CMPSC 312 – Database Systems Syllabus

Fall 2020

Course Instructor

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Exam Code: J
Final deliverable due: 11th December 2020, 9:00am
Syllabus updated on: September 1, 2020

Instructor's Office Hours

There will be no in-person meeting times. Instead, online meetings using Zoom (download link: `https://zoom.us/`. To schedule a meeting with me during my office hours, please visit my web site and click the "Schedule" link in the top right-hand corner. Here, you can browse my office hours slots to schedule an appointment. You will find a Zoom link with the meeting slot link. At the allotted time, I will be online and awaiting your meeting. If given office hour meeting times are not convenient for your schedule, please let me know and I would be happy to work with you to find and other time which would be suitable for your schedule.

- Tuesdays *and* Thursdays: 2:00 pm – 4:00 pm (10 minute time slots)
- Wednesday *and* Friday: 1:30 pm – 2:30 pm (10 minute time slots)
- By appointment, if these times do not work for you.

Online Meetings

We will be using Zoom to record our in-class meetings and labs for online students to participate in the course. The Zoom link for classes and the lab can be found on your

shared course calendar for the event – the calendar link will be given by a separate communication.

Technical Leaders

- https://www.cs.allegheny.edu/teaching/technicalleaders/

Course Meeting Schedule

- **Lecture, Discussion, Presentations, and Group Work:**

    - 31st August - 11th December 2020
    - **Class**; Monday, Wednesday and Friday, 11:30 am – 12:20 pm, Alden Hall, Room 101
    - **Lab**; Wednesday, 3:00 PM - 4:50 PM, online meeting only. See above in Section for details about meeting online.

Calendar

The calendar link is provided below to allow you to add the course and lab meeting times into your own Google calendar. Note, the whole link fits onto one line.

```
https://calendar.google.com/calendar/b/1?cid=
Y182ZWhvaHY2ZWkxazU1N2hwYmc1ZjROcjA5c0Bncm91cC5jYWxlbmRhci5nb29nbGUuY29t
```

Academic Bulletin Description

A study of the design and implementation issues in database management systems. Topics include data models, logical/physical database design, data access/search techniques, normalization theory, mappings from logical to physical structures, storage, and utilization. Additional topics include database reorganization, migration, database integrity, consistency, privacy and security, distributed database systems, architecture of knowledge-based systems, and intelligent query interfaces. One laboratory per week. Prerequisite: Computer Science 112. Offered in alternate years. Distribution Requirements: QR, SP.

Course Objectives

The essence of the discipline of computer science is algorithms; this course will introduce students to the principles of data management using algorithms. We will investigate some of the key techniques that scientists use to manage data. Areas of discussion include, but are not limited to, relational databases and query languages, object-oriented data storage, encoding data in the eXtensible Markup Language (XML), low-level data storage, transactions and concurrency control, data warehousing

and mining, and the implementation and testing of database applications.

The course will introduce students to the theory and practice of data management while covering both the well-established and the cutting-edge areas of the discipline. The course also invites students to assess the correctness of their implementations and conduct both analytical and empirical evaluations of the performance of data management techniques. Moreover, the course will ask students to implement small- and medium-scale data management systems and to install and use a wide variety of support tools. In addition to improving their teamwork skills, students will enhance their ability to write and speak about software in a clear and concise fashion.

Performance Objectives

At the completion of this class, a student must be comfortable with fundamental data management topics and be aware of current research in the area. When given a new data management problem, students should be able to select proper data management tools and implement a complete application that uses them to solve the stated problem. Students also must develop a toolkit of data management concepts that they can use in the context of the solutions to real-world problems. Finally, students must develop and apply a strong knowledge of analytical and empirical techniques that they can use to characterize and predict the performance of data management systems.

Students should also be able to handle many of the important, yet accidental, aspects of implementing programs with modern programming languages and data management systems. In addition to being comfortable with program editors, compilers, debuggers, testing tools, virtual machines, database management systems, and query languages, students will be working with some Python programming where code will be provided to be modified.

