

# Capital University of Economics and Business

## Overseas Chinese College

### Course Syllabus

|                            |  |       |    |               |    |                             |   |
|----------------------------|--|-------|----|---------------|----|-----------------------------|---|
| <b>Year and Semester</b>   | 2024 Spring  |       |    |               |    |                             |   |
| <b>Course Name</b>         | Data Structures and Algorithms Analysis  |       |    |               |    |                             |   |
| <b>Course Code</b>         | MIS222   |       |    |               |    |                             |   |
| <b>Course Type</b>         | <input type="checkbox"/> General Education (Required) <input type="checkbox"/> General Education (Elective)<br><input type="checkbox"/> Basic Disciplinary Course <input type="checkbox"/> Professional Course (Required)<br><input type="checkbox"/> Professional Course (Elective) <input type="checkbox"/> Professional Course (Expanded)<br><input checked="" type="checkbox"/> Professional Course (Advanced) |       |    |               |    |                             |   |
| <b>Course Credits</b>      | 3  |       |    |               |    |                             |   |
| <b>Course Hours</b>        | Total Hours  | Class | 48 | Lecture Hours | 48 | Experiment (Computer) Hours | 0 |
| <b>Applicable object</b>   | <input type="checkbox"/> Freshman <input checked="" type="checkbox"/> Sophomore <input type="checkbox"/> Junior <input type="checkbox"/> Senior  |       |    |               |    |                             |   |
|                            | <input type="checkbox"/> Business Administration (Accounting)  |       |    |               |    |                             |   |
|                            | <input checked="" type="checkbox"/> Information Management and Information Systems (Finance)   |       |    |               |    |                             |   |
| <b>Prerequisites</b>       | C or Java Programming Language   |       |    |               |    |                             |   |
| <b>Instructor</b>          | Prof. Smith  |       |    |               |    |                             |   |
| <b>Contact Information</b> | Office: C217   |       |    |               |    |                             |   |
|                            | Tele: (010) 83951082   |       |    |               |    |                             |   |
|                            | Email: skippersmith66@gmail.com (all email correspondence must have in the Subject field: MIS222IT ID EnglishName reason)  |       |    |               |    |                             |   |
| <b>Office Hour</b>         | TBD  |       |    |               |    |                             |   |
| <b>Learning Centre</b>     | TBD  |       |    |               |    |                             |   |
| <b>Grade/Section</b>       | 22IT   |       |    |               |    |                             |   |
| <b>Course Time/Place</b>   | Th 9:55 – 12:20  |       |    |               |    |                             |   |
| <b>Textbook</b>            | Data Structures and Algorithm Analysis in C, 2nd Edition,<br>Mark Allen Weiss, China Machine Press, ISBN 978-7-111-31280-2.  |       |    |               |    |                             |   |

#### Reference Book

Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2<sup>nd</sup> Edition [ C 程序设计语言 (第 2 版·新版) ]. ISBN 978-7-111-12806-9

Mike Banahan, Declan Brady, Mark Doran, The C Book, 2<sup>nd</sup> Edition. Addison Wesley. Freely available at [https://publications.gbdirect.co.uk/c\\_book/](https://publications.gbdirect.co.uk/c_book/)

#### Course Description

This course aims to elucidate data structures and methods of organizing large amount of data. Even though computers become faster and faster, the need for programs that can handle large amounts of input becomes more acute. This requires more careful attention to efficiency, since inefficiencies in programs become most obvious when input sizes are large.

## Student Learning Objectives

On successful completion of this exam, candidates should be able to:

|            |   |
|------------|---|
| Knowledge  | <ul style="list-style-type: none"> <li>◆ Understand the fundamental structures on which all algorithms are based.</li> <li>◆ Understand the formal method of analyzing general algorithm performance.</li> <li>◆ Describe multiple sort methods and why each might be used.</li> <li>◆ Describe multiple approaches to using trees for storing and/or organizing data.</li> <li>◆ Describe multiple data graphing techniques and why they are used.</li> </ul>            |
| Capability | <ul style="list-style-type: none"> <li>◆ Be able to calculate the Big O for basic algorithms..</li> <li>◆ Identify when using a linked list.</li> <li>◆ Identify when to use loops, nested loops, and function calls to simplify code logic.</li> <li>◆ Utilize arrays for both raw data storage and strings, and being able to identify which is which.</li> <li>◆ Be prepared to study Data Structures and Algorithm Analysis using C or a similar language.</li> </ul> |
| Mindset    | <ul style="list-style-type: none"> <li>◆ Be logical, methodical, consistent and accurate</li> <li>◆ Apply critical thinking in the process of decision making</li> </ul>  |

## Website Source

<https://www.hackerrank.com> for practicing DS&A problems.

## Teaching Methods

This course contains lectures, class discussions, homework, quizzes, presentation and exams. Students must be prepared to discuss the assigned chapters during class. Then real case and practice questions will be delivered to students as a way to test their understanding of the knowledge. This will require individual or group assignment in or after class.

