SYLLABUS

CSCI 3104: ALGORITHMS

FALL 2019, 4 CREDITS, AUGUST 26 – DECEMBER 12, 2019

Class meeting times:

Hoenigman Lecture:

TTH, 12:30-1:45pm; ECCR 150.

Agrawal Lecture:

TTH, 9:30-10:45am; ECCR 1B40.

The Hoenigman section of this class also has a distance section. Distance students are welcome to attend lecture with either instructor if there is a seat available. The material presented in this syllabus applies to all sections of the class taught by both instructors.

INSTRUCTOR INFORMATION

Name: Rhonda Hoenigman

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Name: Shivendra Agrawal

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Office Location: ECOT 738

TA INFORMATION

Zhiyuan Liu, zhiyuan.liu@colorado.edu

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Pre-requisites

CSCI 2270 – Data Structures, CSCI 2824 – Discrete Structures

Course Topics

Fundamentals of algorithms, Time and space complexity, Sorting algorithms, Recurrence relations, Efficient data structures, Divide and Conquer algorithms, Greedy algorithms, Dynamic programming, Graph algorithms, Problems in P and NP, Approximation algorithms.

Course Description

- Lectures 2 times a week (TTH)
- Weekly recitation with course TAs
- Problem sets assigned on Tuesday and Thursday.
- Problem sets will include written and programming questions
- Two midterm exams
- One final take home exam
- Six recitation quizzes
- This will be a challenging course, please plan accordingly

Textbooks and Materials

Required text: The Algorithm Design Manual, by S. Skiena. Springer-Verlag, London. 2008.

Course materials, such as lecture notes and assignments, will be available in electronic form on the Canvas site for the course: http://canvas.colorado.edu/.

Course Outcomes

In this course, students will:
- Become familiar with "standard" algorithms for abstract problem solving
- Learn how to mathematically prove properties of algorithms, including their correctness
- Analyze the time and space complexity of algorithms
- Understand the relative merits or demerits of different algorithms in practice
- Adapt and combine algorithms to solve problems that may arise in practice
- Learn common strategies in the design of new algorithms for emerging applications

Grading

Six recitation quizzes   15% (Drop lowest, 3% each)

Homework	25% (8-10 assignments)
Two midterm exams	50% (Equally weighted)
Take home final	10%

RECITATION

Recitation is an important part of this class. Therefore, attendance is required. There will be six quizzes in recitation in weeks 3, 5, 8, 10, 12, 15. These quizzes are open note, open book. Each quiz will be about 30 minutes and your TA will go over the answers in recitation after the quiz. You can drop one recitation quiz grade.

EXAM INFORMATION

There are two midterm exams for this class, each held as a two-hour evening exam in Weeks 7 and 13 of the semester. Both the in-class students and the distance students are required to take the exams. Because this class has a distance section, it is not possible for us to have a regular, in-class final exam. Instead, we will have a take-home exam.

ADDITIONAL EXAM GRADE REQUIREMENTS TO PASS THE CLASS

You must get at least a 60% average on your midterm exams and final take home exam to receive better than a D+ in this class, regardless of your grades on other parts of the class. A grade of a C- in this class is required to take the next class in the computer science sequence.

FINAL COURSE GRADES

The grades for this class follow the standard percentage breakdown for the College of Engineering:

93%-100%	A
90%-93%	A-
87%-90%	B+
83%-87%	B
80%-83%	B-
77%-80%	C+
73%-77%	C
70%-73%	C-
67%-70%	D+
63%-67%	D
60%-63%	D-
0%-60%	F

COURSE CALENDAR

WEEK 1-2, AUGUST 26-SEPTEMBER 8

Topics: Introduction to algorithm design

- Algorithm definition (CLRS Ch. 1, Skiena Ch. 1)
- Motivating examples(Ch. 1.2, Skiena Ch. 1)
- Correctness proofs (CLRS Ch. 2)
- Complexity analysis (Skiena Ch. 2)

WEEK 3-6, SEPTEMBER 9-OCTOBER 6

Quiz: Week 3 in recitation

Quiz: Week 5 in recitation

Topics: Greedy algorithms
- Interval Scheduling
- Shortest path(Skiena Ch. 6.3)
- Minimum spanning tree (Skiena Ch. 6.1, Ch. 15.3)
- Huffman coding (Skiena Ch. 18.5)
- Network flow (Skiena Ch. 6.5)

WEEK 7, OCT 7-13

Midterm Exam - Friday, Oct 11 at 6pm in MATH 100.

