Welcome to CSC3001!

Baoxiang Wang

Fall 2022

Course staffs

- **Instructor:**
  - *Baoxiang Wang*
    - **Office:** DY 503
    - **Office Hours:** Mon 5:00pm – 6:00pm
    - **Zoom Office Hours:** Mon 5:00pm – 6:00pm
    - **Zoom ID:** 970 6106 7759
    - **Zoom Passcode:** 096858
    - **Email:** bxiangwang@gmail.com

- **Lectures**:
    - Room: TB201
    - Time: Mon Wed 3:30pm-4:50pm
    - Zoom ID: 970 6106 7759
    - Zoom Passcode: 096858

Course staffs

- **Teaching assistants:**

- Zhihan Ning (lead TA), Email: 220019176@link.cuhk.edu.cn
- Dmitry Rybin, Email: dmitryrybin@link.cuhk.edu.cn
- Sirong Dai, Email: 222042001@link.cuhk.edu.cn
- Tongle Wu, Email: 221049025@link.cuhk.edu.cn

- TA Office hours, Tutorial Zoom link: To be announced

Tutorials

- Tutorials begin on the **second** week, i.e. the week of September 12nd
- All tutorials will be broadcasted concurrently with Zoom

Social distancing policy

- Please follow the university’s policy.

Add and drop policy

- We approve all adds and drops requests. Adds and drops are subject to further approval from Registry.

Attendance policy

- The course do not take attendance and do not offer quiz.

Course resources

- Course material of Fall 2021: https://drive.google.com/drive/folders/1e0vLeVG74Kxk_n-Jh5jOJwxN5iUon8Bs?usp=sharing
- Course material of Summer 2022: https://drive.google.com/drive/folders/1Lh4KTUKULLaSru0-TIosX9a4hgnTRQUm?usp=sharing
- Lectures, assignments, exams

- YouTube channels, such as 3B1B https://www.youtube.com/c/3blue1brown, Numberphile, Reducible, Mathemaniac, …

Course resources

- Eric Lehman, F. Thomson Leighton, Albert R. Meyer, Mathematics for Computer Science, 2016.
- Susanna S. Epp, Discrete Mathematics with Applications (4th Edition), Brooks/Cole Cengage Learning, 2011.
- Richard A. Brualdi, Introductory Combinatorics (5th Edition), Pearson Education, Inc., 2010.
- Kenneth H. Rosen, Discrete Mathematics and Its Applications (7th Edition), McGraw-Hill, 2012.

Assessment Scheme

Component/ method	% weight
Assignments	20
Mid-Term Exam	30
Final Exam	50

5 Assignments. Release 1 assignment per ~2 weeks. Due in ~2 weeks.

Please submit the assignments on Blackboard.

Midterm exam: Nov 5th (Saturday) 9:00am – 11:00am. Midterm is onsite. Remote exam is for remote students only. Similar format as previous semesters.

Final exam: Centralized and arranged by Registry. Similar format as previous semesters.

Changes since Summer 2022

- A/A- rate no longer count students from math major (Bins will be drawn according to the overall performance and quantiles of non-math students. Then all students are fit into these thresholds.).
- **Will be renewed in Fall 2022**

- Assignments will have more questions and questions will be harder (in similar difficulty as exams). Assignments will partially be marked by completeness (even if the answers are incorrect, you get most of the scores so long as you try). Difficulty of exams remain the same.
- **Will be discontinued in Fall 2022**

Course outline

Week	Content/ topic/ activity
1	**Propositional Logic:** mathematical proof, logic, basic operators, using simple operators to construct any operator, logic equivalence, De Morgan's law, conditional statement, arguments
	Sets, First-Order Logic: definitions, operations on sets, set identities, Russell's paradox, quantifiers, negation, multiple quantifiers, arguments of quantified statements
2	**Methods of Proofs:** direct proof, contrapositive, proof by contradiction, proof by cases
	Mathematical Induction: the idea of induction, basic induction proofs, inductive constructions, paradox, strong induction, well ordering principle, invariant method
3	**Recursion:** Fibonacci recurrence, problem solving recurrences, Catalan number recurrences, tower of Hannoi, merge sort, second order recurrence relation, generating functions, distinct-roots theorem
	Greatest Common Divisors: common divisors, the quotient-remainder theorem, Euclidean GCD algorithm, prime divisibility, fundamental theorem of arithmetic
4	**Modular Arithmetic:** modular addition, modular multiplication, multiplicative inverse, cancellation, Fermat's little theorem, Wilson's theorem
	Chinese Remainder theorem: theorem and related applications
5	**Graphs:** seven bridges of Konigsberg, graphs, degrees, isomorphism, path, cycle, connectedness, trees, Eulerian cycle, directed graphs
	Graph Matching: stable matching problem and Hall's theorem, reduction and applications, proof of Hall's theorem
6	**Graph Coloring:** graph coloring, applications, some positive results, planar graphs, Euler's formula, 6-coloring
	Combinatorial Proofs and its Principles: binomial coefficients, combinatorial proof, inclusion-exclusion formula, pigeonhole principle and applications
7	**Counting by Mapping:** definition of functions, injection, surjection, bijection, inverse function, composite, bijection rule, division rule, Catalan number
	Cardinality: cardinality, countable, uncountable, diagonal argument. **Revision**

Important notes

CSC3001 discrete mathematics is an introductory course that covers a wide range of topics: logics, set theory, number theory, graph theory, group theory, combinatorics, and counting.

Each topic investigates a small part of the area. We encourage the students to explore more as they like.

Discrete mathematics is very rigorous in logics and arguments. Students will also learn to make sound arguments along with acquiring the knowledge.

Important notes

We hope the course to be quite interactive. We encourage the students to involve the interactions.

From time to time we point out keywords for the students to explore, starting from Google and Wikipedia search.

Next today

- Introduction: Discrete mathematics

- Propositional logic