Course Syllabus

CPTS 515
Advanced Algorithms

(Important: I can't send emails to the entire class through Canvas; so check "Announcements" on your left panel for such communication.)

WSU Catalog description: cpts515 Advanced Algorithms 3 Advanced algorithms and data structures, design and analysis, intractability.

Textbook and Reference:

Thomas H. Cormen, Charles E. Leiserson, Ron L. Rivest, and Clifford Stein, Introduction to Algorithms, third edition, 2009

Instructor: Zhe Dang, Associate Professor of EECS.

    EME 135, 335-7238, **zdang@wsu.edu (mailto:zdang@wsu.edu)**

Course Overview

This is a graduate level algorithm course in computer science, targeting at first–year computer science graduate students. Given the fact that many modern developments in computer science including artificial intelligence and data sciences are algorithm–intense, it is therefore a key that our graduate students are prepared with a solid background in modern algorithms. In this course, we learn classic algorithms as well as general methodology in designing new algorithms and the algorithms applications.

Learning Outcomes

(a). understand the design and analysis principles in modern advanced algorithms and apply the algorithms in solving some computer science problems. This is a central skill for all computer science graduate students and is a key for them to be successful in

their research.

(b). understand the theory foundation of intractability. Many graduate computer science students still think efficient algorithms can always be designed if they are smart or skillful enough. However, theoretically, most problems do not even have efficient algorithms to solve.

I am going to use your hw solutions and exams to evaluate how much you have met the expected outcomes. In general, a C grade can be expected when you satisfactorily reach the outcomes. Students should expect to spend a minimum of 9 hours per week for each online 3-credit course, engaged in the following types of activities: reading, listening to/viewing media, discussion, or conversation in the LMS or other academic technology, conducting research, completing assignments and reviewing instructor feedback, studying for and completing assessments, etc.

Exams: both midterm and final exams are take-home exams. Make-up exams are only available under special circumstances that are allowable by wsu policies like illness etc. Weekly schedule is shown below:

Dates	Lesson Topic
1 Aug. 23 — Aug. 29	Fundamentals on algorithms: Turing model and definition of algorithms, time/space complexity, co
2 Aug. 30 — Sept. 5	Basic algorithms: greedy, divide-conquer and dynamic programming techniques, Basic algorithms
3 Sept. 6 — Sept. 12	Basic algorithms and their analysis on tree structures, Basic algorithms and their analysis on grap
4 Sept. 13 — Sept. 19	Advanced algorithms: Network flows
5 Sept. 20 — Sept. 26	Bipartite matching
6 Sept. 27 — Oct. 3	Linear programming
7 Oct. 4 — Oct. 10	Symbolic graph search and formal verification of software
8 Oct. 11 — Oct. 17	Randomized algorithms: Random variables and their properties
9 Oct. 18 — Oct. 24	Hashing, hash functions and universal hash functions
10 Oct. 25 — Oct. 31	Breaking MD5, Las Vegas and Monte Carlo algorithms: examples

11 Nov. 1 — Nov. 7	Google page rank and Markov chain, How to select a random test case
12 Nov. 8 — Nov. 14	P, NP, co–NP, PSPACE and #P
13 Nov. 15 — Nov. 21	Many–to–one reduction and NP–completeness, NP–complete problems
Thanksgiving Break	Nothing due this week.
14 Nov. 29 — Dec. 5	Approximation algorithms for some NP–complete problems
15 Dec. 6 — Dec. 12	Review sessions
16 Dec. 13 — Dec. 17	

Lectures: MWF 10:10––11:00am, SPRK 335. All lectures will be recorded and all in–class lecture notes will be uploaded. Lectures are also synchronously available through Zoom (meeting id: 989 0797 3235 with passcode 157786).

