Introduction: These are unusual times. I’ve been a professor for more than 20 years but have never experienced anything even remotely like this. Certainly, you haven’t either. I have two sons, both of whom are in college, so I am experiencing this from two sides: as a professor and as a parent of students trying to navigate this situation. Therefore, I am at least somewhat aware of what you are going through.

One of my guiding principles as a professor is this: in a similar situation, how would I want my son’s professor to help him? That doesn’t mean that I’m going to grant your every request or allow you to take the easy route. College is, and should be, challenging. You need to think and solve problems for yourself. My goal as a professor (and as a parent, for that matter) is to help you acquire the tools you need to succeed. That means it’s my job to challenge you. What I promise is this: I will always listen and try to be fair. If you are having real difficulties, academic or otherwise, I will do what I can to help or find those who can.

I encourage you to ask questions. Ask any question. Ask often. Ask again. Then think of more questions. Don’t be surprised if I don’t provide a direct answer but rather lead you to figure things out on your own. Refer back to the sentence above about it being my job to challenge you.

This introduction is a new addition to my syllabus because of the pandemic. Why? Because the changes necessary to course format make it vitally important that you work to engage with the class: with the material, with me, and with your fellow students. Doing so will be different since we will be together less than during a “normal” semester. So please force yourself to engage. Force yourself to stay current with assignments. Force yourself to meet your fellow students. Force yourself to visit my virtual office hours. Doing these things will help you in this class.

One last note. The three most important words on this syllabus are just below the box on the first page: SUBJECT TO CHANGE. We all have to be flexible. The only thing I can promise in that regard is that I will be as flexible as possible without compromising the course and that I will keep you informed about changes as they occur. This will require that you check your email regularly, at least once per day. Anything less than that and you may miss important updates from me.
I’m looking forward to getting to know you and to a good semester. Now to the mundane stuff.

**Time:** Monday, Wednesday and Friday 1:10 PM – 2:05 PM

**Classroom:** Centennial 2215

**Professor:** Dr. David Mathias

**email:** dmathias@uwlax.edu

**website:** https://cs.uwlax.edu/~dmathias

**Office Hours – Virtual Only:** Monday 11:00 – 12:00, Tuesday 3:15 – 4:15, Wednesday 11:00 – 12:00 and Friday 11:00 – 12:00, or by appointment.

**Office Hours Link:** For your safety and mine, my office hours this semester will be entirely online via videoconference. The link will be provided at the beginning of the semester.


**Mode of Instruction:** This is a hybrid class. Lectures will be presented via video. We will meet in person once per week (initially on Wednesdays) for a recitation section. This will provide an opportunity to go over examples, ask questions, work on problems, etc. Some quizzes may occur during these meetings as well.

**Important note:** After Thanksgiving, the course will be entirely online.

**Course Materials:** The materials you need in this class are available via my website (URL above). These include in-class assignments, out-of-class assignments, lecture slides, recorded lectures, the current syllabus, helpful links, etc.

**Etiquette:** At some time during the semester, it may be necessary to When joining a live session via video conference, it is important to observe proper etiquette. Most importantly, make sure that your microphone is muted. Unmute only to ask questions, and then, only if called on. This rule is intended to prevent chaos. In addition, if you turn on your camera, please ensure that what is visible in the background is appropriate. While I am not easily offended, others may be more sensitive.

**Attendance:** I do not take attendance. However, attending class is almost always a very good idea. Knowledge is not poured into your head as water into a glass. Learning requires engaging with the course. If you must miss class due to illness, quarantining, or other obligations, please notify me so that I can advise you of what to do to stay current.
with the material and any assignments. I will make all reasonable accommodations but ultimately you are responsible for whatever you miss.

**Learning Management System:** We will use Canvas in this course. IMPORTANT NOTE: I use Canvas to record grades for individual assignments. I do NOT use Canvas to calculate your grade for the course. While the total grade displayed on Canvas may approximate your grade, it is not guaranteed to be accurate. The formula I will use to calculate your final grade, not including any curve I apply at the end of the semester, is on the syllabus. Feel free to use it to determine where you stand in the class.

