



**KENNESAW STATE  
UNIVERSITY**

COLLEGE OF COMPUTING AND  
SOFTWARE ENGINEERING  
*Department of Computer Science*

**CS 6041/W01– Theory of Computation  
Spring 2023**

## **SYLLABUS**

### **FACULTY AND COURSE INFORMATION**

**Kun Suo**

**Assistant Professor**

**Email:** [ksuo@kennesaw.edu](mailto:ksuo@kennesaw.edu) (D2L email system)

**Home page:** <https://kevinsuo.github.io>

**Office:** J-318

**Office Hours:** M, W 4:00 p.m. – 5:00 p.m. and by appointment

**Class Location and Meeting Times:** D2L

**Course Website:** <https://kevinsuo.github.io/teaching.html>

#### **Required Texts or Technology Resources -**

*Introduction to the Theory of Computation, 3<sup>rd</sup> edition*

*Michael Sipser*

*ISBN-13: 978-1-133-18779-0*

*ISBN-10: 1-133-18779-X*

### **GENERAL EXPECTATIONS FOR COURSEWORK IN GRADUATE PROGRAMS**

Graduate study is markedly different from undergraduate study. This graduate course syllabus serves as a general description of goals and expectations in the course, as well as providing logistical and organizational information. It has been approved by the Faculty of your Academic Department to meet objectives in your discipline, as well as the University's Graduate Faculty standards for graduate study. It contains a number of resources for and expectations of you as a student. Instructionally, it is a general "plan" for the course and not a contract - please know that the course instructor is permitted some departures from it. If you have questions regarding this, please contact the Chair of your Academic Department.

**1. Roles and Responsibilities.** A graduate student should always remember that he or she is taking a particular graduate course to learn advanced content in an academic discipline. While graduate students are expected to think critically and ultimately be able to demonstrate mastery of advanced disciplinary knowledge, his or her instructor has already earned at least one – if not multiple – advanced degrees in the discipline, and spent (in some cases) decades studying it. A Graduate Faculty member may be regarded as a state or national authority in some aspect of the discipline being studied. Moreover, the instructor has an equal instructional obligation to all graduate students engaged in a particular learning activity. Consequently, the graduate instructor exercises discretion in framing instructional interactions about the discipline with graduate students, which may include decisions to terminate discussions or move the discussion to another topic.

**2. Responsibility for Demonstrating Mastery of Advanced Content.** Admission to a graduate program is both elective and selective. In graduate study, a graduate student bears primary responsibility for acquiring knowledge about the discipline he or she is studying. The primary role of a graduate instructor is to assist the student in appropriately applying that knowledge at an advanced level in the discipline. Ultimately, a graduate course provides a graduate student with the opportunity to demonstrate that she or he can master and apply advanced knowledge in an academic discipline. The burden of demonstrating this mastery and application to the satisfaction of the Graduate Faculty lies solely with the graduate student.

**3. Availability of Graduate Faculty Members.** Members of the Graduate Faculty are expected to be authorities in their academic disciplines. In addition to teaching, graduate faculty members serve in significant research, professional, and academic roles. Graduate students should be aware that, in any given semester, these other responsibilities may constitute between forty (40) and eighty (80) percent of a professor's workload. Consequently, graduate students are advised to schedule meetings with their instructors well in advance, knowing that a Graduate Faculty member's research and service obligations may result in him or her not being able to respond to the student for up to two (2) days during the academic week (M-F).

**4. Interactions with Graduate Faculty Members.** A graduate student should ensure that his or her interactions with her or his instructors are professional and appropriate. It is a relationship that is far more analogous to an employment relationship than a social friendship.

**Within the Classroom (or Analogous) Environment.** While graduate student thinking and discussion is expected to be far deeper, more challenging, and more critical about the advanced topic being studied than in undergraduate coursework, the context in which these discussions are framed should remain academically detached and appropriate. An element of graduate education – and particularly the application of advanced content – may require a graduate student to demonstrate the ability to think and analyze advanced knowledge in the discipline in a detached and clinical fashion.