Office Hours: **T, T, 2:30––3:30pm**, EME135. During the first several week, I will hold office hours through Zoom **(meeting id: 689 913 0473 with passcode 157786).** Later on if things get better, I will hold office hours in my office through Zoom; you may also stop by my office at the time for in–person help.   Additionally throughout the semester, **on every Sunday from 2:00––4pm (may be earlier depending on the number of students seeking help). , I will have Zoom office hours (meeting id: 689 913 0473 with passcode 157786).**

Instructor Interaction

In addition to office hours, when it is possible, students can also text the instructor's cell phone number (509-338-5089) for immediate help on lectures, hws, etc. This is a hard course so person-to-person communication is essential if you have difficulties.

Late Work Policy

There are six sets of homework which are usually very difficult. Later work will not be accepted (unless under special circumstances that are allowable by wsu policies like illness etc.). Attendance is mandatory (at least you shall watch videos of each lecture). However, if you can not make the lectures under special circumstances like illness, you at least have to watch the videos. Excessive absences carry penalties naturally: exams and homework sets are closely related to lectures so, highly likely you will not pass the course.

Grading

Midterm (30%), Final (40%), HW (30%). I do not grade on curve. I do not mind if the entire class gets an A or the entire class fails. Here is the formula that I use to calculate your letter grade: A grade on the homeworks/exams is a rational number between 0 and 1. There are two exams: a midterm and a final. The course grade g is computed as $h*0.3+m*0.3+f*0.4$, where h, m, and f are, respectively, the grades for homeworks, the midterm, and the final. The final letter grade of the course is roughly assigned as follows:

Letter grade A when the g is in [0.9, 1];

Letter grade A– when the g is in [0.85, 0.9);

Letter grade B+ when the g is in [0.82, 0.85);

Letter grade B when the g is in [0.78,0.82);

Letter grade B– when the g is in [0.75,0.78);

Letter grade C+ when the g is in [0.72,0.75);

Letter grade C when the g is in [0.68,0.72);

Letter grade C– when the g is in [0.65,0.68);

Letter grade D+ when the g is in [0.62,0.65);

Letter grade D when the g is in [0.55,0.62); and,

Letter grade F when the g is less than 0.55.

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COVID–19 Statement
Per the proclamation of Governor Inslee on August 18, 2021, masks that cover both the nose and mouth must be worn by all people over the age of five while indoors in public spaces. This includes all WSU owned and operated facilities. The state–wide mask mandate goes into effect on Monday, August 23, 2021, and will be effective until further notice.

Public health directives may be adjusted throughout the year to respond to the evolving COVID–19 pandemic. Directives may include, but are not limited to, compliance with WSU's COVID–19 vaccination policy, wearing a cloth face covering, physically distancing, and sanitizing common–use spaces. All current COVID–19 related university policies and public health directives are located at https://wsu.edu/covid–19/ [(https://wsu.edu/covid–19/)](https://wsu.edu/covid–19/)

Our COVID-19 Response | Washington State University (https://wsu.edu/covid-19/)

. Students who choose not to comply with these directives may be required to leave the classroom; in egregious or repetitive cases, student non–compliance may be referred to the Center for Community Standards for action under the Standards of Conduct for Students.

Academic Integrity Statement

All members of the university community share responsibility for maintaining and promoting the principles of integrity in all activities, including academic integrity and honest scholarship. Students are responsible for understanding the full [Academic Integrity Statement (https://communitystandards.wsu.edu/policies-and-reporting/academic-integrity-policy/)](https://communitystandards.wsu.edu/policies-and-reporting/academic-integrity-policy/). Students who violate WSU's Academic Integrity Policy (identified in WAC 504-26-010(3) and -404) will receive *F (fail the course)*, will not have the option to withdraw from the course pending an appeal, and will be reported to the Center for Community Standards. If you have any questions about what is and is not allowed in this course, ask your course instructor.

WSU Reasonable Accommodation Statement

Students with Disabilities:
Reasonable accommodations are available for students with documented disabilities or chronic medical or psychological conditions. If you have such a condition and need accommodations to fully participate in this class, please visit

your campus' Access Center/Services website to follow published procedures to request accommodations. Students may also contact their campus offices to schedule an appointment with a Disability Specialist. All disability related accommodations are to be approved through the Access Center/Services on your campus. It is a university expectation that students connect with instructors (via email, Zoom, or in person) to discuss logistics within two weeks after they have officially requested their accommodations.

