UNIVERSITY OF WATERLOO

Undergraduate Studies Academic Calendar

2023-2024

Combinatorics and Optimization

Degree Requirements

Combinatorics and Optimization

Students in this academic plan must fulfil all the requirements in Table 1 and Table 2. This must include at least 26 math courses and the following specific requirements:

- One of
  - MATH 239 Introduction to Combinatorics
  - MATH 249 Introduction to Combinatorics (Advanced Level)
- One of
  - CO 250 Introduction to Optimization
  - CO 255 Introduction to Optimization (Advanced Level)
- One of
  - CO 330 Combinatorial Enumeration
  - CO 342 Introduction to Graph Theory
- One of
  - CO 351 Network Flow Theory
  - CO 353 Computational Discrete Optimization
  - CO 367 Nonlinear Optimization

  Note: If CO 255 is taken, this requirement can be satisfied by taking one of
    - CO 450 Combinatorial Optimization
    - CO 452 Integer Programming
    - CO 454 Scheduling
    - CO 456 Introduction to Game Theory
    - CO 459 Topics in Optimization
    - CO 463 Convex Optimization and Analysis
    - CO 466 Continuous Optimization
    - CO 471 Semidefinite Optimization
- One of
  - PMATH 336 Introduction to Group Theory with Applications
  - PMATH 347 Groups and Rings
- Three additional courses chosen from
  - CO 330 Combinatorial Enumeration
  - CO 331 Coding Theory
  - CO 342 Introduction to Graph Theory
  - CO 351 Network Flow Theory
  - CO 353 Computational Discrete Optimization
  - CO 367 Nonlinear Optimization
  - CO 430 Algebraic Enumeration
  - CO 431 Symmetric Functions
  - CO 432 Information Theory and Applications
  - CO 434 Combinatorial Designs
  - CO 439 Topics in Combinatorics
  - CO 440 Topics in Graph Theory
  - CO 442 Graph Theory
  - CO 444 Algebraic Graph Theory
  - CO 446 Matroid Theory
  - CO 450 Combinatorial Optimization
  - CO 452 Integer Programming
  - CO 454 Scheduling
  - CO 456 Introduction to Game Theory
  - CO 459 Topics in Optimization
  - CO 463 Convex Optimization and Analysis
  - CO 466 Continuous Optimization

    - CO 471 Semidefinite Optimization
    - CO 481/CS 467/PHYS 467 Introduction to Quantum Information Processing
    - CO 485 The Mathematics of Public-Key Cryptography
    - CO 486 Topics in Quantum Information
    - CO 487 Applied Cryptography
- Three of
    - MATH 237 Calculus 3 for Honours Mathematics or MATH 247 Calculus 3 (Advanced Level)
    - AMATH 331/PMATH 331 Applied Real Analysis or PMATH 333 Introduction to Real Analysis
    - AMATH 332/PMATH 332 Applied Complex Analysis
    - CS 462 Formal Languages and Parsing
    - CS 466 Algorithm Design and Analysis
    - CS 487 Introduction to Symbolic Computation
    - PMATH 334 Introduction to Rings and Fields with Applications or PMATH 348 Fields and Galois Theory
    - PMATH 340 Elementary Number Theory

      Note: These fourth-year CS courses are open only to Computer Science majors.
- Two additional 300- or 400-level math courses (1.0 unit) from ACTSC, AMATH, CS, MATBUS, MATH, PMATH, or STAT
- One additional 300- or 400-level math course (0.5 unit) from ACTSC, AMATH, CO, CS, MATBUS, MATH, PMATH, or STAT
- Three additional math courses (1.5 units) from ACTSC, AMATH, CO, CS, MATBUS, MATH, PMATH, or STAT

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