This can be challenging when the topic under discussion relates to assumptions the student has never challenged previously. Neither graduate students nor members of the Graduate Faculty should “personalize” these discussions. A graduate student does not have the right to disrupt instruction in a learning activity. If a graduate student believes he or she cannot continue to engage in the discussion with appropriate academic detachment, she or he should disengage from the activity until the time that he or she believes he or she can appropriately resume. Simply put, in graduate study, thinking should be disruptive – conduct should never be.

**Outside the Traditional Classroom Environment.** While graduate students and their faculty members may have richer and less formal interactions outside of the classroom environment than those in undergraduate programming (for example, having coffee together to discuss a particular aspect of a study the student wishes to conduct or jointly working on research), it is important for both the faculty member and graduate student to remember that the “formal” instructor/student relationship that undergirds these interactions, and act consistently with that. If a graduate student believes that the faculty member's interactions with him or her are inappropriate, the graduate student should contact the Department Chair of her or his academic department, or the appropriate University official.

**5. Intellectual Property Issues.** More than any other part of the University enterprise, graduate study may result in the creation of ideas and thinking that are legally recognized and protected as intellectual property. Consequently, graduate students should carefully monitor their conduct to ensure that they do not inadvertently misappropriate the intellectual property of a member of the Graduate Faculty or another graduate student. The Graduate College has prepared an overview of intellectual property issues

**6. Electronic Recording.** While graduate students may wish to electronically record a class session as a study aid, in graduate school, this requires a careful balancing of the interests of the student, her or his fellow students, and the graduate instructor. Consequently, a graduate student may not disseminate any electronically recorded class discussion unless given explicit permission by the graduate instructor in writing. Irrespective of whether the student disseminates it, a graduate student should ask permission of his or her graduate instructor before electronically recording the instructor's lectures.

A University generates ideas, and ideas can become intellectual property irrespective of whether they are written in a book or paper. As a recognized authority in her or his academic discipline who has spent years studying, synthesizing, and expanding advanced knowledge in the academic discipline to which he or she has devoted his or her life's work, a graduate instructor has a legally-recognized property interest in her or his thinking about that work, which may include the graduate instructor's lectures. Kennesaw State University prohibits the misappropriation of intellectual property (which is a form of theft), which can result in discipline for a graduate student, up to and including dismissal from the University. If the graduate student is also a member of a profession with an applied code of ethics, it may additionally result in professional discipline, as well as subjecting the student to any civil legal remedies protecting intellectual property. Graduate students should recognize the rights of their fellow graduate students to engage in free exchange of ideas in their graduate coursework, asking questions or making observations that they might not make if they believed those observations could be publicly disseminated without their knowledge or permission.

If a student needs to electronically record a course as a result of a recognized disability or other exceptionality, the student should contact the University's Disabled Student Support Services to develop an appropriate reasonable accommodation.

## **COURSE DESCRIPTION, CREDIT HOURS, AND PREREQUISITES**

**CS 6041:** Theory of Computation

**3 Class Hours 0 Laboratory Hours 3 Credit Hours**

***Prerequisite:** Coursework in Discrete Math or CS 5070 as determined by program admission*

A study of topics from theoretical computer science that includes automata and languages, computability theory, and complexity theory.

## **COURSE LEARNING OUTCOMES**

Upon completion of this course, student will be able to

1. Explain the basic concepts, describe the basic properties, design and describe the strings recognized by:
  - a. regular languages (regular expressions, finite state automata)
  - b. context free languages (context-free grammars, push-down automata)
  - c. unrestricted languages (Turing machines)
2. Demonstrate understanding of undecidable and intractable (P and NP) classes of problems
3. Prove theorems about automata, languages, decidability and problem classes
4. Read and analyze research papers on Computational Theory and its applications

## **TEACHING PHILOSOPHY AND INSTRUCTION METHODS**

As computer science and technology are becoming the backbone of today's world and developing so rapidly, a successful education comes from not only providing students with solid knowledge and existing skills, but also teaching them the thinking of solving new problems and passion to explore the unknown. First, interest is the best teacher for everyone, and I will seek to make the courses interesting and motivate the students engaging in learning. Second, I will not only teach the fundamental concepts and basic knowledge, but also work with my students on the cutting-edge problems and explore the connections between these issues with what we learnt. Last and most importantly, my goal is to guide students to help them develop the ability to find problems, conduct research, design solutions and collaborate with others.

