CSC485B: Topics in Systems: "Data Compression"

Course Dates

CRN(s):	Section A01 CRN: 30224
Term:	Summer 2020
Course Start:	2020-05-04
Course End:	2020-08-17
Withdrawal with 100% reduction of tuition fees:	2020-05-16
Withdrawal with 50% reduction of tuition fees:	2020-06-06
Last day for withdrawal (no fees returned):	2020-07-01

Cross-listed With

Cross-Listed Course(s): SENG480B, CSC578B

Scheduled Meeting Times (M=Mon, T=Tue, W=Wed, R=Thu, F=Fri)

Section:	Location:	Classes Start:	Classes End:	Days of week:	Hours of day:	Instructor:
A01		2020-05-04	2020-07-31	MW	16:30-17:50	Bill Bird

Instructor(s)

Name: **Bill Bird**
Office: ECS 530
Phone: (250) 472-5833
Email: bbird at uvic dot ca

Office Hours:		Comments
Wed	03:00pm-04:00pm	Held via Zoom. Office hours subject to change; check conneX for details.
Thu	03:00pm-04:00pm	Held via Zoom. Office hours subject to change; check conneX for details.

Course Overview

This course covers techniques for data compression, both lossless (such as `gzip` and BZip2) and lossy (such as JPEG and PNG). The course also covers theoretical aspects of compression, efficient algorithms and data structures, and practical programming techniques for implementation.

Topics

Lossless compression

1. Fundamentals of Compression
2. Information and Entropy
3. Applied compression schemes for lossless compression (LZW, DEFLATE, BZip2)
4. Algorithms and transformations for compression (Lempel-Ziv, Burrows-Wheeler, Move to Front, Delta Compression)
5. Huffman coding
6. Arithmetic coding and statistical modelling
7. Techniques for high performance compression implementation

Lossy compression

1. Image compression
2. Audio compression
3. Video compression

Course Objectives And Learning Outcomes

The goal of this course is to cover compression mechanics both from a high level perspective (e.g. algorithms), but also from a low level programming perspective. Students completing this course will have a detailed knowledge of different compression schemes and the ability to choose effective techniques for a particular application of compression. Students will also develop experience with low-level programming techniques for high throughput compression, and an understanding of the types of optimization needed for these techniques.

Online Resources

All course components will be coordinated through the course conneX site at https://connex.csc.uvic.ca

Basic Requirements for Online Courses

This course is offered online, but the same expectations apply as for a face-to-face offering. All students are expected to fully participate in this course. This will require reliable and consistent access to a computer (desktop or laptop) and an internet connection. If you cannot ensure that you will have access to these things for the entire semester, you should plan to take this course at a later date. It will not be possible to adjust the course expectations, due dates or learning outcomes for students who do not have the technological means to complete the course.

Some parts of the course may be offered asynchrously (e.g. prerecorded and posted for viewing at your convenience). However, you are expected to attend synchronously during the scheduled meeting times given at the top of this document. All times given are in Pacific Daylight Time (UTC - 7:00).

Textbooks

All of the required resources are available as ebooks free through the UVIc library

Required:
Handbook of Data Compression (Fifth Edition)
by David Salomon and Giovanni Motta
Springer, 2010
eBook link
Introduction to Data Compression (Fourth Edition)
by Khalid Sayood
Morgan Kaufmann, 2012
eBook link

Other resources will be posted as needed.

Assignments

There will be five programming assignments. All programming assignments will require the use of C or C++. Students are expected to already be fluent in at least one of these languages.

Assignment	Weight	Tentative Due Date
Assignment 1	5%	May 19, 2020
Assignment 2	15%	June 15, 2020
Assignment 3	15%	July 6, 2020
Assignment 4	5%	July 20, 2020
Assignment 5	15%	August 5, 2020

You should start assignments early enough to allow time to seek help if you encounter difficulties. Late assignments will not be accepted.

Students are encouraged to discuss assignment problems with each other and form study groups. However, final assignment submissions must be generated independently, and you will only receive credit for your own work. Submitting the work of another student (in whole or in part) and claiming it as your own, or providing your work to another student for them to submit, is plagiarism. In the context of programming assignments (where the submission is code), you are encouraged to discuss all aspects of the assignment with your peers, and to collaborate on the conceptual aspects of the solution, but do not look at the code written by any other student (either over their shoulder or by sharing it electronically).

