EXPANDED COURSE DESCRIPTION
ELECTRICAL ENGINEERING AND COMPUTER SCIENCE
Lassonde School of Engineering
Electrical Engineering Computer Science
LE / EECS 3101 3.0 SECTION E
DESIGN AND ANALYSIS OF ALGORITHMS
FALL 2019 / WINTER 2020

Last Modified Date: 07/18/2019

COURSE CALENDAR DESCRIPTION

Review of fundamental data structures. Analysis of algorithms: time and space complexity. Algorithm design paradigms: divide-and-conquer, exploring graphs, greedy methods, local search, dynamic programming, probabilistic algorithms, computational geometry. NP-complete problems. Prerequisites: cumulative GPA of 4.50 or better over all major EECS courses (without second digit "5"); LE/EECS 2011 3.00; SC/MATH 1090 3.00; SC/MATH 1310 3.00. Course credit exclusion: LE/SC CSE 3101 3.00.

INSTRUCTOR(S)

<table>
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<tr>
<th>Name</th>
<th>Section / Format / Term</th>
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<tr>
<td>Mirzaian, Andranik</td>
<td>Sec. E / LECT / F</td>
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ADDITIONAL INFORMATION

This course is intended to teach students the fundamental techniques in the design of algorithms and the analysis of their computational complexity. Each of these techniques is applied to a number of widely used and practical problems. At the end of this course a student will be able to: choose algorithms appropriate for many common computational problems; to exploit constraints and structure to design efficient algorithms; and to select appropriate tradeoffs for speed and space. Topics covered may include the following:

- **Review**: Mathematical Induction, asymptotic notation.
- **Analysis techniques**: summations and recurrence relations.
- **Lower Bound Techniques**: (Algebraic) Decision Trees, Adversary Arguments, Problem Reduction (or Transformation).
- **Correctness proofs** via assertions, pre and post conditions, loop invariants, (weak & strong) induction on these assertions.
- **Sorting and order statistics**: Heapsort and Priority Queues, Randomised QuickSort and its expected case analysis, Special Purpose Sorting Algorithms, Linear-Time Selection.
- **Prune-&-Search**: Binary Search, Linear Time Selection Algorithm.
- **Incremental methods**: VLSI Cheap Testing, In-Place Tri-Partition, Maximum Sum Subarray, Longest Smooth Subarray.
- **Divide-and-conquer**: MergeSort, Recursive Doubling, Euclid's (extended) GCD algorithm (and its applications in number theory and encryption techniques), arithmetic with large numbers and matrices, Closest Pair of Points in 2D.
- **Greedy methods**: Coin Change Making, Activity Selection (or Event Scheduling), Point-Interval Cover Problems, some graph algorithms.
- **Dynamic Programming**: Matrix Chain Product, Optimal Static Binary Search Trees, Scheduling, Knapsack Problems, Longest Common Subsequence, some graph algorithms.
- **Graph algorithms**: Depth First Search, Breadth First Search, Biconnectivity and Strong Connectivity, Topological Sort, Minimum Spanning Trees, Shortest Paths, Network Flow, Matching.
- **Theory of NP-completeness.**
COURSE TEXTBOOK

GRADES
The weight distribution of the course components is as follows:
• 30% - 4 Assignments, all equal weight
• 25% - Midterm Test - closed book
• 45% - Final Exam - closed book

COURSE WEBSITE
https://wiki.eecs.yorku.ca/course_archive/2019-20/F/3101E/start

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

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