EXPANDED COURSE DESCRIPTION
ELECTRICAL ENGINEERING AND COMPUTER SCIENCE
Lassonde School of Engineering
Electrical Engineering Computer Science
LE / EECS 4115 3.0 SECTION A
COMPUTATIONAL COMPLEXITY
FALL 2019 / WINTER 2020

Last Modified Date: 07/18/2019

COURSE CALENDAR DESCRIPTION
Study of time and space and other computational resources required for efficient solution of classes of computational problems, including P and NP, PSPACE. Proof techniques including diagonalization, simulation, reduction and completeness. Models of computation, nondeterminism, randomness. Intractability. Prerequisites: cumulative GPA of 4.50 or better over all major EECS courses (without second digit "5"); LE/EECS 2030 3.00 or LE/EECS 1030 3.00; LE/EECS 2001 3.00; LE/EECS 3101 3.00. Previously offered as: LE/CSE 4115 3.00.

INSTRUCTOR(S)

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<th>Name</th>
<th>Section / Format / Term</th>
<th>Contact Email</th>
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<tr>
<td>Dymond, Patrick</td>
<td>Sec. A / LECT / F</td>
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ADDITIONAL INFORMATION

TOPICS AND CONCEPTS
Topics include:
• Models of computation for complexity: Turing Machines, Random Access Machines, Circuits and their resources such as time, space, size, and depth
• Time-and space-bounded diagonalization, complexity hierarchies, resource bounded reducibility such as log space and polynomial time reducibility
• P vs. NP: Nondeterminism, Cook’s Theorem and techniques for proving NP-Completeness
• Nondeterministic space: The Savitch and Immerman/Szelepsenyi Theorems
• Important complexity Classes (and natural problems complete for them) including: P, NP, co-NP, the Polynomial time Hierarchy, log space, Polynomial SPACE and Exponential time
• If time permits the course may also include one or more advanced topics such as parallel complexity classes, interactive proofs, applications to cryptography, and probabilistic classes including random polynomial time

GRADE ASSESSMENT
Note: These are the main factors used for assessment. The actual weights will be announced in the first week of classes.

MARKING SCHEME
Homework exercises – 20%
Midterm tests – 40%
Final – 20%

REQUIRED TEXT
(The third edition's numbering is significantly changed from the second edition’s.)
• Additional material will be from an online draft of S. Arora and B. Barak, *Computational Complexity*, 2007.

The main focus of the course is on Sipser Chapters 7-10. Prior familiarity with material in Chapters 0, 1, 3, 4.2 and 5.3 will be needed.

**REFERENCES**

• Papadimitriou, *Computational Complexity*, Addison-Wesley, 1994

**ACADEMIC INTEGRITY LINKS**

• Senate Policy on Academic Honesty - http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/
• Academic Integrity - http://lassonde.yorku.ca/academic-integrity

**STUDENT LINKS**

• Student Rights and Responsibilities - http://oscr.students.uit.yorku.ca/student-conduct
• Religious Observance - https://w2prod.sis.yorku.ca/Apps/WebObjects/cdm.woa/wa/regobs
• Academic Accommodation for Students with Disabilities - http://secretariat-policies.info.yorku.ca/policies/academic-accommodation-for-students-with-disabilities-policy/
• Student Accessibility Services (SAS) - https://accessibility.students.yorku.ca/
• York University’s Policies on Sexual Violence - http://secretariat-policies.info.yorku.ca/policies/sexual-violence-policy-on/
• York University’s Policies on Gender/LGBTQ*/Positive Space - http://rights.info.yorku.ca/lgbtq/

**LAND ACKNOWLEDGEMENT**

• We acknowledge our presence on the traditional territory of many Indigenous Nations. The area known as Tkaronto has been care taken by the Anishinabek Nation, the Haudenosaunee Confederacy, the Huron-Wendat, and the Métis. It is now home to many Indigenous Peoples. We acknowledge the current treaty holders, the Mississaugas of the New Credit First Nation. This territory is subject of the Dish With One Spoon Wampum Belt Covenant, an agreement to peaceably share and care for the Great Lakes region.
• The Indigenous Framework for York University: A Guide to Action can be found here: http://indigenous.info.yorku.ca/
• Meaning of a land acknowledgement: http://healthydebate.ca/opinions/indigenous-land-acknowledgements

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Many courses utilize Moodle, York University’s course website system. If your course is using Moodle, click here to access it.

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