**Catalog Description:** Three hours. Prerequisites: CS 340; MTH 207. An in-depth analysis of computational complexity of a wide range of algorithms for problems of fundamental importance to computer science. Algorithms to be examined include: sorting, pattern matching, and various graph algorithms.

**Student Learning Outcomes:** This is an upper-level computer science elective that is an appropriate course for a student who wants to: understand the fundamentals of algorithm design and analysis. It is excellent preparation for those who wish to take graduate courses in Computer Science.

By the end of the course, students should be able to:

- Analyze the computational complexity of an algorithm using asymptotic notation.
- Design efficient algorithms for various types of problems.
- Understand the difference between the complexity of an algorithm that solves a problem and the complexity of a problem.
- Derive and solve recurrence relations and summations.
- Apply classical search, sorting, selection, and graph algorithms.
- Demonstrate familiarity with NP-completeness and NP-complete problems.

**Homework:** The largest single component of your grade in this class is homework. Almost every class meeting, I will assign a “Daily Problem.” Without exception, these are due at the beginning of the next class meeting. If you will miss a class or are running late, you may submit your solution to me prior to class. If you submit electronically, the file must be a pdf and must adhere to the rules below for solution format. Note that the term “Daily Problem” does not imply a limit of one problem nor does it guarantee that there will be an assignment every class. In addition, longer-term homework assignments are possible.

Rules for homework submission:
• Solutions are due at the beginning of class. There are no exceptions. The reason is that we will go over the problems when I collect them so that you see a solution (or sketch of a solution) while the work is still fresh in your mind.

• Write on one side of the page only.

• Put your name, the due date and the problem number on separate lines in the upper left corner of the first page.

• If your solution is multiple pages, staple the pages in the upper left corner. Do not simply fold the corners of the pages – use an actual metal staple.

• Write legibly – I can’t grade what I can’t read.

• Did I mention that solutions are due at the beginning of class?

Programming Assignments: Despite the fact that this is a theory course, there is a programming component to the course work. These assignments will give you an opportunity to apply the theoretical concepts and gain an appreciation for the real-world implications of some of the topics we discuss. Programming assignments are due at 11:59 PM on the due date. Late assignments are accepted for up to 24 hours after they are due. The penalty for late submission is 20%.

Programming will be done in Python 3. If you don’t already know Python, this is an opportunity to learn an interesting and hot language. Little to no class time will be devoted to Python instruction. You all know how to program and should be able to acquire skills in a new language on your own. Note that I don’t expect you to become a Python expert and will not test you on Python. You simply have to acquire a working knowledge of the syntax and key concepts. There are many excellent resources online.

• https://docs.python.org/3

• https://docs.python.org/3/tutorial/index.html

• https://www.learnpython.org

Evaluation and Assessment: Weighting of the assignment categories is given below:

• 25% – Quizzes

• 35% – Homework

• 15% – Programming assignments

• 25% – Final exam

• Due to the unusual circumstances in which we find ourselves, I will try to be accommodating. What I ask in return, is that you communicate (early and often) any circumstances that will affect your ability to complete assignments on time.
Please note that an attempt to be flexible should not be construed as a promise that all requests for an extension will be granted.

**Grading Scale:** Letter grades will be assigned according to the table below. Note that if a curve is applied, it will work in your favor, not to your detriment. Let $x$ be your weighted average for the course. Then your letter grade is:

- A: $x \geq 93$
- AB: $89 \leq x < 93$
- B: $83 \leq x < 89$
- BC: $79 \leq x < 83$
- C: $70 \leq x < 79$
- D: $60 \leq x < 70$
- F: $x < 60$

**Course Policy on Collaboration:** For homework and programs, you may discuss general concepts with classmates. However, you should not collaborate in the preparation of solutions or programs. Using any solution that you did not create yourself, including but not limited to solutions found on the Internet, is considered academic misconduct.

