UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF COMPUTER SCIENCE
COURSE OUTLINE

1. **Course:** CPSC 611: Complexity Theory
   Lecture Sections:
   L01, TR 9:30-10:45, Wayne Eberly, ICT 613, 220-5073, eberly@ucalgary.ca
   Office Hours: TR 11:00-11:50

   Course Website: D2L

   Computer Science Department Office, ICT 602, 220-6015, cpsc@cpsc.ucalgary.ca

2. **Prerequisites:** Consent of Department
   (http://www.ucalgary.ca/pubs/calendar/current/computer-science.html#3620)

3. **Grading:** The University policy on grading and related matters is described in sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Assignments (Best 3 out of 4)	50%
Project	50%

   This course **will not** have a Registrar's Scheduled Final Exam.

   Special Regulations affecting Final grade: Each of the above components will be given a percentage grade. The final grade will be calculated weighted by the percentage given above, rounded up to the nearest integer between 0 and 100, and the reconverted to a final letter grade using the attached cut-offs.

4. **Missed Components of Term Work:** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar. Section 3.6. It is the student's responsibility to familiarize theirself with these regulations. See also Section E.6 of the University calendar.

5. **Scheduled Out-of-Class Activities:** REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME ACTIVITY. If you have a clash with this out-of-class activity, please inform your instructor as soon as possible so that alternative arrangements can be made.

6. **Course Materials:**

   Computational Complexity: A Modern Approach, Sanjeev Arora and Boaz Barak, Cambridge University Press 2008 (Recommended)

   Online Course Components:
   Lecture slides will be posted on D2L..

7. **Examination Policy:** None. Students should also read the Calendar, Section G, on examinations.

8. **Approved Mandatory and Optional Course Supplemental Fees:** None.

9. **Writing across the Curriculum Statement:** In this course, the quality of the student's writing in the weighted components of the course will be a factor in the evaluation of these components. See also Section E.2 of the University Calendar.

10. **Human Studies Statement:** Students will be expected to participate as subjects or participants in projects. See also Section E.5 of the University Calendar.

11. **OTHER IMPORTANT INFORMATION FOR STUDENTS:**

a) **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offense that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under Section K, Student Misconduct to inform yourself of definitions, processes and penalties.

b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on assembly points which can be found in each classroom and building.

c) **Student Accommodations:** Students needing an Accommodation because of a Disability or medical condition should contact Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities available at http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf. Students needing an Accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to the Associate Head of Computer Science.

d) **Safewalk:** Campus Security will escort individuals day or night (http://www.ucalgary.ca/security/safewalk/). Call 403-220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

e) **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information see also http://www.ucalgary.ca/secretariat/privacy

f) **Student Union Information:** VP Academic (403) 220-3911 suvpaca@ucalgary.ca SU Faculty Rep (403) 220-3913 science1@su.ucalgary.ca, science2@su.ucalgary.ca and science3@su.ucalgary.ca, Student Ombuds Office: (403) 220-6420 ombuds@ucalgary.ca, http://ucalgary.ca/provost/students/ombuds

g) **Internet and Electronic Device Information:** You can assume that in all classes that you attend your cell phone should be turned off unless instructed otherwise. All communications with other individuals via laptop computers, cell phones or other devices connectable to the internet in not allowed during class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

h) **U.S.R.I.:** At the University of Calgary feedback provided by students through the Universal Student ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference – please participate in USRI surveys.

Department Approval_____ Date_____

Faculty Approval for
out of regular class-time activity: _____
Date:_____

Faculty Approval for
Alternate final examination arrangements: _____
Date:_____

A signed copy of this document is on file in the Computer Science Main Office

CPSC 611 Percentage to Letter Grade Conversion Table

A+	96-100
A	91-95
A-	86-90
B+	81-85
B	76-80
B-	71-75
C+	66-70
C	62-65
C-	58-61
D+	55-57
D	50-54
F	0-49

CPSC 611 Syllabus

Tentative Topics Covered:

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* The Computational Model - and Why It Doesn't Matter (Much)
* Reducibilities, NP, and NP-Completeness
* Space-Bounded Computation
* The Polynomial Hierarchy and Alternations
* Boolean Circuits
* Randomized Computation

Learning Outcomes:

By the end of the course, students will be able to do the following:

* Define a variety of resource-based complexity classes and describe the proved - as well as conjectured - relationships between these.
• Define several kinds of reductions between computational complexity classes and identify one or of these that should be used to define hardness and completeness for most or all of the complexity classes that have been studied.
* Name and describe languages (and corresponding decision problems) that are complete for various complexity cleasses that have been studied, with respect to various kinds of reducibility.
* Describe consequences of the fact that a given computational problem is complete for a given complexity class - both with, and without, conjectures about the relationship between this and other complexity classes.
• Discover and precisely describe reductions between computational problems in order to prove that specified problems are hard for specified complexity classes.
* Recall, and precisely state, classical results in computational complexity theory - including various speedup and hierarchy theorems that relate the complexity classes being studied.
* Explain relationships between deterministic, nondeterministic, and randomized resource-based complexity classes that have been proved - along with others that are consequences of standard complexity-theoretic conjectures.
* Comprehend, and be able to summarize, proofs of various results that have been presented in lectures - to the extent that the proof technique being applied can be accurately described and some details of the argument can be provided.
• Apply various proof techniques - including diagonalization arguments, and the use of simulations - that have been used during the course to prove various results concerning computational complexity theory.

By doing the above... a student will have demonstrated the ability to read, understand and explain technical material concerning theoretical computer science, and to write such material that is readable and correct.

Allowable Sources:

No Restrictions on source material.

Cited Sources:

If you used an article, book, function or algorithm that you did not create for this course you must cite it. (This means you may have to cite yourself!) Use APA for citations in a report, paper or in the header documentation of computer code you submit. If citing a website, make sure you include the date you accessed the website. Don't forget to cite code that you used, even if you modified the code.

Level of Collaboration between Students:

You may discuss the assignments with other students in the class, outside your group, but do NOT share any code or other written material that is part of an assignment submission,, do not ask others to provide you with code or written material to be included in a submission, and do not show code or such written material that you have created for assignments to other students.

You must not discuss assigned with work with tutors, either. Tutorial exercises will frequently be available that concern similar tasks, and these can be discussed instead.

Disclosure Policy

If you discuss the assignments with others, make sure to cite these discussions.