On some assignments, you may be permitted to use material from other sources with proper attribution. Submitting the work of others (whether they are your fellow students or not) without proper acknowledgement will be considered a serious academic offense and may result in failure of the course.

Plagiarism detection software will be used on assignment submissions. Substantiated instances of plagiarism, including cases where only a part of the submission has been plagiarized, will be referred to the Department's academic integrity committee. Note that the university calendar (in https://web.uvic.ca/calendar/undergrad/info/regulations/academic-integrity.html) clearly states that a largely plagiarized assignment should result in a failing grade being assigned for the course.

Exams

The course will have four exams, each worth 10%, following the schedule below.

Exams will be scheduled synchronously: All students will be expected to write exams during the scheduled lecture time

Exam	Weight	Tentative Due Date
Exam 1	10%	June 1, 2020
Exam 2	10%	June 22, 2020
Exam 3	10%	July 13, 2020
Exam 4	10%	July 29, 2020

The format of each exam may vary, but all exams are expected to be given in a synchronous, time limited format. Students will be required to complete each exam independently, and not communicate with anyone (whether or not they are a fellow student) regarding the exam content during the exam.

Small Exercises

Various small exercises will be given throughout the semester to support engagement in the lecture material. These exercises will be assigned at least 48 hours before their due dates (similar to how, in a face-to-face semester, you might be given a task during the Monday lecture to have completed by the Wednesday lecture).

Grading

Component	Weight (out of 100%)
Assignments	55%
Exams	40%
Small Exercises	5%

To receive a passing grade in the course, **all** of the following conditions must be met:

1. The final percentage, according to the computation above, must be at least 50%
2. A grade of at least 20/40 must be achieved on the 40% of the course allocated to Exams
3. A grade of at least 27/55 must be achieved on the 55% of the course allocated to Assignments

Exceptions will be granted for missed work (exams, assignments, exercises) **only** in cases where the university's policy on academic concessions (with appropriate documentation, such as a doctor's note) applies. Documentation must be supplied to the instructor within 5 calendar days of the missed component or the exception will not be granted. The university's policies on academic concessions (at

http://web.uvic.ca/calendar/undergrad/info/regulations/concessions.html) will be strictly followed. In particular, please note that no exceptions can be made for incidental scheduling issues that may result in a missed exam (e.g. sleeping in, traffic, late busses, etc.). You are responsible for taking the necessary precautions to ensure you can write exams on time.

Academic Integrity

Plagiarism detection software will be used on assignment and exam submissions. Submitting the work of others without attribution and enabling others to submit your work without attribution are considered serious academic offences and may result in failure of the course. You cannot share your work with others, neither directly, indirectly or by placing it in a publicly accessible location (such as GitHub).

In the context of programming assignments (where the submission is code), you are encouraged to discuss high-level aspects of the assignment with your peers, and to collaborate on the conceptual aspects of the solution. However, the implementation of an assignment submission must be generated independently, and you will only receive credit for your own work. Do not look at the code written by any other student (sharing solutions electronically, visually, orally or by any other means is prohibited). Collaboration on the coding aspect of programming assignments is not allowed unless explicitly permitted in writing by the course instructor.

In the context of online and take-home exams, collaboration with other students in any form and the solicitation of answers from any outside source is strictly prohibited. Any instance of impersonation during an exam is considered a serious academic offence by both the student being impersonated and the impersonator.

The use of an editor or tutor, either paid or unpaid, to correct or augment your work is strictly prohibited on both assignments and exams.

Substantiated instances of plagiarism, including cases where only a part of the submission has been plagiarized, will be referred to the Department's Academic Integrity Committee. Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the link given below for the UVic policy on academic integrity. Note that the university policy includes the statement that "A largely or fully plagiarized assignment should result in a grade of F for the course."

The Faculty of Engineering Standards for Professional Behaviour are at
https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf

UVic guidelines and policy concerning fraud and academic integrity are at
http://web.uvic.ca/calendar/undergrad/info/regulations/academic-integrity.htm

Grading System

The University of Victoria follows a percentage grading system in which the instructor will submit grades in percentages. The University will use the following Senate approved standardized grading scale to assign letter grades. Both the percentage mark and the letter grade will be recorded on the academic record and transcripts.

