

---

## CSI/MAT 350 – Theory of Computation – FALL 2021

**Professor:** Shaun D. Ramsey, Ph.D. (Dr. Ramsey, Doc, Rams, Ramsey are all fine with he/him/his pronouns)

**Email:** sramsey2@washcoll.edu (preferred contact method)

**Office:** DUNN N106a

**Office Hours:** W 1-2pm, on Zoom Tu 2-3pm (or by drop-in and appointment)

**Zoom:** <https://us06web.zoom.us/j/84531436953?pwd=NUV4R3F4TFJNSzVzV1VzU3dzMmdWUT09>

**Discord:** <https://discord.gg/VXfBwyAsbD>

**Class meetings:** 350-10 WF 4:30-5:20PM - M asynchronously and celebrations

**Text:** Introducing the Theory of Computation by Wayne Goddard

**Web:** <http://shaunramsey.com/class/21FALL/350.html>

---

**Overview and Advising:** Theory of computation is the study in the fundamentals of computer science. A computer scientist should understand the notions of tractable, intractable and complexity before attempting to tackle any problem. By first examining simple languages and building up to higher and more complex languages, we develop a method of understanding complexity. By the end of the course, one should be able to identify different languages (and prove their classifications) and understand the limits of computability and complexity.

**Suggestions:** The natural tendency is to procrastinate on pre-work and homework problems. Do not do so. You will need to practice, fail, try again and get help in order to succeed. As an advanced course, I expect this diligence of each of you.

### Grade Breakdown:

There are 21 Learning Objectives listed in the end of the syllabus. Every other week you'll receive a take-home Celebration (Celebrations of Knowledge thanks to Dr. Poulsen!) to be completed on your own with no online or outside resources. You are on your honor there and will be required to abide by and sign the honor code each submission. On a graded Celebration, each question will be graded as "successful", "growing" or "not yet". A single "successful" is considered Proficient in the chart below. Two grades on an objective of "successful" will result in "demonstrated" in the chart below. For your grades, you must meet the minimum for the base grade in each of the categories.

The final exam in the course will consist of two parts. The first part consists of big picture questions on the overall ideas of the course. Your performance on this part contributes to the plus/minus grade in the course. The other part of the final exam will be a last Celebration of Knowledge of the semester and will give you the chance to meet additional learning outcomes that you have not yet mastered.

Grade		D	C	B	A
Learning Objectives					
Proficient	Successful (x1)	6	3	3	3
Mastered	Successful (x2)	6	12	14	17
Homeworks/Proofs		50%	70%	80%	90%

Plus/minus grades:

- A plus is added if you meet all the base requirements and the big-picture portion of the final exam is passed.
- A minus is added if (1) you meet the Learning Objectives Requirement but not one of the other two categories AND that other category is no more than two levels below the others OR (2) You meet the minimum requirements for the base grade but fail the big-picture portion on the final exam.

**Attendance:** Attendance is strongly encouraged and will be tracked.

**Lateness:** I reserve the right to give any late assignment a score of 0, but this course is about getting around to the material at our own pace. Still, there are a minimum number of objectives to accomplish and staying on track is much easier than catching up. We learn this material by doing it!

**Accommodations:** If you have an accommodation that has been reported to the college, please let me know as soon as possible so I can work to meet your accommodation. Please notify me of any necessary accommodation at least two weeks prior to the requirement so we can make it happen. If you suspect you might need an accommodation, I recommend that you speak with OAS as soon as possible.

**Academic Honesty:** You are always subject to the Honor Code of Washington College. All work must be your own. When handing in any assignment you are required to cite every reference, including web pages and classmates. Failure to do so will be considered plagiarism.

**Career Center:** It is important to utilize all the resources available to you. The Career Center is a wonderful center dedicated to helping you. You can receive mock interviews there, attend a career fair, and even attend a workshop on graduate school admissions. For more information on these programs and other ways to connect with the Center for Career Development, please contact Nanette Cooley at [ncooley2@washcoll.edu](mailto:ncooley2@washcoll.edu).

**Quantitative Skills Center:** The QSC can help you with all your number needs! Struggling in a class with numbers? Want to check over your work before handing it in? Just like working with a knowledgeable tutor nearby? Then the QSC is for you! The Quantitative Skills Center is a tutoring service provided to all members of the Washington College community. Consider making a one-on-one appointment. For more information and to view a brief video guide, visit our website. Appointments need to be reserved two days in advance, so be sure to think ahead! To make appointments go here: <https://washcoll.mywconline.com/>

**Counseling Center:** We all experience stressful and difficult events as a normal part of life and especially right now. As your instructor, I am not qualified to serve as a counselor, but I am a useful ear. So please feel welcome to open a discourse with me. I may guide you to a counselor and if you do need an actual counselor, Washington College offers counseling services on-campus that are available to you at no cost. All counseling services provided are completely confidential and in no way connected to your academic record. I strongly encourage you to take advantage of this valuable resource. Please contact The Office of Counseling Services at 410-778-7261, or email: [vanderson2@washcoll.edu](mailto:vanderson2@washcoll.edu) to schedule an appointment.

**General Tentative Schedule:**

---

Week 1	FAs, REs
Week 2	NFAs, Properties and Closure, Celebration 1
Week 3	GNFA*/RIP, PL
Week 4	PL, Celebration 2
Week 5	CFG, PDA
Week 6	Properties, Celebration 3
Week 7	CNF, PL
Week 8	PL, Celebration 4
Week 9	TMs, Variations
Week 10	Properties, r and r.e., Celebration 5
Week 11	Diagonalization, Halting Problem
Week 12	Catch-up, Celebration 6
Week 13	Reduction
Week 14	Celebration 7

---

**Note:** This document and a tentative week by week schedule are available from the website listed above.

**Learning Objectives:**

## 1. Regular Languages

- 1.1. (RE1) I can translate a finite automata into an English description.
- 1.2. (RE2) I can craft an FA from an English description.
- 1.3. (RE3) I can translate an RE into an FA.
- 1.4. (RE4) I can convert between NFAs and DFAs.
- 1.5. (RE5) I can translate an FA into an RE using rips.
- 1.6. (RE6) I can apply the concept of closure in a proof.
- 1.7. (RE7) I can prove a language is not regular using the pumping lemma for regular languages.

## 2. Context Free Languages

- 2.1. (CFL1) I can translate a CFG into an English description
- 2.2. (CFL2) I can create a CFG from an English description.
- 2.3. (CFL3) I can generate a parse tree.
- 2.4. (CFL4) I can translate a CFG into Chomsky's Normal Form.
- 2.5. (CFL5) I can create a PDA from an English description.
- 2.6. (CFL6) I can give an English description for a PDA.
- 2.7. (CFL7) I can prove a language is not context free using the pumping lemma for context free languages.

## 3. Turing Machines and Complexity

- 3.1. (TM1): I can translate a TM into an English description.
- 3.2. (TM2): I can create a TM from an English description.
- 3.3. (TM3): I understand the idea of diagonalization, self-denying machines and paradoxes.
- 3.4. (TM4): I can describe the differences between decidable, recognizable, and their complements.
- 3.5. (TM5): I understand the halting problem and its categorization.
- 3.6. (TM6): I can describe and apply Rice's Theorem.
- 3.7. (TM7): I can describe and apply the concept of reducibility as a proof technique.