For more information, contact a Disability Specialist on your home campus:

- Pullman, WSU Global Campus, Everett, Bremerton, and Puyallup: 509–335–3417 Access Center (https://www.accesscenter.wsu.edu/) (https://www.accesscenter.wsu.edu) or email at access.center@wsu.edu (mailto:access.center@wsu.edu)

- Spokane: 509–358–7816 Access Services (https://spokane.wsu.edu/studentaffairs/access-resources/) (https://spokane.wsu.edu/studentaffairs/access-resources/) or email j.schneider@wsu.edu (mailto:j.schneider@wsu.edu)

- Tri-Cities: Access Services (http://www.tricity.wsu.edu/disability/) (http://www.tricity.wsu.edu/disability/) or email g.hormel@wsu.edu (mailto:g.hormel@wsu.edu)

- Vancouver: 360–546–9238 Access Center (https://studentaffairs.vancouver.wsu.edu/student-wellness-center/access-center) (https://studentaffairs.vancouver.wsu.edu/student-wellness-

center/ (https://studentaffairs.vancouver.wsu.edu/student-wellness-
center/access-center) or email van.access.center@wsu.edu
(mailto:van.access.center@wsu.edu)

Religious Accommodation Statement

Washington State University reasonably accommodates absences allowing for students to
take holidays for reasons of faith or conscience or organized activities conducted under
the auspices of a religious denomination, church, or religious organization. Reasonable
accommodation requires the student to coordinate with the instructor on scheduling
examinations or other activities necessary for course completion. Students requesting
accommodation must provide written notification within the first two weeks of the
beginning of the course and include specific dates for absences. Approved
accommodations for absences will not adversely impact student grades. Absence from
classes or examinations for religious reasons does not relieve students from responsibility
for any part of the course work required during the period of absence. Students who feel
they have been treated unfairly in terms of this accommodation may refer to Academic
Regulation 104 – Academic Complaint Procedures.

Safety and Emergency Notification

Classroom and campus safety are of paramount importance at
Washington State University, and are the shared responsibility

of the entire campus population. WSU urges students to follow the "Alert, Assess, Act," protocol for all types of emergencies and the "Run, Hide, Fight" (https://oem.wsu.edu/emergency-procedures/active-shooter/) response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and ACT in the most appropriate way to assure your own safety (and the safety of others if you are able).

Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety, and related topics, please view the FBI's Run, Hide, Fight video (https://www.fbi.gov/services/cirg) and visit the WSU safety portal (https://oem.wsu.edu/about-us/).

Full details can be found at https://provost.wsu.edu/classroom-safety/ (https://provost.wsu.edu/classroom-safety/)

Discrimination and Harassment Policy

This policy expresses WSU's commitment to maintaining an environment free from discrimination, including sexual harassment. This policy applies to all students,

faculty, staff, or others having an association with the University.
Discrimination, including discriminatory harassment, sexual harassment, and sexual misconduct (including stalking, intimate partner violence, and sexual violence) is

prohibited at WSU (See WSU Policy Prohibiting Discrimination and Harassment (Executive Policy 15) and WSU Standards of Conduct for Students)

If you feel you have experienced or have witnessed discriminatory conduct, you can contact the WSU Office of Compliance and Civil Rights (CCR) and/or the WSU Title IX Coordinator at 509-335-8288 to discuss resources, including confidential resources, and reporting options. (Visit https://ccr.wsu.edu/ for more information). Most WSU employees, including faculty, who have information regarding sexual harassment or sexual misconduct are required to report the information to CCR or a designated Title IX Coordinator or Liaison. Visit https://ccr.wsu.edu/file-acomplaint/ for more information.