F	D	C	C+	B-	B	B+	A-	A	A+
0-49	50-59	60-64	65-69	70-72	73-76	77-79	80-84	85-89	90-100

Grades	Description
A+, A, A-	**Exceptional**, **outstanding** or **excellent** performance. Normally achieved by a minority of students. These grades indicate a student who is *self-initiating*, *exceeds expectation* and has an *insightful* grasp of the subject matter.
B+, B, B-	**Very good**, **good** or **solid** performance. Normally achieved by the largest number of students. These grades indicate a *good* grasp of the subject matter or *excellent grasp in one area balanced with satisfactory grasp in the other areas*.
C+, C	**Satisfactory**, or **minimally satisfactory**. These grades indicate a *satisfactory performance and knowledge* of the subject matter.
D	**Marginal Performance**. A student receiving this grade demonstrated a *superficial grasp* of the subject matter.
F	**Unsatisfactory performance**. Wrote final examination and completed course requirements; no supplemental.

Posting of Grades

Marks for assignments and examinations, as well as provisional final grades, will be made available through the conneX gradebook.
Each student will be able to view only their own grades.

For some assignment tasks, student submissions (with all identifying information removed) and numerical marks for the task will be posted publicly to the entire course. However, no student numbers or names will be associated with the posted information.

Course Experience Survey (CES)

I value your feedback on this course. Towards the end of term you will have the opportunity to complete a confidential course experience survey (CES) regarding your learning experience. The survey is vital to providing feedback to me regarding the course and my teaching, as well as to help the department improve the overall program for students in the future. When it is time for you to complete the survey, you will receive an email inviting you to do so. If you do not receive an email invitation, you can go directly to the CES site

You will need to use your UVic NetLink ID to access the survey, which can be done on your laptop, tablet or mobile device. I will remind you closer to the time, but please be thinking about this important activity, especially the following three questions, during the course.

- What strengths did your instructor demonstrate that helped you learn in this course?
- Please provide specific suggestions as to how the instructor could have helped you learn more effectively.
- Please provide specific suggestions as to how this course could be improved.

Csc Student Groups

The Computer Science Course Union (https://onlineacademiccommunity.uvic.ca/cscu/) serves all students who are either in a computer science program or taking a class in computer science. Please sign yourself up on their mailing list if you would like to be informed about their social events and services.

The Engineering Students' Society (ESS) serves all students registered in an Engineering degree program, including Software Engineering (BSEng). For information on ESS activities, events and services navigate to http://www.engr.uvic.ca/~ess .

Course Policies And Guidelines

Late Assignments: No late assignments will be accepted unless prior arrangements have been made with the instructor **at least 48 hours before** the assignment due date.
Coursework Mark Appeals: All marks must be appealed **within 7 days** of the mark being posted.
Attendance: We expect students attend all lectures and labs. It is entirely the students' responsibility to recover any information or announcements presented in lectures from which they were absent.
Electronic devices in labs and lectures: No unauthorized *audio* or *video* recording of lectures is permitted.
Electronic devices in midterms and exams: Calculators are only permitted for examinations and tests if explicitly authorized and the type of calculator permitted may be restricted. No other electronic devices (e.g. cell phones, pagers, PDA, etc.) may be used during examinations or tests *unless explicitly authorized*.
Plagiarism: Submitted work may be checked using plagiarism detection software. Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the link given below for the UVic policy on academic integrity. Note that the university policy includes the statement that "A largely or fully plagiarized assignment should result in a grade of F for the course."

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https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf
U.Vic guidelines and policy concerning fraud and academic integrity are at
http://web.uvic.ca/calendar/undergrad/info/regulations/academic-integrity.html
U. Vic Privacy Policy: If any student has concerns about their private information being stored or accessed outside of Canada, they are required to inform the course instructor about their concerns before the end of second week of classes.

Equality

This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the

opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Centre for Accessible Learning (formerly the Resource Centre for Students with a Disability) located in the Campus Services Building.

The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.