

# Algorithm Design for Data Science

## DATS 6001 - 10, Spring 2021

### 1 Meeting Time and Location

- Meeting time: Tuesday, 7:10 PM - 9:40 PM
- Location: <https://gwu.webex.com/join/yuxiaohuang>

### 2 Instructor

- Yuxiao (James) Huang
  - Email: [yuxiaohuang@gwu.edu](mailto:yuxiaohuang@gwu.edu)
  - Github: <https://github.com/yuxiaohuang>
  - Website: <https://sites.google.com/view/yuxiaohuang>
  - Office address: <https://gwu.webex.com/join/yuxiaohuang>
  - Office hours:
    - \* Wednesday, 7:00 PM - 9:00 PM
    - \* Thursday, 7:00 PM - 8:00 PM
    - \* Note: If you would like to meet during my office hours, please send email to set up an appointment, so that we can have a scheduled time slot for one-on-one meeting.

### 3 Teaching Assistant

- Chaelin Shin
  - Email: [chaelinshin@gwmail.gwu.edu](mailto:chaelinshin@gwmail.gwu.edu)
  - Office address: <https://gwu.webex.com/meet/chaelinshin>
  - Office hours:
    - \* Monday, 9:00 AM - 11:00 AM
    - \* Tuesday, 9:00 AM - 11:00 AM
    - \* Thursday, 9:00 AM - 11:00 AM
    - \* Friday, 9:00 AM - 10:00 AM

### 4 Course Description

- This course covers Algorithm Design. Unlike the ones offered in most CS departments, this course is particularly tailored for non-CS major students. Specifically, we will only focus on (the theory and implementation of) the most important problems in algorithm design.
- The main goal of this course is to teach students to write code that is bug-free and has the lowest time complexity (i.e., uses the minimum time) and space complexity (uses the minimum space). This is the key skill that will be tested in the “Whiteboard Coding” interviews for Data Scientist / Software Engineer positions.

- In this course we will cover Data Structures (Array, Stack, Queue, and Tree) and Algorithms (Search, Sort, and Dynamic Programming). See details in the Tentative Schedule in sec. 19.
- This course will use Python exclusively. We assume students have used Python previously hence we will not discuss the syntax of the language in class.

## 5 Learning Outcomes

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

- understand the theory and implementation of the data structures and algorithms covered in the course
- use appropriate data structures and algorithms to design solutions that have the lowest time and space complexity
- write bug-free code to implement the solutions

## 6 Course Github Repository

The syllabus and lecture notes (write-up and coding exercises) can be found in the course github repository.

## 7 Textbook

- There is no textbook for this course.
- Instead, the course will be largely based on lectures notes, which are available in the course github repository.
- Students are highly recommended to read the lecture notes and work on the coding exercises before the class.

## 8 Average Minimum Amount of Out-Of-Class or Independent Learning Expected Per Week

- Going over the theories and coding covered in class is integral for success in this course.
- You should spend at least 5 hours of out-of-class or independent learning per week.

## 9 Homework

- There will be 6 homework, which will only include coding questions.
- Each homework has 10 points (hence 60 points in total).
- Homework **must** be completed individually.

## 10 Exam

- There will be 2 exams (a Take-Home Midterm and Take-Home Final), which will only include coding questions.
- Each exam has 20 points (hence 40 points in total).

## 11 Submission

- Homework and exams will be due for submission through **blackboard** by 11:59 PM (Eastern time). See more details in sec 19.
- **Submission will no longer be accepted after the deadline, and will receive a grade of 0.**

## 12 Grading Scheme

- 60% Homework (6)
- 40% Exams (2)
  - 20% Midterm Examination
  - 20% Final Examination

## 13 Grading Rubrics

We will apply the following grading rubrics for each question in the Homework and Exams.

- If there is no implementation, the student shall receive 0% of the full mark (assigned to the question).
- If there is an implementation:
  - if the implementation cannot generate the correct output for the provided test cases, the student shall receive 60% of the full mark
  - if the implementation can generate the correct output:
    - \* if neither the required time complexity nor space complexity is met, the student shall receive 70% of the full mark
    - \* if the required space complexity is met but not the time complexity, the student shall receive 80% of the full mark
    - \* if the required time complexity is met but not the space complexity, the student shall receive 90% of the full mark
    - \* if both the required time complexity and space complexity are met, the student shall receive 100% of the full mark
  - if the student did not explain the logic behind their implementation, the corresponding mark will be deducted

## 14 Grade Appeals

- A grade becomes permanent one week after you receive the grade.
- Grade appeals and questions must be raised in writing (email) within one week after the day on which the grade was received.

