COMP-611: Mathematical Tools for Computer Science

This course provides a deep dive into essential mathematics for computer science and is designed to teach not just important mathematical tools but the skill of mathematical thought in the context of CS, including how to write advanced mathematical proofs.

Instructor
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TA
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Class times: MW 11:30 am-1 pm

Prerequisites: No formal prerequisites, and no experience with proofs is expected. This course is aimed at CS graduate students who do not have a background in formal mathematics and are looking to raise their math skills. Students should not take this course if they have majored in Mathematics or an equivalent subject, or have taken a proof-based math or computer science course within the previous two years.

Textbooks: None

Syllabus
All material will be presented from a rigorous mathematical point of view, with a view to understanding *why* theorems are true, how they tie together, and how these concepts can be used in practice to derive further results in theoretical or applied computer science research. Topics will include:

1) Formal proof techniques: induction, contradiction, monovariants, etc.
2) Mathematical foundations: linear algebra, number theory, graph theory, and applications to algorithmic reasoning
3) Analysis, probability, and applications to machine learning
4) Algorithms and their rigorous analysis
5) Introduction to complexity theory

Grading
Student evaluations will be made as follows:
- **90% - Problem sets**: 6 proof-based problem sets, weighted equally, assigned about every 2 weeks
- **10% - Participation**: 5% based upon attendance at class (no deduction for absences with prior permission); 5% based upon asking/answering questions or making constructive

comments during at least 50% of classes (getting the "right" answer does not matter). It is expected that all students can get full participation credit.

Collaboration policy
Collaboration is an important part of understanding, and talking to fellow students about the problem sets is encouraged. All collaborators must be listed on the submitted solutions. Written solutions must be completely your own - do not copy material from elsewhere or share proofs / Overleaf / written notes etc. with other students.

Language of Submission
In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

Inclusivity
As the instructor of this course I endeavor to provide an inclusive learning environment. However, if you experience barriers to learning in this course, please do not hesitate to discuss them with me or the Office for Students with Disabilities (514-398-6009).