## **COURSE CONTENT AND REQUIREMENTS/GRADING SCALE**

### **Course Topics and Outline**

- Deterministic finite automata and Nondeterministic finite automata

- Regular expression and Regular language
- Non-regular language
- Context free language and Pushdown Automata
- Non-Context free language
- Turing machine
- Decidability, Reducibility and Complexity

Week/Date	Topic	Chapters	Assignment
1	Introduction and overview	0	HW1
2	Deterministic finite automata	1.1	
3	Nondeterministic finite automata	1.2	HW2
4	Regular expression and Regular language	1.3	
5	Non-regular language	1.4	HW3
6	Exam 1		
7	Context free language	2.1	HW4
8	Pushdown Automata	2.2	
9	Non-Context free language	2.3	
10	Exam 2		
11	Turing machine	3	HW5
12	Decidability	4	
13	Reducibility	5	
14	Complexity and NP-completeness	7	HW 6
15	Conclusion		
16	Exam 3		

Disclaimer: This syllabus represents my current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.

### Grading Scale and Course Policies

Homework, quizzes, project, and exams will be given numerical scores. These scores will be averaged at the end of the semester using the following weighting:

Item	Points, percentage or measurement
<b>Attendance</b>	5%
<b>Homework</b>	35%
<b>Exam 1</b>	15%
<b>Exam 2</b>	15%
<b>Exam 3</b>	30%

**Homework Submission:** Copying or paraphrasing codes from other sources or other students will be considered a violation of the Student Code of Conduct. Due dates for homework assignments will be specified on the homework themselves. **No late submission is accepted.**

Letter grades will be determined by ranking the numerical averages of all students in the class. Cut-off points for grades will depend on the performance of the class as a whole; however, they will be no higher than 90 (A), 80 (B), 70 (C), and 60 (D).

Your final weight average will be used to determine your final letter grade using the table below:

Grade	Points, percentage or measurement
A	90-100
B	80-89
C	70-79
D	60-69
F	0-60

### Course Policies:

**Attendance Policy:** Regular attendance is expected; please notify me in advance if you will be unable to attend because of business travel or other valid reason. If a student misses 2 or more than 2 classes, the student's final grade may be decreased.

**Quiz/Exam Policy:** Three exams will be given throughout the semester. Students who are late to class on a day when an exam is administered will not be given extra time to complete the exam. Makeup exams **WILL NOT** be given. For online students, please read <http://www.kennesaw.edu/dlc/virtualexam/>.

**Electronic Devices and Classroom Behavior Policy:** In order to minimize the level of distraction, all beepers and cellular phones must be on quiet mode during class meeting times. Students who wish to use a computer/PDA for note taking need prior approval of the instructor since key clicks and other noises can distract other students. Recording of lectures by any method requires prior approval of the instructor. Students using a laptop in class should not check their email, browse the web, or in other way detract from the focus of the class.

Students are reminded to conduct themselves in accordance with the Student Code of Conduct ([KSU Student Code of Conduct, Section III](#)), as published in the Undergraduate and Graduate Catalogs. Every KSU student is responsible for upholding the provision. Students who are in violation of KSU policy will be asked to leave the classroom and may be subject to disciplinary action by the University.

**Tutoring:** The College of Computing and Software Engineering offers some tutoring services for certain courses. If this applies to your course, you may want to include this resource for your students. Tutoring info can be found here: <http://ccse.kennesaw.edu/ccselabs/ccse-tutoring.php>

## COURSE WITHDRAWAL

Check the [eCore calendar](#) for the late registration/add period and the drop period of the session you are enrolled in.

