The Hong Kong University of Science and Technology

UG Course Syllabus (Fall 2025-26)

Course Title: Honors Object-Oriented Programming and Data Structures

Course Code: COMP2012H

No. of Credits: 5-credit

Any pre-/co-requisites: Grade A or above in COMP 1021 / COMP 1022P / COMP 1022Q (prior to 2020-21) / ISOM 3230

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Course Description

This course is an accelerated and intensive course on concepts and techniques behind object-oriented programming (OOP) and data structures using an OOP language. It covers the major materials of COMP2011 and COMP2012, and its curriculum is designed for students with excellent programming background or substantial programming experience. Topics include: functions; pointers; abstract data types and their class implementation; static and dynamic construction and destruction of objects; data member and member functions; public interface and encapsulation; class hierarchies; polymorphism; inheritance and dynamic binding; standard template library; generic programming using templates; object-oriented view of data structures: linked lists, queues, stacks, trees, and their algorithms such as searching, sorting and hashing. Prerequisite(s): Grade A or above in
COMP 1021 / COMP 1022P / COMP 1022Q (prior to 2020-21) / ISOM 3230
Exclusion(s): COMP 2011, COMP 2012

List of Topics

1. Introduction to computer programming
2. Fundamentals of C++: data types, variables, operators
3. Flow controls
4. Arrays
5. Functions, scope, and recursion
6. File I/O
7. Pointers
8. lvalue references
9. Structures
10. Class, object construction, initialization, and destruction

11. Separate compilation and makefile
12. Inheritance and polymorphism
13. Generic programming
14. Standard Template Library (STL)
15. Namespace
16. Static data members and member functions
17. rvalue references and move semantics
18. Linked lists
19. Stack and queue
20. Binary search tree
21. AVL tree
22. Hashing

Textbooks and Reference books

Paul Deitel, Deitel & Associates (2017). C++ How to Program.

M.A. Weiss (2014). Data Structures and Algorithm Analysis in C++.

Data Structures and Algorithm Analysis Ed. 3.2 (C++ Version).

Cay S. Horstmann, Wiley (2012). C++ For Everyone.

B. Eckel (2000). Thinking in C++.

L. Nyhoff (2005). ADTs, Data Structures and Problem Solving with C++.

Stanley Lippman (2013). C++ Primer.

Scott Meyers (2005). Effective C++: 55 Specific Ways to Improve Your Programs and Designs.

Intended Learning Outcomes (ILOs)

By the end of this course, students should be able to:

-1 Understand that recursive and non-recursive functions are abstractions of sub-problems in a task.
-2 Describe the concept and know how to use pointers in indirect addressing and dynamic memory allocation.
-3 Understand and know how to implement a few simple data structures as abstract data type in an OOP language such as stacks, lists, queues, binary tree, and hash table.
-4 Understand and implement generic programming using OOP in terms of function overloading, operator overloading, function and class templates.

-5 Understand and implement inheritance and polymorphism using static binding, dynamic binding, and virtual functions.
-6 Understand and be able to implement searching and hashing algorithms using data structures or STL (standard template library).
-7 Write a program of fewer than a thousand lines of OOP codes to solve simple to medium problems with classes.
-8 Use common software tools to develop and debug a program written in an OOP language.
-9 Develop programs using separate compilation and/or STL.

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

[List specific assessed tasks, exams, quizzes, their weightage, and due dates; perhaps, add a summary table as below, to precede the details for each assessment.]

Assessment Task	Contribution to Overall Course grade (%)	Due date
8 lab exercises	8 (1 each)	It is weekly due.
4 assignments	32 (8 each)	It is due every three weeks.
Midterm exam	25	ARO confirms the date.
Final exam	35	ARO confirms the date.
Total	100	

* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Mapping of Course ILOs to Assessment Tasks
[add to/delete table as appropriate]

Assessed Task	Mapped ILOs	Explanation
8 lab exercises	ILO1, ILO2, …, ILO9	The first lab asseses ILO1 and ILO2. The 2nd lab asseses ILO3. The 3rd lab asseses ILO4. The 4th lab asseses ILO5. The 5thlab asseses ILO6. The 6th lab asseses ILO7. The 7thlab asseses ILO8. The 8th lab asseses ILO9.

4 assignments	ILO1,…,ILO9	The first assignment assesses ILO1 and ILO2. The second assignment assesses ILO3 and ILO4. The third assignment assesses ILO5 and ILO6. The fourth assignment asseses ILO7, ILO8, and ILO9.
Midterm exam	ILO1,…,ILO4	This task assesses all the materials from ILO1 to ILO4.
Final exam	ILO1, …, ILO9	This task assesses all the materials from ILO1 to ILO9.

Grading Rubrics

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive grasp of subject matter, expertise in problem-solving, and significant creativity in thinking. Exhibits a high capacity for scholarship and collaboration, going beyond core requirements to achieve learning goals.
B	Good Performance	Shows good knowledge and understanding of the main subject matter, competence in problem-solving, and the ability to analyze and evaluate issues. Displays high motivation to learn and the ability to work effectively with others.
C	Satisfactory Performance	Possesses adequate knowledge of core subject matter, competence in dealing with familiar problems, and some capacity for analysis and critical thinking. Shows persistence and effort to achieve broadly defined learning goals.
D	Marginal Pass	Has threshold knowledge of core subject matter, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline.
F	Fail	Demonstrates insufficient understanding of the subject matter and lacks the necessary problem-solving skills. Shows limited ability to think critically or analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline.

Course AI Policy

It is not allowed to use any generative AI tools for any assignments and any exams.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission.

Resubmission Policy

Except in special circumstances, resubmission for reassessment will not be allowed for any assessment.

Required Texts and Materials

Reference book: Excel and Excel VBA Programming for Beginners – 3rd Edition for Office 2013

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

Additional Resources

Online course content to be published in HKUST canvas when the semester begins.