Incomplete Grade Policy (Academic Rule 90h)

Incompletes are granted only with permission of the instructor and are subject to the following guidelines:

1. Students must request an incomplete in writing or by e-mail from the instructor before the end of the semester.
2. The request must be signed and dated by the student (or identified by student's e-mail address), and must explain the reasons behind the request for the incomplete.
3. In order to be considered for an incomplete, **there are two main conditions:**
   1. A student must complete a minimum amount of the assigned course work. Specifically, a student must complete 75 percent of the course work.
   2. A student must have a mathematical possibility of passing the class. A passing grade is 60 percent or above for the entire course.
4. If extraordinary circumstances (e.g., family emergency, serious illness) are involved and are documented to the instructor's satisfaction, the professor/ instructor retains the discretion to grant an incomplete even if the minimum conditions outlined in item 3 above are not met.

If an incomplete is granted, the standard WSU policy applies (i.e., ALL work must be completed within one full year from the end of the enrollment semester at issue, unless a shorter time is specified by the instructor. Otherwise, an automatic grade of "F," or failing, will be entered on the student's transcript).

Credit Hour Equivalent

Academic credit is a measure of the total minimum time commitment required of a typical student in a specific course. For the WSU semester system, one semester credit is assigned for a minimum of 45 hours of student effort. See **Academic regulation 27 (http://www.catalog.wsu.edu/General/AcademicRegulations/ListBy/27)** .

Students should expect to spend a minimum of 9 hours per week for each online 3-credit course engaged in the following types

of activities; reading, listening to/viewing media, discussion conversation in the LMS or other academic technology, conducting research, completing assignments and reviewing instructor feedback, studying for and completing assessments, etc.

The **Graduate Student Rights and Responsibilities** document describes procedures for channeling graduate student complaints, grievances, and concerns to faculty, staff and administrators for appropriate action. In conjunction with this document, graduate students must adhere to the Graduate School's Policies and Procedures available on the Graduate School's website: http://gradschool.wsu.edu/policies-procedures/. While these rights and responsibilities outline the complaint process, s tudents are encouraged to use the Graduate School Deans for guidance and advice on conflicts that may arise at any point during their course of study at the University. **https://gradschool.wsu.edu/rights-and-responsibilities/ (https://gradschool.wsu.edu/rights-and-responsibilities/)**

Academic Integrity

Academic integrity is the cornerstone of higher education. As such, **all members of the university community share responsibility for maintaining and promoting the principles of integrity in all activities, including academic integrity and honest scholarship.** Academic integrity will be strongly enforced in this course. Violation of WSU's Academic Integrity Policy (identified in Washington Administrative Code (WAC) 504-26-010(3) and -404) may result in penalties up to and including failing the assignment, exam, quiz, course requirement, or the course itself and students will not have the option to withdraw from the course pending an appeal, and will be reported to the Office of Community Standards.

Cheating includes, but is not limited to, plagiarism and unauthorized collaboration as defined in the Standards of Conduct for Students, WAC 504-26-010(3). You need to read and understand all of the definitions of cheating: **http://app.leg.wa.gov/WAC/default.aspx?cite=504-26-010** **(http://app.leg.wa.gov/WAC/default.aspx?cite=504-26-010)** . If you have any questions about what is and is not allowed in this course, you should ask course instructors before proceeding.

Copyright

Any course-related materials, presentations, lectures, etc. are the instructor's intellectual property and may be protected by copyright. The use of University electronic resources for commercial purposes, including advertising to other students to buy notes, is a violation of WSU's computer abuses and theft policy (WAC 504-26-218). Selling class notes through commercial note taking services without written advance permission from the faculty, could be viewed as be as copyright infringement and/or academic integrity violation, WAC 504-26-010 (3)(a,b,c,i).

Academic Regulations

Students enrolled in online courses are subject to the same University academic regulations as on-campus students. For the most accurate and up to date information go to **http://registrar.wsu.edu/academic-regulations/ (http://registrar.wsu.edu/academic-regulations/)** .