Students may withdraw from one or more courses up to one week prior to the last day of class. To completely or partially withdraw from classes at KSU, a student must withdraw online at [www.kennesaw.edu](http://www.kennesaw.edu), under Owl Express, Registration and Student Records. Students who officially withdraw from courses before mid-semester will receive a "W" in those courses and receive no credit. They will not, however, suffer any academic penalty. Students who officially withdraw after mid-semester one week prior to the last day of class will receive a "WF," which will be counted as an "F" in the calculation of their grade point average. Exact withdrawal dates will be published in the official academic calendar and are subject to approval by the Board of Regents.

The only exceptions to these withdrawal regulations will be for instances involving unusual circumstances that are fully documented.

Students will receive refunds only when they withdraw from all their classes and only by the schedule outlined in the University System refund policy.

## **GRADE APPEALS AND STUDENT COMPLAINTS**

See below for commentary on Grade Appeals in the 2018-2019 Graduate Catalog:

Grade appeal will follow the level of the course. Students' rights to grade appeals are defined in the university catalog. A key element in the grade appeal procedure is the faculty member's responsibility to publish a specific grading policy for each of his/her classes. Specifically, the grade appeal procedure states: "Each faculty member must specify his/her grading policy, at the first of the semester. He/she may change his/her grading policy for cause after that time, but he/she must do so uniformly, with ample notification to students, if at all possible."

Note that failure to publish the grading policy would mean that a faculty member would have great difficulty in sustaining his/her assigned grade if a student appealed with anything but a frivolous or irresponsible basis for his/her charge. The grading policy should be quite specific and should be distributed to each class in written form. Some departments may also require faculty members to file grading policy statements in the departmental office. Because the student can submit a grade appeal to the Department Chair within 20 business days after the first day of classes of the next academic term after the academic term in which the final grade was awarded to the student (see Grade Appeals Procedure, section B), it is strongly recommended that instructors retain any student papers, tests, projects, or other materials not returned to the student for 70 days after the end of a semester or if an appeal is filed until the appeal is resolved. Refer to the following section for specific grade appeal procedures.

Students can find more details regarding the appeal process here:

<http://catalog.kennesaw.edu/content.php?catoid=39&navoid=3087>

## **COVID-19 POLICY**

### **Course Delivery**

KSU may shift the method of course delivery at any time during the semester in compliance with University System of Georgia health and safety guidelines. In this case, alternate teaching modalities that may be adopted include hyflex, hybrid, synchronous online, or asynchronous online instruction.

### **COVID-19 illness**

If you are feeling ill, please stay home and contact your health professional. In addition, please email your instructor to say you are missing class due to illness. Signs of COVID-19 illness include, but are not limited to, the following:

- Cough
- Fever of 100.4 or higher
- Runny nose or new sinus congestion
- Shortness of breath or difficulty breathing
- Chills
- Sore Throat
- New loss of taste and/or smell

COVID-19 vaccines are a critical tool in "Protecting the Nest." If you have not already, you are strongly encouraged to get vaccinated immediately to advance the health and safety of our campus community. As an enrolled KSU student, you

are eligible to receive the vaccine on campus. Please call (470) 578-6644 to schedule your vaccination appointment or you may walk into one of our student health clinics.

For more information regarding COVID-19 (including testing, vaccines, extended illness procedures and accommodations), see KSU's official [Covid-19 website](#).

### **Face Coverings**

Based on guidance from the University System of Georgia (USG), all vaccinated and unvaccinated individuals are encouraged to wear a face covering while inside campus facilities. Unvaccinated individuals are also strongly encouraged to continue to socially distance while inside campus facilities, when possible.

## **ACADEMIC INTEGRITY**

Every KSU student is responsible for upholding all provisions of the Student Code of Conduct, as published in the Undergraduate and Graduate Catalogs. The Code of Conduct includes the following:

- Section II of the Student Code of Conduct addresses the University's policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to University materials, misrepresentation/falsification of University records or academic work, malicious removal, retention, or destruction of library materials, malicious/intentional misuse of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the University Judiciary Program, which includes either an "informal" resolution by a faculty member, resulting in a grade adjustment, or a formal hearing procedure, which may subject a student to the Code of Conduct's minimum one semester suspension requirement.
- Students involved in off-campus activities shall not act in a disorderly or disruptive fashion, nor shall they conduct any dangerous activity.
- Students involved in off-campus activities shall not take, damage or destroy or attempt to take, damage or destroy property of another.