## Grade Criterion

| Component     | Weight | Description |
|---------------|--------|-------------|
| Final Exam    | 20%    |             |
| Mid-Term Test | 20%    |             |
| Homework      | 10%    |             |
| Quizzes       | 10%    |             |
| Presentation  | 20%    |             |
| Participation | 10%    |             |
| Attendance    | 10%    |             |
| <b>Total</b>  | 100%   |             |

## Detailed Grade Computation

|               | Before Midterm | After Midterm |
|---------------|----------------|---------------|
| Attendance    | 5%             | 5%            |
| Participation | 5%             | 5%            |

|               |     |     |
|---------------|-----|-----|
| Homework      | 5%  | 5%  |
| Quizzes       | 5%  | 5%  |
| Presentation  |     | 20% |
| Mid-Term Test | 20% |     |
| Final exam    |     | 20% |
| Total         | 40% | 60% |

## **Assessment of Student Performance**

### ***Self-Study and Reading ability Practice***

Instructor will give out the chapters or the reference books to read and use class hours to have discussion; students should be able to show a proactive attitude and ability for self-study and reading. Knowledge and oral English will be elements of homework or presentation score.

### ***Homework***

Students should finish their homework by themselves. Copying from others will be treated as plagiarism and the homework scores will be lowered. Students should hand in all assignments on time. Late assignments will be accepted at the discretion of the instructor (i.e., when the student was ill or had an excused absence). Late assignments without reasonable proof will be reduced in score by 50%.

### ***Attendance***

Because the course covers a great deal of material, attending every class session is very important for performing well.

- ◆ Being late for 15 minutes or more is considered an absence.
- ◆ Five hours or above of unexcused absences will result in the lower level of the final grade by one grade band (e.g. from C – to D +). Any excused absence must be discussed directly with the teacher.
- ◆ Absence which is more than 1/3 of the total teaching hours will cause an F (a failing grade) directly. but students are welcome to continue attending classes.
- ◆ An incomplete grade (I) will be considered in case of medical or family emergencies.

### ***Participation***

- ◆ Students should participate in classes actively. Half of participation grade is determined by their presentation in class. They are encouraged to ask questions relevant to the subject and express their own opinions. Every student should respect the ideas, opinions, and questions of their classmates.
- ◆ Students should also use office hours to ask questions or talk with the instructor for good communication and effective learning.
- ◆ Frequently visiting the instructor and chatting in English during office hours is highly recommended.
- ◆ Any misbehavior and non-class related activities in class will result in the lower level of the participation grade, including ringing cell phones.
- ◆ All above behaviors will be solely evaluated by the instructor for scoring.

### ***Textbook***

Students must bring the textbook, a computer (if possible), USB drive, pen/pencil, and paper to class.

**Topical Course Outline (original)**

| Week | Topics   | Platform   | Homework   |
|------|--|------------|--|
| 1    | ● Syllabus   | Classroom  | —  |
|      | ● Chapter 1 Introduction (self-study)<br>● Chapter 2 Algorithm Analysis  | Classroom  | —  |
|      | ● Big O calculation<br>● Checking analysis   | Classroom  | CH02 2.1, 2.2, 2.5abc,<br>2.13abcdef, 2.18abcd                     |
| 2    | ● Chapter 3 Lists, Stacks, & Queues<br>● Abstract data types   | Classroom  | —  |
|      | ● Linked Lists<br>● Structure implementation<br>● Big O analysis   | Classroom  | —  |
|      | ● Doubly/circularly linked lists   | Classroom  | CH03 3.1, 3.3ab, 3.11 (Due<br>Week 4)                              |
| 3    | ● Chapter 3 Lists, Stacks, & Queues<br>● Stacks<br>● Big O analysis  | Classroom  | —  |
|      | ● Stacks in arrays vs. linked lists<br>● Queues<br>● Big O analysis  | Classroom  | —  |
|      | ● Queues in arrays vs linked lists<br>● Circular queues  | Classroom  | CH03 3.17a, 3.19   |
| 4    | ● Quiz 1   | Classroom  | —  |
|      | ● Chapter 4 Trees<br>● Definitions<br>● General Trees<br>● Binary Search tree ADT<br>● Big O analysis<br>● Binary Search tree practice | Classroom  | —  |
|      | ● AVL Trees<br>● Big O analysis<br>● AVL Tree practice<br>● Splay Trees (self-study)   | Classroom  | CH04 4.1ab, 4.2abcde, 4.3,<br>4.4, 4.5, 4.8, 4.9ab (due<br>Week 6) |
| 5    | ● Chapter 4 Trees<br>● B-Tree explanation  | Real world | —  |
|      | ● B-Tree insertion<br>● B-Tree insertion practice  | Real world | —  |
|      | ● B-Trees deletion<br>● B-Tree deletion practice   | Real world | CH04 4.16, 4.23, 4.36ab  |
| 6    | ● Chapter 6 Priority Queues (Heaps)<br>● Applications of Priority Queues   | Classroom  | —  |
|      | ● Priority Queues using trees<br>● Practice  | Classroom  | —  |
|      | ● Priority Queues in arrays<br>● Linear Priority Queues<br>● Practice  | Classroom  | CH06 6.2ab, 6.6  |
| 7    | ● Chapter 7 Sorting<br>● Insertion sort<br>● Big O analysis<br>● Practice  | Classroom  | —  |