Discrimination and Harassment Policy

Discrimination, including discriminatory harassment, sexual harassment, and sexual misconduct (including stalking, intimate partner violence, and sexual violence) is prohibited at WSU (See **Policy Prohibiting Discrimination, Discriminatory Harassment, Sexual Harassment, And Sex And Gender Based Violence (https://policies.wsu.edu/prf/index/manuals/executive-policy-manual-contents/ep15-discrimination-sexual-harassment-and-sexual-misconduct/)** (Executive Policy 15) and WSU Standards of Conduct for Students (**Chapter 504-26 WAC**

sexual-misconduct/) (Executive Policy 15) and WSU Standards of Conduct for Students (**Chapter 504-26 WAC (https://app.leg.wa.gov/WAC/default.aspx?cite=504-26)**).

If you feel you have experienced or have witnessed discriminatory conduct, you can contact the WSU Office of Civil Rights Compliance & Investigation (CRCI) and/or the **WSU Title IX Coordinator** **(https://crci.wsu.edu/title-ix/)** at 509-335-8288 to discuss resources, including confidential resources, and reporting options. (Visit **crci.wsu.edu** **(https://crci.wsu.edu/title-ix/)** for more information).

Most WSU employees, including faculty, who have information regarding sexual harassment or sexual misconduct are required to report the information to CRCI or a designated Title IX Coordinator or Liaison. (Visit **crci.wsu.edu/reporting-requirements (https://crci.wsu.edu/reporting-requirements-2/)** for more info).

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Students with Disabilities: Reasonable accommodations are available for students with documented disabilities or chronic medical or psychological conditions. If you have a disability and need accommodations to fully participate in this class, please visit your campus' Access Center/Services website to follow published procedures to request accommodations. Students may also contact their campus offices to schedule an appointment with a Disability Specialist. All disability related accommodations are to be approved through the Access Center/Services on your campus. It is a university expectation that students visit with instructors (via email, Zoom, or in person) to discuss logistics within two weeks after they have officially requested their accommodations.

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- Spokane: 509-358-7816, **Spokane Access Services** **(https://spokane.wsu.edu/studentaffairs/access-resources/)** , or email **j.schneider@wsu.edu (mailto:j.schneider@wsu.edu)**
- Tri-Cities: **Tri-Cities Access Services** **(http://www.tricity.wsu.edu/disability/)** or email **g.hormel@wsu.edu (mailto:g.hormel@wsu.edu)**
- Vancouver: 360-546-9238, **Vancouver Access Center** **(https://studentaffairs.vancouver.wsu.edu/student-wellness-center/access-center)** , or email **van.access.center@wsu.edu (mailto:van.access.center@wsu.edu)**

Accommodations for Religious Observances or Activities

Washington State University reasonably accommodates absences allowing for students to take holidays for reasons of faith or conscience or for organized activities conducted under the auspices of a religious denomination, church, or religious organization. Reasonable accommodation requires the student to coordinate with instructor on scheduling examinations or other activities necessary for course completion. Students requesting accommodation must provide written notification within the first two weeks of the beginning of the course and include specific dates for absences. Approved accommodations for absences will not adversely impact student grades. Absence from classes or examinations for religious reasons does not relieve students from responsibility for any part of the course work required during the period of absence.

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the **"Run, Hide, Fight"** **(https://oem.wsu.edu/emergency-procedures/active-shooter/)** response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and ACT in the most appropriate way to assure your own safety (and the safety of others if you are able).

Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety, and related topics, please view the FBI's Run, Hide, Fight video and visit the WSU safety portal.

Full details including campus-specific safety information can be found at **https://provost.wsu.edu/classroom-safety/** **(https://provost.wsu.edu/classroom-safety/)**

Lauren's Promise

I will listen and believe you if someone is threatening you.

Lauren McCluskey, a 21-year-old honors student athlete, was murdered on Oct. 22, 2018, by a man she briefly dated on the University of Utah campus. We must all take actions to ensure that this never happens again.

If you are in immediate danger, call 911.

If you are experiencing sexual assault, domestic violence, and stalking, please report it to me and I will connect you to resources or call the National Alternatives to Violence at 877-334-2887 (24-hour crisis hotline).