Required Textbooks

- *Database Systems Concepts, Fifth or Sixth Edition.* Avi Silberschatz, Henry F. Korth, and S. Sudarshan.

Class Policies

Grading

The grade that a student receives in this class will be based on the following categories. All percentages are approximate and, if the need to do so presents itself, it is possible for the assigned percentages to change during the academic semester.

Class Participation	10%
First Examination	10%
Second Examination	10%
Laboratory Assignments	40%
Final Project (Due by 11th December 2020, 9:00am)	30%

These grading categories have the definitions which are defined below.

- *Class Participation*: All students are required to actively participate during all of the class sessions. Your participation will take forms such as answering questions about the required reading assignments, completing in-class exercises, asking constructive questions of the other members of the class, giving presentations, leading a discussion session in class and in the course's Slack channels.

- *First and Second Examinations*: The first and second examinations will cover all of the material in their associated module(s). While the second examination is not cumulative, it will assume that a student has a basic understanding of the material that was the focus of the first examination. The date for the first and second examinations will be announced at least one week in advance of the scheduled date. Unless prior arrangements are made with the course instructor, all students will be expected to take these examinations on the scheduled date and complete the tests in the stated period of time.

- *Laboratory Assignments*: These assignments invite students to explore the concepts, tools, and techniques associated with the management of data. All of the laboratory assignments require the use of the provided tools to design, implement, and evaluate systems that solve data management problems. To ensure that students are ready to develop software in both other classes at Allegheny College and after graduation, the instructor will assign individuals to teams for some of the laboratory assignments. Unless specified otherwise, each laboratory assignment will be due at the beginning of the next laboratory session. Some of the laboratory assignments in this course will expect students to give both a short presentation and a demonstration of the software that they created to manage a collection of data.

- *Final Project*: This project will present you with the description of a problem and ask you to implement a full-featured solution using one or more programming languages and a wide variety of data management techniques. The final project in this class will require you to apply all of the knowledge and skills that you have accumulated during the course of the semester to solve a problem and, whenever possible, make your solution publicly available as a free and open-source tool. The project will invite you to draw upon both your problem solving skills and your knowledge of programming languages and data management systems.

Assignment Submission

We will be using GitHub Classroom to collect all assignments. It is expected that you are able to effectively use `git` to submit your work. If you require help, please see your peers, the Technology Leaders, or your instructor.

All assignments will have a stated due date. The electronic version of the class assignments are to be turned in at the beginning of the lab session on that due date. Submissions after the beginning of class are counted as being late. Assignments will be accepted for up to one week past the assigned due date with a 15% penalty. All late assignments must be submitted at the beginning of the session that is scheduled one week after the due date.

Extensions

Unless special arrangements are made with the course instructor, no assignments will be accepted after the late deadline. If you are requesting extensions for a lab assignment, then you are to email me with your request and also provide a *valid reason* for your extension. This request must come before the due date of the lab and not on the due date. Requests will not be granted where the reason appears to be insignificant. Extensions are 24 hours of extra time (after the original due date) and are given out at my discretion. The decision to provide you with an extension (or not) will be weighed in light of fairness to your peers who are still able to complete their labs, regardless of their own busy schedules.

The submission of homework comprises the Honor Code pledge of the student(s) completing the work. For any assignment completed in a group, students must also turn in a one-page reflection that describes each group member's contribution to the submitted deliverables.

Attendance

Classes will be attended by in-person and online students. Each class will be recorded to produce videos for online students and to enhance learning for the class.

If you will not be able to attend your session, then please email the course instructor at least one week in advance to describe your situation. Students who miss more than five unexcused classes, laboratory sessions, or group project meetings will have their final grade in the course reduced by one letter grade. Students who miss more than ten of the aforementioned events will automatically fail the course.

