CSCI 3313 Foundations of Computing

Semester: Spring 2021

Lecture - Tues, Thurs 4:45 – 6:00pm; Lab Tues 9:35—10:50am

Location: Blackboard

Course Website: https://cs3313-2021.github.io/
(Detailed syllabus, links to notes, tutorials, videos will be available on the website)

Online Platforms:

- Piazza (for discussions),
- Blackboard (grades, lecture recordings, homeworks)
- Github (for course materials – lecture notes).

Instructor:

Name: Bhagi Narahari
Campus address: Science and Engineering Hall, 2nd Floor,
Phone: 202 994 6719
GW E-mail: narahari@gwu.edu

Remote office hours: Monday 3-4pm, Thursday 2:30—3:30pm
https://gwu.edu.zoom.us/j/6782509981

Teaching Assistants: (information on office hours location and changes to hours will be posted on Piazza)

- Siyuan (Andy) Feng (TA) ff910829@gwu.edu
  - Office Hours: Tues 3-4pm, Friday 3-4pm
  - Location: https://gwu-edu.zoom.us/j/2232838799?pwd=SUFFeC9YWDBjOUtVNmdsVHFDUnFMdz09
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- Linsheng Liu (TA) lls@gwu.edu
  - Office hours: Tues, Thurs- 1:30—2:30pm
  - Location:
- Grant McClearn (undergrad TA) grantmcc1@gwu.edu
  - Office Hours: Friday 11-1pm
  - Location: https://gwu-edu.zoom.us/j/98699709079
- Marshall Thompson mdt_@gwu.edu
  - Office Hours: Monday, Wednesday 12—1pm
  - Location: https://zoom.us/j/7655190175?pwd=SWxjbzNvS25aSm42anU4MG5wUlVqZz09
- Oliver Broadrick obroadrick@gwu.edu
  - Office Hours: Tues, Thurs 12:30—1:30pm
  - Location: https://gwu.webex.com/meet/obroadrick

Course Description:

Introduction to the theory of computing and automata theory. Formal languages and automata, regular expressions, context free languages, finite state automata and pushdown automata; Turing machines and computability; recursive function theory; undecidability.

This is a core undergraduate Computer Science course on the theory of computing. The course introduces the foundations of computer computer science including questions such as "what is computation", "what are the mathematical models of computing machines", "what are the formal models to define languages, including syntax of programming languages", "what is a computable problem". The course covers these questions and in the process introduces important concepts such as Turing machines, formal languages, models of automata, theory behind parsing (the first stage in a compiler), and algorithms for parsing and design of finite state machines. This is a theoretical course and requires rigorous mathematical analysis, including deriving formal proofs, which will help you develop your on mathematical and abstraction skills. The lecture, and some lab sessions, will consist of in-class activities and students will be required to work in groups.

Course prerequisites:

CSCI 2113, CSCI 2461, and CSCI 1311 Discrete Mathematics

Learning outcomes that state descriptions of behaviors or skills that students will be able to demonstrate at the end of the course or unit:

This is a required course for the BS in Computer Science.

As a result of completing this course, students will be able to:

1. Understand key concepts in the theoretical foundations of computer science including:
    - Automata models including finite state automata, pushdown automata, Turing machines
    - Formal languages and formal grammars including regular languages, context free languages and recursively enumerable languages
    - Computability and complexity.
2. Identify the relationship between languages and computability including the language/machine hierarchy.
3. Understand the foundations and design algorithms for lexical analysis and parsing of computer languages.
4. Develop ability to read and construct valid mathematical arguments (proofs) and statements (theorems), to determine the complexity of machine models, limits and features of grammars.
5. Develop the ability to abstract computational problems and develop a mathematical perspective to problem solving.

Average amount of direct instruction and average minimum amount of independent (out-of-class) learning expected per week:

The course will be taught using a combination of recorded video lectures (and tutorials) and live synchronous sessions. As a 3 credit course, it will require a minimum of 2.5 hours per week of direct instruction and minimum of 5 hours of independent learning. In addition, the laboratory section will require 75 minutes of direct instruction

and will include independent learning exercises including software tools to assist in your learning. Over the course of the semester, your independent learning will include watching video recordings, readings (lecture notes and/or textbook), and homeworks. The synchronous sessions will include lecture summaries, exercises and discussions. All synchronous sessions will be conducted using Blackboard Collaborate, and recordings of most of these sessions will be provided on blackboard.

Discussion forum

Students may post questions on the discussion board available on Piazza (anonymous posting has been enabled at the start; it may be disabled if proper protocol is not followed).
Either the instructor or the TAs will then provide answers in timely manners (within 24 hours).
Students are encouraged to provide comments and respond to questions from other students.

Lab Section and Teaching Assistants.

You must be registered in a lab section – both lab sections meet on Tuesday 9:35am. These will be conducted by the TAs and will include exercises and quizzes that will be graded. The Labs will be held on Blackboard.

Goals of Laboratories:

- Serve as a recitation section to review concepts covered in the lecture.
- Apply the concepts you learn by working through exercises.
- Discussion of questions and applications of the concepts to various problems in Computer science.