Frequently students will be provided with "take-home" exams or exercises. It is the student's responsibility to ensure they fully understand to what extent they may collaborate or discuss content with other students. No exam work may be performed with the assistance of others or outside material unless specifically instructed as permissible. If an exam or assignment is designated "no outside assistance" this includes, but is not limited to, peers, books, publications, the Internet and the WWW. If a student is instructed to provide citations for sources, proper use of citation support is expected. Additional information can be found at the following locations:

- <http://www.apa.org/journals/webref.html>
  - <http://bailiwick.lib.uiowa.edu/journalism/cite.html>
  - <http://www.indiana.edu/~wts/wts/plagiarism.html>
  - <http://www.virtualsalt.com/antiplag.htm>
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## **CAMPUS POLICIES**

Confidentiality and Privacy Statement (FERPA):

Kennesaw State University adheres to the Family Educational Rights & Privacy Act of 1974 - FERPA. See the following link for more information:

[http://usg.edu/information\\_technology\\_handbook/section9/tech/9.5\\_privacy\\_and\\_security](http://usg.edu/information_technology_handbook/section9/tech/9.5_privacy_and_security)

#### University - Student Rights & Responsibilities:

Students of Kennesaw State University are entitled to an environment that is conducive to learning and individual growth. To this end, students enrolling at Kennesaw State University assume a responsibility to abide by the policies and regulations expressed in this section. By doing so, students may fulfill their responsibilities and enjoy the exercise of their own rights while also respecting the rights of others.

<http://catalog.kennesaw.edu/content.php?catoid=27&navoid=2263>

#### Ethics Statement:

All students are responsible for knowing the information, policies and procedures outlined in the Kennesaw State University Codes of Conduct. The KSU Codes of Conduct include: the general Student Code of Conduct, the Residential Code of Conduct, and the Code of Academic Integrity. Kennesaw State University reserves the right to make changes to this code as necessary and once those changes are posted online, they are in effect. Students are encouraged to check online for the updated versions of all policies.

<http://scai.kennesaw.edu/codes.php>

#### Sexual Misconduct Policy:

Kennesaw State University is committed to providing programs, activities, and educational environment free from all forms of sex discrimination. For more information click here. KSU issues this statement of policy to inform the community of the University's comprehensive plan addressing sexual misconduct, educational programs, and procedures that address sexual assault, domestic violence, dating violence, and stalking, whether the incident occurs on or off campus. This policy generally covers faculty, students, and staff of the University, as well as third parties. Third parties include but are not limited to guests, vendors, contractors, retirees, and alumni.

<http://scai.kennesaw.edu/procedures/sexual-misconduct.php>

#### Course Accessibility Statement (ADA Statement):

<http://catalog.kennesaw.edu/content.php?catoid=27&navoid=2263&hl=FERPA&returnto=search#ADA>

## **ADDITIONAL STUDENT RESOURCES**

For CCSE Student resources:

<http://ccse.kennesaw.edu/student-resources.php>

#### KSU Service Desk:

The KSU Service Desk is your portal to getting assistance or access to University IT Services. Students call: 470-578-3555 or email [studenthelpdesk@kennesaw.edu](mailto:studenthelpdesk@kennesaw.edu)

For Academic Advising information and to schedule appointments:

<http://ccse.kennesaw.edu/advising/index.php>

Links to frequently used and helpful services:

<http://www.kennesaw.edu/myksu/>

#### Department of Career Planning & Development

<https://careers.kennesaw.edu>

#### Counseling and Psychological Services

<https://counseling.kennesaw.edu>

#### Center for Health Promotion and Wellness

<https://wellness.kennesaw.edu>



Student Health Services

<https://studenthealth.kennesaw.edu>