Labs: The laboratory sessions will be held online and therefore, it is the student's responsibility to check up on materials for lab and to ask questions when necessary to ensure comprehension of deliverables.

Bring your own computer to class

The classrooms in the Departement of Computer Science no longer provide machines for student use. You are to bring your own wifi-ready device to class to be able to follow along with course material. If the class is meeting online using Zoom, then please be sure that you machine is configured correctly to use these services to connect you to the class. As it is your responsibility to maintain your machine, please perform online research to determine how to configure your machine accordingly, or to install any necessary software to enable online meetings.

During the semester, you will be told which software to install on your machine to be prepared for class. Some of the prominant software that we may be using include;

- Git and GiHub (a software development software system): `https://github.com/`

- Atom (an editor): `https://atom.io/`

- Docker (a software container system): `https://www.docker.com/`

  - Basic tutorial from Docker: `https://www.docker.com/101-tutorial`
  - Play with Docker: `https://labs.play-with-docker.com/`
  - Please note: machines running Windows "Home" are not able to use Docker. Please verify that your machine is able to run the software by visiting the department's Approved Laptops page `https://www.cs.allegheny.edu/resources/laptops/`.

- SQLite (a database system): `https://www.sqlite.org/index.html`

  - Some machines have differing methods of installing this database software. Please visit the link to determine how to get your machine ready to run this software.

Class Preparation

In order to minimize confusion and maximize learning, students must invest time to prepare for class discussions and lectures. During the class periods, the course instructor will often pose demanding questions that could require group discussion, the creation of a program or test suite, a vote on a thought-provoking issue, or a group presentation. Only students who have prepared for class by reading the assigned material and reviewing the current assignments will be able to effectively participate in these discussions. More importantly, only prepared students will be able to acquire the knowledge and skills that are needed to be successful in both this course and the field of data management. In order to help students remain organized and effectively prepare for classes, the course instructor will maintain a class schedule with reading assignments and presentation slides. During the class sessions students will also be required to download, use, and modify programs, diagrams, and data sets that are made available through the course GitHub repository.

Email

Using your Allegheny College email address, I will sometimes send out class announcements about matters such as assignment clarifications or changes in the schedule. It is your responsibility to check your email at least once a day and to ensure that you can reliably send and receive emails. This class policy is based on the following statement in *The Compass*, the college's student handbook.

> "The use of email is a primary method of communication on campus. . . . All students are provided with a campus email account and address while enrolled at Allegheny and are expected to check the account on a regular basis."

Disability Services

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. Students with disabilities who believe they may need accommodations in this class are encouraged to contact Disability Services at (814) 332-2898. Disability Services is part of the Learning Commons and is located in Pelletier Library. Please do this as soon as possible to ensure that approved accommodations are implemented in a timely fashion.

Honor Code

The Academic Honor Program that governs the entire academic program at Allegheny College is described in the Allegheny Course Catalog and in *The Compass: Student Handbook*. The Honor Program applies to all work that is submitted for academic credit or to meet non-credit requirements for graduation at Allegheny College. This includes all work assigned for this class (e.g., examinations, laboratory assignments, and the final project). All students who have enrolled in the College will work under the Honor Program. Each student who has matriculated at the College has acknowledged the following pledge:

> *I hereby recognize and pledge to fulfill my responsibilities, as defined in the Honor Code, and to maintain the integrity of both myself and the College community as a whole.*

Additionally, we expect that you will adhere to the following Department Policy:

