Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

Expected Implementation in Academic Year	AY2025-2026
Semester/Trimester/Others (specify approx. Start/End date)	Semester 2
Course Author * Faculty proposing/revising the course	Wu Hongjun
Course Author Email	wuhj@ntu.edu.sg
Course Title	Algorithms and Computing
Course Code	MH1403
Academic Units	3
Contact Hours	39
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	PS0001 OR BS1009 OR CV1014 OR MS1008 OR MA1008 OR {CB0494, CH2107} OR {CB0494, BG2211}
Co-requisites	CB0494
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

Course Aims

This course aims to give you a systematic introduction to data structures and algorithms for constructing efficient computer programs. Emphasis is on data abstraction issues in the program development process, and on the design of efficient algorithms. Simple algorithmic paradigms such as greedy algorithms, divide-and-conquer algorithms and dynamic programming will be introduced. Elementary analyses of algorithmic complexities will also be taught.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Implement data structures in Python.
ILO 2	Analyze the complexity of algorithms.
ILO 3	Design and implement efficient algorithms for given applications.
ILO 4	Solve large problems systematically and effectively.
ILO 5	Work as a team and collaborate to manage larger programming projects.

Course Content

Introduction to the course
Algorithm Analysis
Python Classes
Array, Linked List, Python List
Stack
Queue
Tree
Binary Search Tree
AVL Tree
Sorting Algorithms
Greedy algorithms
Divide-and-Conquer algorithms
Dynamic programming

Reading and References (if applicable)

- Textbook: Michael T. Goodrich and Roberto Tamassia, Algorithm Design and Applications, WILEY, 2014 (978-1-118-33591-8)
- Reference: Huang Guangbin and Ng Jim Mee, Data structures and algorithms, Pearson Education South Asia, 2007 (9789810679149)

Both books will be available at NTU libraries.

NOTE: The above readings comprise the foundational readings for the course and more up-to-date relevant readings will be provided when they are available.

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Introduction to the course, Algorithm Analysis	1-4	lecture notes	In-person	Learning algorithm analysis
2	Python Classes	1-4	lecture notes	In-person	Learning Python classes
3	Array, Linked List, Python List	1-4	lecture notes	In-person	Learning array, linked list, Python list
4	Stack and Queue	1-4	lecture notes	In-person	Learning stack and queue
5	Tree	1-4	lecture notes	In-person	Learning tree
6	Binary Search Tree	1-4	lecture notes	In-person	Learning binary search tree
7	AVL Tree	1-4	lecture notes	In-person	Learning AVL tree
8	Sorting Algorithms	1-4	lecture notes	In-person	Learning sorting algorithms
9	Divide-and-Conquer Algorithms	1-5	lecture notes	In-person	Learning divide-and-conquer algorithm
10	Midterm Test	1-5	Exam paper	In-person	Midterm Test
11	Greedy Algorithms	1-5	lecture notes	In-person	Learning greedy algorithms
12	Dynamic Programming	1-5	lecture notes	In-person	Learning dynamic programming
13	Introduction to Linear programming, Integer programming, and Revision	1-4	lecture notes	In-person	Learning linear programming, integer programming

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures (26 hours)	Lectures are to introduce the basic knowledge on data structure, algorithms and complexity analysis. The concept of each lecture will be enhanced by the tutorial and lab sessions after the lectures
Laboratories (8 hours)	Lab sessions will be on the format of both individual and group projects, you are expected to solve the given project by Python programming languages. Lab tutors will be present at the lab sessions only to guide you in finding solutions by yourselves
Tutorials (8 hours)	Tutorials are divided into two parts: introduction to the programming of the data structures, and solution solving. You are expected to solve the tutorial questions by yourselves before coming to the tutorial sessions, and solutions will only be provided after that

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Assignment(Assignment)	1, 2, 4, 5		4	Four programming labs	Individual	Analytic	Relational
2	Continuous Assessment (CA): Test/Quiz(Mid-semester Quiz)	1, 2, 3, 4		30	Midterm test	Individual	Analytic	Relational
3	Summative Assessment (EXAM): Final exam(Examination (2 hours))	1, 2, 3, 4		60	Final exam	Individual	Analytic	Relational
4	Continuous Assessment (CA): Class Participation(Answer questions in Lecture)	1,2,4,5		6	Students answer questions in lectures	Individual	Analytic	Relational

Description of Assessment Components (if applicable)

There are four lab assignments. You are required to submit all the lab assignments.

Formative Feedback

You will be receiving formative feedback verbally during tutorials and through written grading of your lab assignments. You will receive summative group feedback on the exam following the conclusion of the course.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Creative Thinking	Intermediate
Digital Fluency	Intermediate
Problem Solving	Intermediate

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to attend the lectures and the tutorial sessions, and to take all scheduled assignments (labs) by due dates. Not submitting a lab assignment before the corresponding deadline will be counted as no submission. You are expected to take responsibility to follow up with course notes, assignments and course related announcements they have missed.

Policy (Absenteeism)

Absence due to medical or other reasons

If you are sick and unable to attend the midterm test, you must:
1. Send an email to the instructor regarding the absence.
2. Submit a Medical Certificate* to your home school.

*The Medical Certificate mentioned above must be issued in Singapore by a medical practitioner registered with the Singapore Medical Association.

In such cases, a make-up midterm test will be arranged.

Policy (Others, if applicable)

Diversity and inclusion policy

Integrating a diverse set of experiences is important for a more comprehensive understanding of science.

It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:

If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
If you feel like your performance in the class is being impacted by your experiences outside of class;
If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;

Please speak to your teaching team, our school pastoral officer or a peer or senior (either in-person or via email) about how we can help facilitate your learning experience.

As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the class are expected to adhere to the NTU anti-harassment policy. if you witness something that goes against this or have any other concerns, please speak to your instructors or a faculty member.

Appendix 1: Assessment Rubrics

Rubric for Laboratories: Assignments (4%)

You will submit the lab programming codes. Each lab submission is worth one mark. The guidelines for marking each code in your lab submission are as follows.

code works well and the algorithm in the code is good	full marks
code is partially correct (the code works for some cases)	50% of the full marks
code does not work, and the student does not know how to solve the problem	zero marks

Rubric for Class Participation: (6%)

Answer questions in Lecture: Questions are asked in 12 lectures. The guidelines are as follows:

The correct answers are at least 8/12	6 marks
The correct answers are 7/12	5 marks
The correct answers are 6/12 or answered at least 9/12	4 marks
The correct answers are 5/12 or answered at least 8/12	3 marks
The correct answers are 4/12 or answered at least 7/12	2 marks
The correct answers are 3/12 or answered at least 6/12	1 marks

Rubric for Mid-semester Quiz: Short Answer Questions (30%)

Point-based marking (not rubric-based). Short answer questions.

Rubric for Examination: Short Answer Questions (60%)

Point-based marking (not rubric-based). Short answer questions.