Topics: Review, Catch up

WEEK 8, OCTOBER 14 - 20

Quiz: Week 8 in recitation

Topics: Divide and Conquer algorithms
- MergeSort (Skiena Ch. 4.5, Clauset notes on Canvas)
- Recurrence(Skiena Ch. 4.10, Clauset notes on Canvas)
- Quicksort (Skiena Ch. 4.6, Clauset notes on Canvas)

WEEK 9-10, OCTOBER 21-NOVEMBER 3

Quiz: Week 10 in recitation

Topics: Dynamic programming (Skiena Ch. 8)
- Weighted interval scheduling
- Principles of DP
- Shortest path(Skiena Ch. 15.4)
- Sequence alignment (Clauset notes on Canvas)

WEEK 11-12, NOVEMBER 4-17

Quiz: Week 12 in recitation

Topics: NP Complete and approximation algorithms (Skiena Ch. 9)
- NP-Complete problems
- Set cover
- Vertex cover

- 3-SAT(Skiena Ch. 9)

WEEK 13, NOVEMBER 18-24
Midterm Exam - Thursday, November 21 at 6pm in MATH 100.
Topics: Review, Catch up

WEEK 14, NOVEMBER 25 - DECEMBER 1
No classes, fall break

WEEK 15, DECEMBER 2-8
Quiz: Week 15 in recitation
Topics: Randomized algorithms, amortized analysis
- Universal hashing(Skiena Ch. 3.7)

WEEK 16, DECEMBER 9-15
Topics: Amortized analysis

SUBMITTING WORK LATE
Each week, your homework will consist of two parts:

- Part A - A small assignment given out on Tuesday that is due Thursday;
- Part B - A larger assignment given out on Thursday that is due the following Tuesday.

For Part B assignments, you can receive a two-day extension for a 20% grade penalty. After two days, your homework is late and cannot be turned in. There is no extension available on Part A assignments. In the event of a documented personal, family, or medical emergency, consult your TA about receiving a penalty free extension. If you know you will be missing a weekly recitation, go to a recitation with the same TA being held at a different time. Recitation assignments are due by the end of recitation. Your lowest recitation grade will be dropped.

ATTENDANCE
Attendance at all class meetings and recitations is required. You are responsible for knowing the material presented during class and recitation, even if you were not in attendance when the material was presented.

OTHER ASSIGNMENT REQUIREMENTS
Assignments must be typed. We do not accept work that is hand written, even if it is neat. Code assignments need to be submitted in an executable code file. It is recommended that you use Latex or

Markdown to produce your assignments and submit a pdf. Assignments should have your name, date, your TA's name, and homework number included at the top of the file.

A limited amount of printing may be required in this class. You need to ensure that your printing account has sufficient funds for this. Your initial allocation may deplete quickly, depending on your other printing activities. If this causes problems, please come see me.

ACCOMMODATION FOR DISABILITIES

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see Temporary Medical Conditions under the Students tab on the Disability Services website.

SEXUAL MISCONDUCT, DISCRIMINATION, HARASSMENT AND/OR RELATED RETALIATION

The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct intimate partner abuse (including dating or domestic violence), stalking, protected-class discrimination or harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or cureport@colorado.edu. Information about the OIEC, university policies, anonymous reporting, and the campus resources can be found on the OIEC website.

Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

RELIGIOUS HOLIDAYS

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, exam, quiz, and assignment deadlines are published in the syllabus. Please inform me at the beginning of the semester if any of these dates will conflict with religious obligations.

See the campus policy regarding religious observances for full details.

CLASSROOM BEHAVIOR

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, ability, and nationality. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on class behavior and the student code.

It is my expectation that each of you will be respectful to your fellow classmates and instructors at all times. In order to create a professional atmosphere within the classroom, you are expected to:

* Arrive to class on time.

* Turn off your cell phone (talk and text), and put your cell phone away so that it won't be a distraction.

* Bring your laptop to class if you have one to participate in classroom activities. Please restrict laptop use to these activities only, no email, Facebook, Youtube, etc.

* Put away newspapers and magazines.

* Refrain from having disruptive conversations during class.

* Remain for the whole class; if you must leave early, do so without disrupting others.

* Display professional courtesy and respect in all interactions related to this class.

Compliance with these expectations will assist all of us in creating a learning community and a high quality educational experience.

Though many of the above stated policies address academic climate within the classroom, these policies should also be upheld outside of the classroom. As a member of the CU community you are expected to consistently demonstrate integrity and honor through your everyday actions. Faculty, TAs, and staff members are very willing to assist with your academic and personal needs. However, multiple professional obligations make it necessary for us to schedule our availability. Suggestions specific to interactions with faculty and staff include:

* Respect posted office hours. Plan your weekly schedule to align with scheduled office hours.

* Avoid disrupting ongoing meetings within faculty and staff offices. Please wait until the meeting concludes before seeking assistance. Respect faculty and staff policies regarding use of email and note that staff and faculty are not expected to respond to email outside of business hours. Send

email messages to faculty and staff using a professional format. Tips for a professional email include:

* Always fill in the subject line with a topic that indicates the reason for your email to your reader.

* Respectfully address the individual to whom you are sending the email (e.g., Dear Professor Smith).