## 15 Letter Grade Distribution

[93, 100]	A
[90, 93)	A-
(87, 90)	B+
[83, 87]	B
[80, 83)	B-
(77, 80)	C+
[73, 77]	C
[70, 73)	C-
<70	F

## 16 University Policies

### 16.1 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: <https://provost.gwu.edu/policies-procedures-and-guidelines>.

### 16.2 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 <https://studentconduct.gwu.edu/academic-integrity>. The University's "Guide of Academic Integrity in Online Learning Environments" is available at <https://studentconduct.gwu.edu/guide-academic-integrity-online-learning-environments>. Contact information: [rights@gwu.edu](mailto:rights@gwu.edu) or 202-994-6757.

## 17 Support for Students Outside the Classroom

### 17.1 Virtual Academic Support

- A full range of academic support is offered virtually in fall 2020. See <https://coronavirus.gwu.edu/top-faqs> for updates.
- Tutoring and course review sessions are offered through Academic Commons in an online format. See <https://academiccommons.gwu.edu/tutoring>.
- Writing and research consultations are available online. See <https://academiccommons.gwu.edu/writing-research-help>.
- Coaching, offered through the Office of Student Success, is available in a virtual format. See <https://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 <https://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 [https://library.gwu.edu/events?order=DATE\\_ASC&format=workshop&open\\_to=GWorld&series=&category=&sponsor=&events\\_date\\_start=&events\\_date\\_end=&terms=&page=1](https://library.gwu.edu/events?order=DATE_ASC&format=workshop&open_to=GWorld&series=&category=&sponsor=&events_date_start=&events_date_end=&terms=&page=1).

### 17.2 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 <https://gwu.mywconline.com>.

### 17.3 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, or access other academic support resources at <https://academiccommons.gwu.edu>. For assistance contact [academiccommons@gwu.edu](mailto:academiccommons@gwu.edu).

#### **17.4 Disability Support Services (DSS) 202-994-8250**

Any student who may need an accommodation based on the potential impact of a disability should contact <https://disabilitysupport.gwu.edu> to establish eligibility and to coordinate reasonable accommodations.

#### **17.5 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. See <https://healthcenter.gwu.edu/counseling-and-psychological-services>.

### **18 Safety and Security**

- In an emergency: call GYPD 202-994-6111 or 911.
- For situation-specific actions: review the Emergency Response Handbook at <https://safety.gwu.edu/emergency-response-handbook>.
- In an active violence situation: Get Out, Hide Out or Take Out. See <https://www.youtube.com/watch?v=CpBT6tAa0dY&feature=youtu.be>.
- Stay informed: <https://safety.gwu.edu/stay-informed>.

### **19 Tentative Schedule**

Date	Topic	Release	Due
01/12	<a href="#">Time and Space Complexity</a>	Homework 1	
01/19	<a href="#">Time and Space Complexity</a>		
01/26	<a href="#">Array, Stack, and Queue</a>	Homework 2	Homework 1
02/02	<a href="#">Array, Stack, and Queue</a>		
02/09	<a href="#">Array, Stack, and Queue</a>		
02/16	<a href="#">Binary Search</a>	Homework 3	Homework 2
02/23	<a href="#">Binary Search</a>		
03/02	<a href="#">Sort</a>	Homework 4 Midterm Exam	Homework 3
03/09	<a href="#">Sort</a>		Midterm Exam
03/16	Spring Break (No Class)		
03/23	<a href="#">Tree and Search</a>	Homework 5	Homework 4
03/30	<a href="#">Tree and Search</a>		
04/06	<a href="#">Tree and Search</a>		
04/13	<a href="#">Dynamic Programming</a>	Homework 6	Homework 5
04/20	<a href="#">Dynamic Programming</a>		
04/27	No Class	Final Exam	Homework 6
05/04	No Class		Final exam