

Liverpool John Moores University

Title: Data Structures and Algorithms for Games
Status: Definitive
Code: **5207COMP** (127986)
Version Start Date: 01-08-2021

Owning School/Faculty: Computer Science and Mathematics
Teaching School/Faculty: Computer Science and Mathematics

Team	Leader
Chris Carter	Y
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Academic Level: FHEQ5 **Credit Value:** 20 **Total Delivered Hours:** 45.5
Total Learning Hours: 200 **Private Study:** 154.5

Delivery Options

Course typically offered: Semester 2

Component	Contact Hours
Lecture	22
Practical	22

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Artefacts	AS1	Data Structure Driven Games Application Development	60	
Exam	AS2	Examination	40	1.5

Aims

To study abstract data types (ADTs) and common implementations of these data types.

To develop applications using the STL containers in order to implement .

Games software in a group setting, where each member is in charge of a specific role and set of algorithmic and data requirements.

*To build on programming skills through implementation of algorithms and use of appropriate data structures in problem solving for games development.
To recognise and specify how complexity of operations on these ADTs and their overall performance characteristics are affected by both the ADT in question and its implementation strategy.*

Learning Outcomes

After completing the module the student should be able to:

- 1 Apply appropriate data structures in order to solve specific sub problems related to game development within a specific game's development role.
- 2 As a group, enhance a specified games software design by applying data structures in tandem with appropriate algorithmic processing.
- 3 Appraise a range of fundamental data structures and analyze fundamental characteristics of algorithms.
- 4 Define and discuss the syntactic and semantic language constructs required to use particular data structures and their appropriate algorithms.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Application Development	1	2
Examination	3	4

Outline Syllabus

*Identifying how data structures are shared between different games domains.
Constructing Functional Requirements for an entire game using data structure techniques
Identifying shared processing, algorithms and data requirements
Distribution of Algorithmic Processing across a games requirements specification.
Definition and Principles of Abstract Data Types and Concrete Implementations.
STL Algorithms, Iterators and Containers
The relationship between Discrete Mathematics and Data Structures.
Use of Templates in the STL
Hardware Architectures and their practical implications on Data Structure usage and Algorithmic Processing.
CPU vs GPU Data Structures, CPU to GPU Coordination, Data Parallelism and SIMD Processing.
Modern Language constructs for memory management and aliased data structures: smart, shared and weak pointers vs Raw types.
Games-Specific Data Structures
Algorithms for creating, modifying and processing data structures.
Algorithm types: iterative and recursive
Reasoning about the performance of Algorithms.
Aggregate ADTs*

Linear ADTs

Hierarchical ADTs

Associative ADTs

Relationship between ADTs and computing fundamentals (e.g. Stack, Queue)

Logic and Bitwise Processing.

Profiling and Debugging a program's structure.

Modern Techniques for Algorithmic Control: Lambdas, Move Semantics, Function Binding

Learning Activities

Lectures – to deliver the theoretical concepts on data structures and algorithms applied to computer games development.

Practical – Tutor-led practical session in the computer laboratory.

Further exercises – additional exercises for students to work on in their own time.

Directed learning – provides additional reading to enable practical work to be completed.

Learning materials can be accessed digitally via University Virtual Learning Environment (VLE).

Notes

This module is a technical, skills-focused module. Students will be introduced to Data Structures as Abstract Data Types and cover the fundamentals of discrete mathematics which provide the foundations for data structure design and implementation. Students will gain exposure of how to create their own implementation in games industry standard languages and their standard libraries. Each structure will be covered from a game programming perspective, demonstrating real-world usage within game engines and game applications. It will require previous experience in programming; It will build on existing programming-based skills such as problem / functional decomposition and the use of an IDE to develop and test programs.