Any form of sexual harassment or violence will not be excused or tolerated at Washington State University. WSU has instituted procedures to respond to violations of these laws and standards, programs aimed at the prevention of such conduct, and intervention on behalf of the victims.

- **National Resources for Domestic Violence, Sexual Assault, and Stalking:**
- **National Domestic Violence Hotline:** 1-800-799-SAFE and **https://www.thehotline.org/help/** **(https://www.thehotline.org/help/)**
- **RAINN (Rape, Abuse & Incest National Network):** 1-800-656-HOPE (4673) and **https://www.rainn.org/** **(https://www.rainn.org/)**
- **Victim Connect Resource Center:** 1-855-484-2846 and **https://victimconnect.org/** **(https://victimconnect.org/)**
- **Love is Respect ─ National Dating Abuse Hotline:** 1 (866) 331- 9474
  - Text: 22522 and **https://www.loveisrespect.org/** **(https://www.loveisrespect.org/)**
- **Anti─Violence Project Hotline:** 212-714-1141 and **https://avp.org/get-help/** **(https://avp.org/get-help/)**

Online Collaboration

The essence of education is exposure to diverse viewpoints. In your discussion posts you'll meet students with vastly different opinions and backgrounds. You're encouraged to disagree with the substance of others' ideas and opinions but do so with an active sense of respect for one another, and without losing focus on the topic at hand. Personal attacks, inflammatory statements, flaming, trolling, and disruption of the discussion do not have a place in academic discourse. Postings must comply with University policy on use of computing resources, including those regarding harassment and discrimination, as well as conform to the WSU **Community Standards** **(https://communitystandards.wsu.edu/home/)** .

Your instructors will promote high-quality academic discussions by removing any posts they view as disruptive of the educational process and alerting students whose posts have been removed that they have violated course expectations. Students who continue to misuse the discussion boards after a warning may be subject to removal of access rights, course failure, and referral to the Office of Community Standards.

For netiquette guidelines, visit **https://online.wsu.edu/currentstudent/netiquette-guidelines/** **(https://online.wsu.edu/currentstudent/netiquette-guidelines/)**

WSU Global Campus Student Support

The WSU Global Campus Current Student site **https://online.wsu.edu/currentstudent/ (https://online.wsu.edu/currentstudent/)** has all the non-content and administrative and contact related information you need to be a successful online learner as well as **study tips and skills for success** **(https://online.wsu.edu/currentstudent/student-support/skills-for-success/)**.

Technical Support

If you need technical assistance, please select the **Course Information** link in the course menu, then select Technical Support.

Library Support

All students enrolled in Washington State University online courses can use the WSU Libraries online databases and receive reference and research assistance from their home campus. Students can also borrow books and other circulating material as well as access full-text journal articles.

General Library Links by Campus

- **Pullman Library Support** **(http://libraries.wsu.edu/)**
- **Global Campus Library Support** **(http://libguides.libraries.wsu.edu/global)**
- **Vancouver Library Support** **(https://library.vancouver.wsu.edu/)**
- **Tri-Cities Library Support** **(http://tricities.wsu.edu/library)**
- **Library Support at Spokane – Riverpoint and Nursing at Yakima** **(https://spokane.wsu.edu/library/)**
- **College of Nursing Library Support** **(https://nursing.wsu.edu/library-services/)**

Online Tutoring

As a WSU student enrolled in a graduate level course, you have **FREE unlimited access to writing support** through **eTutoringOnline**. This is not a course requirement, but a resource you may utilize as needed.

Writing Lab tutors will respond to papers in ANY academic subject. If you're working on a paper for ANY of your courses our tutors can help you. Just submit your paper, ask specific questions on the submission form, and a tutor will respond within 24-48 hours. For more information visit **www.eTutoringOnline.org** **(http://www.etutoringonline.org/)**

Important Dates and Deadlines

Students are encouraged to refer to the academic calendar often to be aware of critical deadlines throughout the semester. The academic calendar can be found at **http://registrar.wsu.edu/academic-calendar/** **(http://registrar.wsu.edu/academic-calendar/)**.