Required textbooks and/or other materials and recommended readings:

There are two options for a textbook; the instructor recommends , and will be using the book by Linz. For both options there will be additional material provided by the instruction team.

- An Introduction to Formal Languages and Automata, 6th edition, Peter Linz, Jones and Bartlett Learning. www.jblearning.com

  or
- Introduction to the Theory of Computation, 3rd edition, Michael Sipser, Cengage Learning, www.cengage.com

Week-by-week schedule of topics

Refer to the course webpage for detailed schedule.

Date	Topic(s) and readings	Assignment(s) due
Week 1	Introduction and review of proof techniques	Lab 1 exercises
Weeks 1-5	Finite Automata and Regular Languages	Homeworks 1,2,3; Quiz 1,2,3,4
Week 5	Exam 1 on Regular Languages and Finite Automata	
Weeks 6-10	Context Free Grammars and Pushdown Automata	Homeworks 4,5,6, Quiz 5,6,7,8

Week 10	Exam 2 on Context free languages	
Weeks 11-14	Turing Machines and Computability	Homework 7,8; Quiz 9,10,11
	Final Exam	

Assignments *(these are subject to change)*

Assignment	Description	Total Points
Homework 1	Proofs and Deterministic FA	10
Homework 2	Non-deterministic Finite Automata	15
Homework 3	Properties of Regular languages	10
Homework 4	Context Free grammars	10
Homework 5	Pushdown Automata	15
Homework 6	Properties of context free languages and parsing	15
Homework 7	Turing machines	15
Homework 8	Turing machines and Undecidability	10

Grading

- Three exams (50 %).
    - There will be two exams during the semester and a final exam.
- Quizzes and Class participation (25%)
    - The lowest quiz score will be dropped.
- Homeworks(25%)

Late Homeworks: No late submissions will be accepted except for medical exceptions. You must email the instructor or the TA (Andy Feng) *before* the due date to get the extension.

University policies

University policy on observance of religious holidays

In accordance with University policy, students should notify faculty during the first week of the semester of their intention to be absent from class on their day(s) of religious observance. For details and policy, see "Religious Holidays" at provost.gwu.edu/policies-procedures-and-guidelines

Academic Integrity Code

Academic Integrity is an integral part of the educational process, and GW takes these matters very seriously. Violations of academic integrity occur when students fail to cite research sources properly, engage in unauthorized collaboration, falsify data, and in other ways outlined in the Code of Academic Integrity. Students accused of academic integrity violations should contact the Office of Academic Integrity to learn more about their rights and options in the process. Outcomes can range from failure of assignment to expulsion from the University, including a transcript notation. The Office of Academic Integrity maintains a permanent record of the violation.

More information is available from the Office of Academic Integrity at studentconduct.gwu.edu/academic-integrity. The University's "Guide of Academic Integrity in Online Learning Environments" is available at studentconduct.gwu.edu/guide-academic-integrity-online-learning-environments. Contact information: rights@gwu.edu or 202-994-6757.

Support for students outside the classroom

Virtual academic support

A full range of academic support is offered virtually in fall 2020. See coronavirus.gwu.edu/top-faqs for updates.

Tutoring and course review sessions are offered through Academic Commons in an online format. See academiccommons.gwu.edu/tutoring

Writing and research consultations are available online. See academiccommons.gwu.edu/writing-research-help

Coaching, offered through the Office of Student Success, is available in a virtual format. See studentsuccess.gwu.edu/academic-program-support

Academic Commons offers several short videos addressing different virtual learning strategies for the unique circumstances of the fall 2020 semester. See academiccommons.gwu.edu/study-skills. They also offer a variety of live virtual workshops to equip students with the tools they need to succeed in a virtual environment. See tinyurl.com/gw-virtual-learning

Writing Center

GW's Writing Center cultivates confident writers in the University community by facilitating collaborative, critical, and inclusive conversations at all stages of the writing process. Working alongside peer mentors, writers develop strategies to write independently in academic and public settings. Appointments can be booked online. See gwu.mywconline.

Academic Commons

Academic Commons provides tutoring and other academic support resources to students in many courses. Students can schedule virtual one-on-one appointments or attend virtual drop-in sessions. Students may schedule an appointment, review the tutoring schedule, access other academic support resources, or obtain assistance at academiccommons.gwu.edu.

Disability Support Services (DSS) 202-994-8250

Any student who may need an accommodation based on the potential impact of a disability should contact Disability Support Services to establish eligibility and to coordinate reasonable accommodations. disabilitysupport.gwu.edu

Counseling and Psychological Services 202-994-5300

GW's Colonial Health Center offers counseling and psychological services, supporting mental health and personal development by collaborating directly with students to overcome challenges and difficulties that may interfere with academic, emotional, and personal success. healthcenter.gwu.edu/counseling-and-psychological-services

Safety and Security

- In an emergency: call GWPD 202-994-6111 or 911
- For situation-specific actions: review the Emergency Response Handbook at safety.gwu.edu/emergency-response-handbook
- In an active violence situation: Get Out, Hide Out, or Take Out. See go.gwu.edu/shooterpret
- Stay informed: safety.gwu.edu/stay-informed