Department of Computer Science Honor Code Policy

It is recognized that an important part of the learning process in any course, and particularly in computer science, derives from thoughtful discussions with teachers, student assistants, and fellow students. Such dialogue is encouraged. However, it is necessary to distinguish carefully between the student who discusses the principles

underlying a problem with others, and the student who produces assignments that are identical to, or merely variations on, someone else's work. It will therefore be understood that all assignments submitted to faculty of the Department of Computer Science are to be the original work of the student submitting the assignment, and should be signed in accordance with the provisions of the Honor Code. Appropriate action will be taken when assignments give evidence that they were derived from the work of others.
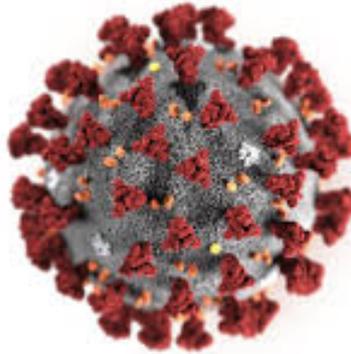
Covid-19

Figure 1: Safety first: Face masks and social distancing in effect.

The pandemic from the coronavirus (shown in Figure 1) has changed the usual style of teaching of this course. Please follow the below points carefully.

- **Remote Attendance** If you are participating entirely remotely this semester and relying on technology to attend class meetings, occasional technology problems that disrupt your participation will not harm your participation grade, but as with illnesses and family emergencies, chronic absences for this reason will require a more extensive discussion with me and may impact your grade.

- **Face Coverings and Physical Distancing** For your safety, a mask covering both your mouth and your nose is required for all in-person activities, per College policy; you will not be permitted to enter or stay in a classroom or other learning space without a face covering, and class time missed for this reason may count against your participation grade. Face coverings are also required for in-person office hours and consultations with other campus professionals. Physical distancing must be respected at all times in the classroom. Chairs will be positioned 6 feet apart, and should remain so.

- **Illness and In-person Attendance** If you feel ill, please stay in your residence and complete the daily health screening, and err on the side of caution when deciding whether or not to come to class. Especially if you feel feverish or have a cough, please avoid contact with others; if you feel like you'd like to "power through" class rather than miss it and have to make it up, please do so remotely.

- **Keeping Devices Charged** You will need to ensure that your laptop, tablet, or other device is sufficiently charged so that you may participate in class(es). Even if you are in-person in the classroom, you may need to use a device, especially as you will be 6 feet from your nearest peer. It won't be possible for all students to charge their devices at once in the classroom, so please make sure you bring the power cord(s) for your devices to class, pack a power strip if you have multiple devices, and pay attention to the power meter on your device.

- **Video and Microphones** Please turn off your microphone when not speaking during any meeting where you are using your computer. The microphone may allow for background sound to contribute to noise during the meeting. It is strongly encouraged that you use your video to show yourself during meeting. Enabling your video will allow the instructor to see hands to indicate questions. Showing video also helps to stimulate group discussions.

College Messages

- **Statement of Community** Allegheny students and employees are committed to creating an inclusive, respectful and safe residential learning community that will actively confront and challenge racism, sexism, heterosexism, religious bigotry, and other forms of harassment and discrimination. We encourage individual growth by promoting a free exchange of ideas in a setting that values diversity, trust and equality. So that the right of all to participate in a shared learning experience is upheld, Allegheny affirms its commitment to the principles of freedom of speech and inquiry, while at the same time fostering responsibility and accountability in the exercise of these freedoms.

- **Learning Commons** If you are not already, you should become familiar with the Learning Commons, located in Pelletier Library (http://sites.allegheny.edu/learningcommons/). Among other things, the staff at the Learning Commons can assist you with study and time management skills, writing, and critical reading. You should know that if you are having trouble in this class, or if I think you can specifically benefit from their services, I will refer you to the Learning Commons. Experienced peer writing and speech consultants in the Learning Commons help writers and speakers to determine strategies for effective communication and to make academically responsible choices at any stage in the writing or speaking process and on assignments in any discipline. Both appointments and drop-in sessions are available. To view the hours of operation, and to make an appointment, visit the Learning Commons website.

- **Religious Accommodations** If you need to miss class or reschedule a final examination due to a religious observance, please speak to the professor well in advance to make arrangements. See http://sites.allegheny.edu/religiouslife/religious-holy-days/.