



教學計劃表 Syllabus

課程名稱(中文) Course Name in Chinese	資料結構AA		學年/學期 Academic Year/Semester		114/1				
課程名稱(英文) Course Name in English	Data Structures								
科目代碼 Course Code	CSIEB010AA	系級 Department & Year	學二	開課單位 Course-Offering Department	資訊工程學系				
修別 Type	學程 Program	學分數/時間 Credit(s)/Hour(s)		3.0/3.0					
授課教師 Instructor	/張紘睿								
先修課程 Prerequisite									
課程描述 Course Description									

Introduction

A data structure is a way of organizing and storing data so that it can be processed efficiently by a computer program. The CSIEB0100 Data Structures course is therefore about the organization, storage and effective processing of data for computer programs. The objectives of this course can be summarized as follows.

- Understand the concept of abstract data types(ADT) for data modeling.
- Study different types of data structures and the algorithms that operate on them.
- Learn how to choose appropriate data structures and algorithms for problem solving.
- Learn to evaluate the cost/performance of data structures and algorithms.
- Learn how to design new data structures and algorithms if necessary.

This is a lecture-oriented course with associated lab course CSIE@0700. It is strongly recommended that you take both courses at the same time. The sample code will be presented in C++. It is therefore a prerequisite of this class to be familiar with the C++ programming language. We will use the free Code::Blocks IDE in class. You may choose any C++ compiler/IDE you like.

Regular Topics

The topics to be covered in the lecture are listed as follows (**: topics to be covered depending on the time and progress):

- Data structures and abstract data types
- C++ review and algorithms
- Arrays and strings
- Stacks and queues
- Linked lists (single and doubly linked)
- Trees (basic facts, binary trees, search, heap)
- Graphs (basic facts, representations, shortest paths, spanning trees)
- Internal sorting (insertion sort, quick sort, merge sort, heap sort, radix sort)
- External sorting
- Hashing and maps (dictionary structures)
- Priority queues**
- Efficient search structures**
- Advanced data structures**

課程目標 Course Objectives

A data structure is a way of organizing and storing data so that it can be processed efficiently by a computer program. The CSIEB0100 Data Structures course is therefore about the organization, storage and effective processing of data for computer programs. The objectives of this course can be summarized as follows.

Understand the concept of abstract data types(ADT) for data modeling.

Study different types of data structures and the algorithms that operate on them.

Learn how to choose appropriate data structures and algorithms for problem solving.

Learn to evaluate the benefits, costs and effectiveness of different data structures on a program.

Learn how to design new data structures and algorithms if necessary.

This is a lecture-oriented course with associated lab course CSIE@0700.

It is strongly recommended that you take both courses at the same time.

The sample code will be presented in C++. It is therefore a prerequisite of this class to be familiar with the C++ programming language.

系專業能力 Basic Learning Outcomes		課程目標與系專業能力相關性 Correlation between Course Objectives and Dept.'s Education Objectives
A	資訊專業終身學習能力Ability of lifetime learning in information profession	●
B	實驗驗證資訊科學能力Ability of validate experimental result validation in information science field	●
C	資訊工具整合運用能力Ability of integrated applications of information technology	●
D	資訊系統應用設計開發能力Ability of information application system design and development	●
E	團隊合作溝通協調能力Ability of teamwork, communication, and coordination	○
F	資訊科技問題解決能力Ability of problem solving regarding information and communication technology	○
G	瞭解資訊科技多元影響能力Ability to understand information technology's multiple influences	○
H	肩負資訊人社會責任能力Ability of bearing the social responsibilities being among information professionals	

圖示說明Illustration : ● 高度相關 Highly correlated ○ 中度相關 Moderately correlated

授課進度表 Teaching Schedule & Content

週次Week	內容 Subject/Topics	備註Remarks
1	Course Introduction <ul style="list-style-type: none"> . Course description . Regular topics . Special topic(s) . Syllabus . Textbook and references . Assignments . Exams 	