**Academic Integrity:** Academic misconduct is a violation of the UWL Student Honor Code (http://catalog.uwlax.edu/undergraduate/academicpolicies/studentconduct) and is unacceptable. I expect you to submit your own original work and participate in the course with integrity and high standards of academic honesty. When appropriate, cite original sources, following the style rules of our discipline.

PLEASE NOTE that whenever a grade penalty is imposed due to academic misconduct, the instructor is required to write a letter documenting the misconduct. Copies are sent to the student, to the Office of Student Life (where the letter remains on file in the student’s record), and to the Dean of the student’s College. Refer to https://www.uwlax.edu/student-life/student-resources/student-handbook for a detailed definition of academic misconduct, and for possible sanctions and consequences. The Office of Student Life can also assist.

Plagiarism or cheating in any form may result in failure of the assignment or the entire course, and may include harsher sanctions. Refer to the Student Handbook #14.02 for a detailed definition of academic misconduct.

For helpful information on how to avoid plagiarism, go to “Avoiding Plagiarism” on the Murphy Library website (http://libguides.uwlax.edu/plagiarism2). You may
also visit the Office of Student Life (https://www.uwlax.edu/student-life/) if you have questions about plagiarism or cheating incidents. Failure to understand what constitutes plagiarism or cheating is not a valid excuse for engaging in academic misconduct.

**UWL COVID-19 Statement:** Students with COVID-19 symptoms or reason to believe they were in contact with COVID-19 should call and consult with a health professional, such as the UWL Student Health Center (608-785-8558). Students who are ill or engaging in self-quarantine at the direction of a health professional should not attend class. Students in this situation will not be required to provide formal documentation and will not be penalized for absences. However, students should:

- notify instructors in advance of the absence and provide the instructor with an idea of how long the absence may last, if possible
- keep up with classwork if able
- submit assignments electronically
- work with instructors to either reschedule or electronically/remotely complete exams, labs, and other academic activities
- consistently communicate their status to the instructor during the absence

Instructors have an obligation to provide reasonable accommodation for completing course requirements to students adversely effected by COVID-19. This policy relies on honor, honesty, and mutual respect between instructors and students. Students are expected to report the reason for absence truthfully and instructors are expected to trust the word of their students. UWL codes of conduct and rules for academic integrity apply to COVID-19 situations. Students may be advised by their instructor or academic advisor to consider a medical withdrawal depending on the course as well as timing and severity of illness and students should work with the Office of Student Life if pursuing a medical withdrawal.

**PRO-UWL:** This class is participating in the Navigate Progress Report Online early alert system designed to promote student success. If I notice that you are experiencing difficulties early in the semester (e.g., low assignment scores or limited participation), I may note this information and you will receive notification indicating that I have entered feedback. I encourage you to meet with me and/or utilize helpful campus resources listed on UWL’s Student Success page: https://www.uwlax.edu/info/student-success/

**Inclusive Excellence:** UWL’s core values include “Diversity, equity, and the inclusion and engagement of all people in a safe campus climate that embraces and respects the innumerable different perspectives found within an increasingly integrated and culturally
diverse global community” (https://www.uwlax.edu/chancellor/mission).
If you are not experiencing my class in this manner, please come talk to me about your experiences so I can try to adjust the course if possible.

**Student Course- and Faculty-Related Concerns, Complaints, and Grievances:**

**Informal Complaints:**
If a student has a concern or a complaint about a faculty member or course, the general process for making informal complaints is outlined in steps 1-3 below. Students are welcome to bring a friend or a UWL staff member with them during the following steps. Students who report concerns/complaints/grievances, whether informally or formally, will be protected from retaliation and have the right to expect an investigation and the option to have regular updates on the investigation:

1. The student should speak directly to the instructor.
2. If the student is uncomfortable speaking with the instructor, or they are unsatisfied with the solution, they should go to the chair of the faculty member’s home department.
3. If the student is uncomfortable speaking with the department chair, or the chair is the faculty member in question, or they are unsatisfied with the solution, the student should speak with their college dean.

