

University of Lethbridge  
Department of Mathematics and Computer Science

Computer Science 4110/5110 A – Advanced Algorithms  
Course Outline – Fall 2013

---

**LECTURES:** Tu Th 1:40 p.m. – 2:55 p.m. **ROOM:** TH173

**INSTRUCTORS:** Robert Benkoczi (office C556)  
robert.benkoczi@uleth.ca

**TEXT:** *The Design of Approximation Algorithms*  
by Shmoys and Williamson  
available 4 free @ <http://www.designofapproxalgs.com/>

**GRADING SCHEME:**

assignments	20%
project / presentations	10%
Midterm	20%
Take home final exam	50%

**GRADE DISTRIBUTION:** This information is provided as a guideline only and may be revised in this offering.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Minimum %	95	85	80	77	73	70	67	63	60	55	50	0

**TOPICS:**

This course is about designing approximation algorithms for difficult optimization problems for which no optimal algorithms with running time polynomial in the problem size are known. Approximation algorithms find feasible solutions that may not be optimal but are not too far from the optimal one.

We will overview various interesting algorithm design techniques that may prove extremely useful to graduate students tackling research questions in various fields and to undergraduates who may encounter interesting problems in their future projects in the industry. Some of the techniques we will visit involve:

- linear programming and duality,
- greedy, local search, and dynamic programming,
- random sampling and randomized rounding of linear and semidefinite programs
- cuts and metrics in networks

**PREREQUISITES:**

- A third year course on algorithms
- Familiarity with CPSC 1820 subjects such as random variables and proof techniques.

Familiarity with NP-hardness is useful but not essential. All other concepts such as linear and semidefinite programming will be covered in class.

**COMMENTS:**

- Graduate vs. undergraduate work: this graduate class is open to undergraduate students. Graduate students will be required to do additional work. For example, graduate students are required to give one class presentation. Both graduate and undergraduate students are asked to submit a term project.
- How much mathematics is it involved in this course? This is a computer science course. The mathematics involved is elementary, at the level of CPSC 1820.