|    |  |           |   |
|----|--|-----------|---|
|    | <ul style="list-style-type: none"> <li>• Shellsort</li> <li>• Practice</li> </ul>  | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>• Mergesort</li> <li>• Heapsort</li> </ul>  | Classroom | CH07 7.1, 7.2, 7.4, 7.9a, 7.11, 7.13 (due Week 9) |
| 8  | <ul style="list-style-type: none"> <li>● Chapter 7 Sorting</li> <li>• Quicksort</li> <li>• Big O analysis</li> </ul>   | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>• Practice</li> </ul>   | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>• Bucketsort</li> </ul>   | Classroom | CH07 7.17, 7.18ab, 7.20, 7.25                     |
| 9  | <ul style="list-style-type: none"> <li>● Review</li> </ul>   | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>● Mid-term test</li> </ul>  | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>● Mid-term test</li> </ul>  | Classroom | —   |
| 10 | <ul style="list-style-type: none"> <li>● Chapter 5 Hashing</li> <li>• Hashing explained</li> <li>• Terminology</li> <li>• Separate Chaining</li> <li>• Big O analysis</li> </ul> | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>• Linear Probing</li> <li>• Quadratic Probing</li> </ul>  | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>• Double Hashing</li> <li>• Rehashing</li> </ul>  | Classroom | CH05 5.1abcd, 5.2, 5.4, 5.6                       |
|    |  |           |   |
| 11 | <ul style="list-style-type: none"> <li>● Chapter 9 Graphing</li> <li>• Graphing Explained</li> </ul>   | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>• Terminology and examples</li> <li>• Adjacency Lists &amp; Arrays</li> </ul>   | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>• Topological Sort</li> <li>• Shortest Path Algorithms</li> </ul>   | Classroom | CH09 9.1, 9.2, 9.5ab (due Week 14)                |
|    |  |           |   |
| 12 | <ul style="list-style-type: none"> <li>● Review</li> </ul>   | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>● Review</li> </ul>   | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>● Quiz 2</li> </ul>   | Classroom | —   |
| 13 | <ul style="list-style-type: none"> <li>● Chapter 9 Graphing</li> <li>• Minimum Spanning Trees</li> </ul>   | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>• Depth First Search</li> <li>• Strong Components</li> </ul>  | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>• Maximum Flow</li> </ul>   | Classroom | CH09 9.11, 9.15ab, 9.26                           |
|    |  |           |   |
| 14 | <ul style="list-style-type: none"> <li>● Presentations</li> </ul>  | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>● Presentations</li> </ul>  | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>● Presentations</li> </ul>  | Classroom | —   |
| 15 | <ul style="list-style-type: none"> <li>● Presentations</li> </ul>  | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>● Presentations</li> </ul>  | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>● Presentations</li> </ul>  | Classroom | —   |
| 16 | <ul style="list-style-type: none"> <li>● Presentations or Review</li> </ul>  | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>● Presentations or Review</li> </ul>  | Classroom | —   |
|    | <ul style="list-style-type: none"> <li>● Presentations or Review</li> </ul>  | Classroom | —   |

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### **Teacher's Office Hour**

- ♦The instructor's office hour is shown in the front of the office door.
- ♦Students are suggested to use the instructor's office hour and learning center to ask questions or talk with the instructor once at least per week for good communication and effective learning, which is recorded in the students' participation.
- ♦The time can be scheduled by instructors or students, or both.

### **Cheating and Plagiarism**

Cheating is not tolerated. Any student caught cheating on a quiz; test or exam will be given a mark of zero (0) for the particular work. At the beginning of the semester the definition of plagiarism will be carefully explained, when any thoughts or writings of another person are used, they must be clearly identified (usually one uses quotation marks) and the source notes. **If any student is caught cheating on any homework assignment, the highest score the student can earn in that course is a "C".**

### **Important Dates**

|                     |   |
|---------------------|---|
| <b>Midterm Test</b> | <b>Week 9</b>   |
| <b>Final Exam</b>   | <b>Week 17 (Refer to the notice of the Academic Affairs Office)</b> |

*Note: This syllabus is tentative and may be changed or modified throughout the semester. All students will be notified and a new syllabus will be given.*

**Instructor: Prof. Smith**

**Department Head: Prof. Li**