2	Basic Concepts and Abstract Data Types <ul style="list-style-type: none"> • What are data structures? • Why do we study data structures? • What is an abstract data type(ADT)? • Relationship between data structures and ADTs • Classification of data structures • Algorithms and performance analysis • Complexity and asymptotic notations 	
3	OO and C++ Review <ul style="list-style-type: none"> • Object orientation • Object-oriented programming(OOP) • C++ review • C++ templates • Data structures in C++ • OOP with C++ 	
4	Arrays and strings: <ul style="list-style-type: none"> • Array ADT • Polynomial ADT • Sparse matrices • String ADT 	
5	Stacks and queues: <ul style="list-style-type: none"> • Stack ADT • Queue ADT • Maze • Expression Evaluation 	
6	Linked lists: <ul style="list-style-type: none"> • Singly linked lists • Circular lists • Doubly linked lists • Lists applications 	
7	Tree I: <ul style="list-style-type: none"> • Tree ADT • Binary trees • Threaded binary trees • Heaps • Binary search trees 	
8	Tree II: <ul style="list-style-type: none"> • Selection trees • Heaps • Binary search trees • Selection trees 	
9	期中考試週 Midterm Exam	
10	NDHU Sports Day(no classes)	
11	Graphs I: <ul style="list-style-type: none"> • Graph ADT • Graph operations • Graph representation • Graph implementation • Minimum cost spanning trees • Shortest paths and transitive closure • Graph search 	
12	Internal Sorting I: <ul style="list-style-type: none"> • Internal sorting concept • Insertion sort • Quick sort • Merge sort 	
13	Internal Sorting II: <ul style="list-style-type: none"> • Heap sort • Radix sort • How fast can we sort? • Applying sorting algorithms (Which algorithm to use? Use multiple algorithms?) 	

14	External sorting <ul style="list-style-type: none"> External sorting concept External sort-merge algorithm External sorting applications 	
15	Hashing Associative arrays Hash functions Hash tables and dictionaries	
16	Advanced topics: ** <ul style="list-style-type: none"> Priority queues AVL trees Red-black trees B-trees, B+-trees Digital search structures Data structures for advanced applications: spatiotemporal, big data, streaming, social network analysis, ... 	
17	期末考試週 Final Exam	
18	Special topic: data structures and AI (Artificial Intelligence) ** <ul style="list-style-type: none"> Relationship between DSA(Data Structures and Algorithms) and AIML(Artificial Intelligence and Machine Learning) Commonly used DSA for AIML What kind of data structures and algorithms does ChatGPT use? How AIML can improve DSA 	

教學策略 Teaching Strategies

課堂講授 Lecture 分組討論 Group Discussion 參觀實習 Field Trip
 其他 Miscellaneous:

教學創新自評 Teaching Self-Evaluation

創新教學 (Innovative Teaching)

問題導向學習 (PBL) 團體合作學習 (TBL) 解決導向學習 (SBL)
 翻轉教室 Flipped Classroom 磨課師 Moocs

社會責任 (Social Responsibility)

在地實踐 Community Practice 產學合作 Industry-Academia Cooperation
 跨域合作 Transdisciplinary Projects

跨界教學 Transdisciplinary Teaching 跨院系教學 Inter-collegiate Teaching
 業師合授 Courses Co-taught with Industry Practitioners

其它 other:

學期成績計算及多元評量方式 Grading & Assessments

配分項目 Items	配分比例 Percentage	多元評量方式 Assessments						
		測驗 會考	實作 觀察	口頭 發表	專題 研究	創作 展演	卷宗 評量	證照 檢定
平時成績(含出缺席) General Performance (Attendance Record)								
期中考成績 Midterm Exam	35%	✓						
期末考成績 Final Exam	35%	✓						
作業成績 Homework and/or Assignments	30%		✓					
其他 Miscellaneous (_____)								

評量方式補充說明

Grading & Assessments Supplemental instructions

Grading policy may change if necessary.

教科書與參考書目 (書名、作者、書局、代理商、說明)

Textbook & Other References (Title, Author, Publisher, Agents, Remarks, etc.)

Textbook

Ellis Horowitz, Sartaj Sahni and Dinesh Mehta. Fundamentals of Data Structures in C++, 2nd Edition, Silicon Press, Summit, New Jersey, 2007. (Code: https://inside.mines.edu/~dmehta/FDS_CPP/)

Reference Books

- Wikibooks. Fundamental Data Structures. The data structure Wikibook.
- Open Content. Open Data Structures. An open content textbook.
- Narasimha Karumanchi. Data Structures And Algorithms Made Easy, 5th Edition. CareerMonk Publications, 2017.
- Clifford A. Shaffer. Data Structures and Algorithm Analysis, Edition 3.2.0.10, March 28, 2013. (Both C++ and Java versions are available on-line with source code.)

課程教材網址(含線上教學資訊,教師個人網址請列位於本校內之網址)

Teaching Aids & Teacher's Website (Including online teaching information.

Personal website can be listed here.)

<https://elearn4.ndhu.edu.tw/>

其他補充說明 (Supplemental instructions)