* Avoid email or text message abbreviations.

* Be brief and polite.

* Add a signature block with appropriate contact information.

* Reply to email messages with the previously sent message. This will allow your reader to quickly recall the questions and previous conversation.

DISCRIMINATION AND HARASSMENT

The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. CU-Boulder will not tolerate acts of discrimination or harassment based upon Protected Classes or related retaliation against or by any employee or student. For purposes of this CU-Boulder policy, "Protected Classes" refers to race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Individuals who believe they have been discriminated against should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Student Conduct (OSC) at 303-492-5550. The full policy on discrimination and harassment has more information.

HONOR CODE

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu); 303-492-5550). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the Honor Code Office website

CSCI 3104 FALL 2019 ACADEMIC HONESTY AND COLLABORATION POLICY

The Computer Science Department at the University of Colorado at Boulder encourages collaboration among students because we recognize that students are most successful when they are working with other students to understand new concepts. The ultimate goal is that you fully understand the code you develop and be able to collaborate with others in a mutually beneficial way.

We also want to be clear on what we consider collaboration and what we consider academic dishonesty. The Department has created a Collaboration Policy that makes explicit when behavior is within the bounds of collaboration and when it is actually academic dishonesty, and therefore a violation of the University of Colorado at Boulder's Honor Code.

USE OF OUTSIDE RESOURCES

One area where there can be confusion is whether it is ok to use outside resources for assignments and exams. Unless otherwise specified, you may make "reasonable" use of outside resources (internet, other books, people), but then you must give credit by citing your sources in the comments inside your code.

Reasonable use of outside resources does NOT include acquiring a complete, or almost complete, solution to an assignment or question on an assignment, from any source, whether you cite the source of the solution or not.

Acquiring a solution, whether you submit it as your own work or not, is considered plagiarism and violates the University's Honor Code policy.

If two people are collaborating on an assignment, we expect each person to present their own unique solution. If your solution looks identical, or very similar, to another student's solution, we will consider this academic dishonesty for both students. Both students will receive a 0 on the assignment for the first offense. Multiple offenses will result in an F in the course and you will be reported to honor code.

If you submit code that is structurally identical to code found on the Internet, such as GeeksForGeeks, Chegg, or Course Hero, you will receive a 0 on the assignment for the first offense. Multiple offenses will result in an F in the course and you will be reported to honor code.

THINGS TO CONSIDER

Once you've seen an assignment solution, you can't un-see it. The solution you produce will likely look a lot like the one you've acquired, and you are at greater risk of being accused of academic dishonesty.

There is a difference between generating your own solution and modifying someone else's solution. If we wanted you to just modify a solution, we would have provided the solution as part of the question, and asked you to modify it.

Examples of citing sources include:

    // Modified version from https://github.com/Phhere/MOSS-PHP
    // Adapted from Program #7.2 in book "Accelerated C++" by Stroustrup
    // Worked with Joe Smith from class to come up with algorithm for sorting
    // Received suggestions from stackExchange website (see http://….)

A good rule of thumb: "If it did not come from your brain, then you need to attribute where you got it."

USE OF OUTSIDE RESOURCES ON EXAMS
Don't.

On exams, we're testing you on what you know and we expect that everything you submit is from your brain, class lecture notes, the textbook, or other pre-approved materials provided in class. In this class, exams include the quizzes, midterms, and the final exam. Use of outside resources in these cases violates the collaboration policy.

EXAMPLES OF COLLABORATING CORRECTLY
- Asking another student for a helpful suggestion.
- Reviewing another student's code for issues/bugs/errors.
- Working together on the whiteboard (or paper) to figure out how to approach and solve the problem. In this case you must include that person's name in your collaboration list at the top of your submission. All students need to submit their own unique write-up.

Previous experience with this course has taught us that some students get help completing assignments using the Internet or their classmates, but if they don't understand the material, they are not able to pass the exams. You are required to have a passing average grade on your midterm and take home exams, so it's in your best interest to put in the work to understand the concepts presented in the assignments. We expect you to be able to create the code (or solve the problem) on your own before you submit your assignment. If any member of the instructional team believes that you are submitting someone else's work, you might be called upon to explain your solution in a one-on-one meeting with the instructor.

Any discovered incidents of violation of this collaboration policy will be treated as violations of the University's Academic Integrity Policy and will lead to an automatic academic sanction in the course and may be reported to both the College of Engineering and Applied Science and the Honor Code Council. Students who are found to be in violation of the Academic Integrity Policy can be subject to non-academic sanctions as well, including but not limited to university probation, suspension, or expulsion.

Other information on the Honor Code can be found at www.colorado.edu/policies/honor.html and www.colorado.edu/academics/honorcode.

Collaboration boundaries are hard to define crisply, and may differ from class to class. If you are in any doubt about where they lie for a particular course, it is your responsibility to ask the course instructor.