



YEAR 12 A LEVEL COMPUTER SCIENCE SUMMER TERM 3 – PAPER 2

‘An ambitious curriculum that meets the needs of all’

Medium Term Planning – Data Structures

Curriculum Intent	Pupils will be taught the following National Curriculum guidelines this term:
Skills/Assessment Objective Links	<p>At the end of this Unit all students should be able to:</p> <ul style="list-style-type: none">describe the concept and uses of a<ul style="list-style-type: none">QueueStackGraphGraph Depth First and Breath FirstTree pre, post, in orderBinary search treeHash tablelist typical uses of each of these data structuresknow how an adjacency matrix and an adjacency list may be used to represent a graphtraverse a binary tree in pre-order, in-order and post-ordercreate a binary search treebe able to apply a simple hashing algorithmstate what is meant by a collision and describe how collisions may be handledstate a possible order in which nodes are visited in depth first and breadth first graph traversals <p>Most students will be able to:</p> <ul style="list-style-type: none">distinguish between an array, list and tupledescribe the addition, deletion and maintenance of data within queues, stacks, hash tables and treesdescribe the characteristics of an array-based queue, circular queue and priority queuewrite an algorithm for traversing a linked listbe able to compare the use of adjacency matrices and adjacency lists for representing graphsbe able to apply a number of different hashing algorithms <p>Some students will be able to:</p> <ul style="list-style-type: none">describe and apply the following operations to a linear, circular and priority queue:<ul style="list-style-type: none">add an itemremove an itemtest for empty queuetest for full queuewrite algorithms for adding and deleting elements to/from a linked listwrite algorithms for pre-order, in-order and post-order tree traversalstrace depth-first and breadth-first graph traversal algorithms
Numeracy	MOD, DIV, <, >
Literacy	<p>Vocabulary Tier 3: Elementary data type, composite data type, abstract data type, static data structure, dynamic data structure, heap, overflow, underflow, array, record, tuple, list, linked list, queue, circular queue, priority queue, First In, First Out (FIFO), enqueue, dequeue, append, push, pop, stack, Last In, First Out (LIFO), call stack, stack frame, parameter, return address, hashing, hash table, collision, mid-square method, folding method, dictionary, graph, edge, arc, vertex, node, directed graph, digraph, undirected graph, weighted edge, adjacency matrix, adjacency list, Page Rank algorithm, tree, root, child, parent, subtree, leaf node, binary search tree, pre-order, in-order and post-order traversal, depth-first traversal, breadth-first traversal, pre-order and post-order tree traversal optimisation problem</p> <p>Vocabulary Tier 2: weight, edge, list, pre order, post order, problem</p> <p>Reading: Worksheets, presentations, answer sheets, exam questions, mark scheme, further reading for homework, conduct research for NEA</p>

	<p>Writing: Answer on the worksheet via word, complete NEA</p> <p>Oracy: listening and using tier 3 words</p>
Becoming future ready	<p>Careers/Employability:</p> <p>Understand the grade requirements at universities and the topics that can be applied for. Explore apprenticeship opportunities with a range of industries.</p> <ul style="list-style-type: none"> ▪ Software Architect. ▪ Data Scientist. ▪ Machine Learning Engineer. ▪ Blockchain Developer ▪ Cybersecurity Engineer. ▪ Cloud Solutions Architect. ▪ AI Research Scientist. ▪ Full-Stack Developer.
Adaptation	Throughout this topic, quality first teaching will provide differentiation:
QFT/SEND Provision	<p>By product: Learners are asked to present outcomes writing different code, not all code will be equal in style and sophistication, all code will work with teachers input, top end programmers will be set challenges on how to extend code and be expected to conduct a level of independent research. Learners are asked to present outcomes in a different way via pieces of writing, targeted questioning, models and drawings and speaking.</p> <p>By resource: Worksheets are well presented and accessible. Instructions are clearly outlined and separate from the information so that pupils know where to begin and end. Handouts are differentiated by outcome. Resources used will appeal to the range of preferred learning styles of pupils e.g. visual, auditory or kinesthetic learners. Scaffolding of tasks – word frames.</p> <p>By Intervention: By providing different levels of supervision and support</p> <p>By Progressive Questioning: Exploring pupils’ understanding through interactive dialogue using Blooms Taxonomy.</p> <p>By Grouping: According to prior coding attainment, gender, social preference, preferred learning style.</p> <p>By Task: Pupils identify targets which are meaningful via level of coding ability and feedback sheets</p> <p>By Offering Optional Activities: In class or as homework, to extend learning.</p> <p>This QFT/SEND provision will be explicit within the lesson by lesson schemes of work.</p>
Implementation Curriculum Delivery	To be able to:
Learning Outcomes (Knowledge)	<p>Topic 1 Queues FIFO</p> <p>Understand the concept of an abstract data type</p> <p>Be familiar with the concept and uses of a queue</p> <p>Describe the creation and maintenance of data within a queue (linear, circular, priority)</p> <p>Describe and apply the following to a linear, circular and priority queue</p> <ul style="list-style-type: none"> o Add an item o Remove an item o Test for an empty queue o Test for a full queue <p>Topic 2 Stacks LIFO</p> <p>Be familiar with the concept and uses of a stack</p> <p>Be able to describe the creation and maintenance of data within a stack</p> <p>Be able to describe and apply the following operations:</p> <ul style="list-style-type: none"> o Push o Pop o Peek (or top) o Test for empty stack o Test for full stack <p>Be able to explain how a stack frame is used with subroutine calls to store return addresses, parameters and local variables</p> <p>Topic 3 Trees</p>



Know that a tree is a connected, undirected graph with no cycles
Know that a binary tree is a rooted tree in which each node has at most two children
Be familiar with typical uses for rooted trees

Topic 4 Graphs

Be aware of a graph as a data structure used to represent complex relationships
Be familiar with typical uses for graphs
Be able to explain the terms: graph, weighted graph, vertex/node, edge/arc, undirected graph, directed graph
Know how an adjacency matrix and an adjacency list may be used to represent a graph
Be able to compare the use of adjacency matrices and adjacency lists

Topic 5 Graphs Traversal Algorithm - Depth First

Be able to trace depth-first algorithms
Be able to trace breadth-first algorithms
Describe typical applications of each

Topic 6 List and Linked Lists

Explain how a list may be implemented as a static or dynamic data structure
Describe the linked list data structure
Show how to

- Create
- Traverse
- Add data to
- Remove data from a linked list

Topic 7 Hash Tables

Be familiar with a hash table and its uses
Be able to apply simple hashing algorithms
Know what is meant by a collision and how collisions are handled using rehashing
Be familiar with the concept of a dictionary
Be familiar with simple applications of a dictionary

End of unit assessment

Current learning to be developed in the future within:

Links into understanding algorithms and bring in programming techniques

Assessment

See assessment maps for formative and summative assessment opportunities.

Impact

Review assessment results and target pupils that require further support via:-

- Learning conversation
- Changing seating plan
- Plan lessons to address areas of concern in assessment
- Targeted homework based on low performance areas identified in the assessment and marked pieces
- Stretch and challenge high ability pupils by identifying ambitious next steps to expand knowledge

Create a feedback sheet for each student
Each student identifies areas of Green, Amber and Red using Mark Assessment on their feedback sheet
Complete NOW task on areas identified as Amber and Red