>
</tr>
<tr>
<td>Participation</td>
<td>5</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
Department of Computer Science Grading Policy:

1. Instructors will explicitly promise when every assignment and exam will be graded and returned to students. These promised dates will appear in the syllabus, associated with the corresponding due dates and exam dates.
2. Graded homework will be returned before the next homework is due.
3. Exams will be returned "promptly", as defined by the instructor (and as promised in the syllabus).
4. Grading delays beyond promised return-by dates will be announced as soon as possible with an explanation for the delay.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal, respectively.

Course Goal

Course Goal: Students will learn about the mathematical concepts and practices that are most generally useful in the study of computer science.

Course Objectives:

Students will:
- Learn and apply principles of logic to construct sound arguments.
- Learn several proof forms and construct complete proofs using those forms.
- Learn a variety of fundamental mathematical principles and apply them to solve problems relevant to the study of computer science.

Expected Learning Outcomes

- Reconstruct concept definitions and explain how more advanced concepts are defined in terms of more basic concepts.
- Given a set of hypotheses, determine whether or not a given conclusion logically follows from them.
- Given a non-trivial provable conjecture, construct a complete and logically sound proof that convincingly argues the truth of the conjecture.
- Demonstrate ability to convert between logic and set expressions.
- Solve specific types of recurrence relations and prove that the solutions define the same sequences as the original relations.
- Given a counting problem, produce the correct quantity of potential outcomes by identifying and applying the appropriate counting concepts.

Scheduled Topics/Activities

Be advised that this is just an outline. It does not list every topic to be covered in the class.

1. Mathematical Review (Week 1)
   Fractions, rational numbers, sets, logarithms, exponents, quadratic equations and so on.

2. Logic (Week 1)
   Propositions, conditional propositions and application of equivalences
3. Quantification and arguments (Week 2)
Predicates, universal quantification, existential quantification, and evaluating quantified expressions

4. Proofs of "p implies q" (Week 3)
Direct proofs, disproving conjectures, proof by contraposition, and proof by contradiction

5. Additional Set Concepts (Week 3)
Properties, set operators, and set proofs

6. Matrices (Week 4)
Matrix basics, matrix operations, and logical matrices

7. Relations and Functions (Week 5)
Binary relations, properties, and representations

8. Mathematical Induction (Week 6)
Principle of mathematical induction, weak and strong induction

9. Counting (Week 7)
Pigeonhole principle, product and sum rules, permutations and combinations

10. Recursive Algorithms (Week 8)
Properties of Algorithms, Recursive Algorithms, and Structural Induction

11. Recurrence Relations and probability (Week 9)

Assignments and mid-term exam schedule:
Late submissions will not be accepted. (although accommodations may be granted in exceptional circumstances)

<table>
<thead>
<tr>
<th>Assignments</th>
<th>Start Date</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework 1</td>
<td>06/06/2019</td>
<td>06/17/2019</td>
</tr>
<tr>
<td>Homework 2</td>
<td>06/13/2019</td>
<td>06/24/2019</td>
</tr>
<tr>
<td>Homework 3</td>
<td>06/20/2019</td>
<td>06/27/2019</td>
</tr>
<tr>
<td>Mid-term Exam, July 2nd Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homework 4</td>
<td>07/08/2019</td>
<td>07/15/2019</td>
</tr>
<tr>
<td>Homework 5</td>
<td>07/15/2019</td>
<td>07/22/2019</td>
</tr>
<tr>
<td>Homework 6</td>
<td>07/22/2019</td>
<td>07/29/2019</td>
</tr>
<tr>
<td>Final Exam, August 7th Wednesday</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Absence and Class Participation Policy
The UA’s policy concerning Class Attendance, Participation, and Administrative Drops is available at http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop
The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: http://policy.arizona.edu/human-resources/religious-
**accommodation-policy.**

Absences preapproved by the UA Dean of Students (or dean’s designee) will be honored. See [https://deanofstudents.arizona.edu/absences](https://deanofstudents.arizona.edu/absences)

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is required at all lectures. Absences may affect a student’s performance in the course. If you anticipate being absent, are unexpectedly absent, or are unable to participate in class online activities, please contact me as soon as possible.

*To request a disability-related accommodation to this attendance policy, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu. If you are experiencing unexpected barriers to your success in your courses, the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office is located in the Robert L. Nugent Building, room 100, or call 520-621-7057.*

**Course Communications**

All the course materials will be posted on D2l and announcements will be communicated through email. The instructor and the TAs will attempt to reply to email and discussion board postings from students within 24 hours (48 on weekends).

We encourage you to answer the posted questions of other students on Piazza if and when you are able to do so. This is why we have a discussion board that is open to the entire class.

To help your email stand out in our inboxes, please prefix your subject lines with "CSc 245:". For example- "CSc 245: My virtual pet ate my digital homework!". Doing this will help reduce the chance that your email is inadvertently marked as 'spam'.

**Honors Credit**

Students wishing to contract this course for Honors Credit should e-mail me to set up an appointment to discuss the terms of the contact and to sign the Honors Course Contract Request Form. The form is available at [http://www.honors.arizona.edu/honors-contracts](http://www.honors.arizona.edu/honors-contracts)

**Department of Computer Science Code of Conduct**

The Department of Computer Science is committed to providing and maintaining a supportive educational environment for all. We strive to be welcoming and inclusive, respect privacy and confidentiality, behave respectfully and courteously, and practice intellectual honesty. Disruptive behaviors (such as physical or emotional harassment, dismissive attitudes, and abuse of department resources) will not be tolerated. The complete Code of Conduct is available on our department web site. We expect that you will adhere to this code, as well as the UA Student Code of Conduct, while you are a member of this class.

**Classroom Behavior Policy**

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

rev.12/11/18
Threatening Behavior Policy
The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations
The Disability Resources Offices provides guidelines regarding accessibility and accommodations: http://drc.arizona.edu/instructors/syllabus-statement.

Code of Academic Integrity
Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity.

The University Libraries have some excellent tips for avoiding plagiarism, available at http://new.library.arizona.edu/research/citing/plagiarism.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy
The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy.

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students
UA Academic policies and procedures are available at http://catalog.arizona.edu/policies.

Student Assistance and Advocacy information is available at http://deanofstudents.arizona.edu/student-assistance/students/student-assistance.

Confidentiality of Student Records

Subject to Change Statement
Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.