Depending on the specifics of the student’s concern, it may be helpful for them to reach out to additional offices:

- Complaints/concerns/grievances about grades, teaching performance, course requirements, course content, incivility, or professional ethics should follow the process outlined above. Students may also wish to seek support from the Student Life office.
- Complaints/concerns/grievances related to hate/bias and discrimination may follow the process outlined above, and in addition or instead students may contact the Campus Climate office and/or submit a hate/bias incident report.
- Complaints/concerns/grievances related to sexual misconduct may begin with the process outlined above, but will need to also involve the Equity & Affirmative Action and Violence Prevention offices, and/or the Title IX Team. Students should know that faculty members are mandatory reporters of sexual misconduct, but that confidential resources are available to them.

**Formal Complaints:**
If the student is unsatisfied with the solution of their informal complaint, they have the
right to file a formal institutional complaint with the Student Life office, as described in the Student Handbook.

**Student Evaluation of Instruction:** UWL conducts student evaluations electronically. Approximately 2 weeks prior to the conclusion of a course, you will receive an email at your UWL email address directing you to complete an evaluation for each of your courses. In-class time will be provided for students to complete the evaluation in class. Electronic reminders will be sent if you do not complete the evaluation. The evaluation will include numerical ratings and, depending on the department, may provide options for comments. The university takes student feedback very seriously and the information gathered from student evaluations is more valuable when a larger percentage of students complete the evaluation. Please be especially mindful to complete the surveys.

**Useful Resources:** The following links are provided for your convenience. This is not an exhaustive list of services available on campus.

ACCESS Center: [http://www.uwlax.edu/access-center](http://www.uwlax.edu/access-center)

Student Support Services: [http://www.uwlax.edu/student-support-services](http://www.uwlax.edu/student-support-services)

For statements regarding Sexual Misconduct, Religious Accommodations, Students with Disabilities, and Veterans and Active Military Personnel, please see: [https://www.uwlax.edu/info/syllabus](https://www.uwlax.edu/info/syllabus)
Approximate schedule:

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<th>Week:</th>
<th>Topics:</th>
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<tr>
<td>1</td>
<td>September 7: Course intro; Why study analysis of algorithms?</td>
<td>2.1</td>
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<td>The sorting problem; Insertion sort</td>
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<td>2</td>
<td>September 14: Introduction to asymptotics</td>
<td>3.1–3.2</td>
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<td>3</td>
<td>September 21: Mathematics review; Summations</td>
<td>Appendix A</td>
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<td>4</td>
<td>September 28: Mergesort; Recurrence relations</td>
<td>4.3–4.4</td>
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<td>Recursive insertion sort</td>
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<td>Quiz 1</td>
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<td>5</td>
<td>October 5: Divide and conquer; Quicksort; Heaps</td>
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<td>October 12: Sorting lower-bound</td>
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<td>I lied: Breaking the bound</td>
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<td>7</td>
<td>October 19: Choosing without sorting: Selection</td>
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<td>8</td>
<td>October 26: Graphs &amp; trees; Traversal</td>
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<td>9</td>
<td>November 2: Common graph algorithms</td>
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<td>Quiz 3</td>
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<td>10</td>
<td>November 9: Minimum spanning trees</td>
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<td>Greed is good: Algorithms by Gordon Gekko</td>
<td>16.1–16.2</td>
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<td>11</td>
<td>November 16: Shortest paths</td>
<td>24.2–24.3</td>
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<td>Union-Find data structure</td>
<td>21.1–21.2</td>
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<td>12</td>
<td>November 23: Hard problems: A gentle intro to complexity theory</td>
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<td>Thanksgiving</td>
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<td>13</td>
<td>November 30: Randomized algorithms</td>
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<td>December 7: TBD</td>
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<td>15</td>
<td>December 14: Review</td>
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<td><strong>Final</strong></td>
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