

GCSE (9–1)
Teacher Guide

COMPUTER SCIENCE

J276
For first teaching in 2016

**Old to new subject
content crossover for
GCSE Computer Science**

Version 1



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Old to new subject content crossover for GCSE Computer Science

New Spec (J276)	Old Spec (J275)
<p>*all highlighted content below is either new or has come from AS, or has changed from J275</p>	
<p>Comp 1</p>	
<p>Systems Architecture</p> <ul style="list-style-type: none"> the purpose of the CPU Von Neumann architecture: <ul style="list-style-type: none"> MAR (Memory Address Register) MDR (Memory Data Register) Program Counter Accumulator common CPU components and their function: <ul style="list-style-type: none"> ALU (Arithmetic Logic Unit) CU (Control Unit) Cache the function of the CPU as fetch and execute instructions stored in memory how common characteristics of CPUs affect their performance: <ul style="list-style-type: none"> clock speed cache size number of cores embedded systems: <ul style="list-style-type: none"> purpose of embedded systems examples of embedded systems. 	<p>A451 The CPU:</p> <p>(a) state the purpose of the CPU (b) describe the function of the CPU as fetching and executing instructions stored in memory (c) explain how common characteristics of CPUs such as clock speed, cache size and number of cores affect their performance.</p>
<p>Memory</p> <ul style="list-style-type: none"> the difference between RAM and ROM the purpose of ROM in a computer system the purpose of RAM in a computer system the need for virtual memory flash memory. 	<p>A451 Memory</p> <p>(g) describe the difference between RAM and ROM (i) describe the purpose of RAM in a computer system</p>
<p>Storage</p> <ul style="list-style-type: none"> the need for secondary storage data capacity and calculation of data capacity requirements common types of storage: <ul style="list-style-type: none"> optical magnetic solid state suitable storage devices and storage media for a given application, and the advantages and disadvantages of these, using characteristics: <ul style="list-style-type: none"> capacity speed portability durability reliability cost 	<p>A451 Secondary Storage</p> <p>(s) explain the need for secondary storage (t) describe common storage technologies such as optical, magnetic and solid state (u) select suitable storage devices and storage media for a given application and justify their choice using characteristics such as capacity, speed, portability, durability and reliability.</p>

New Spec (J276)	Old Spec (J275)
<p>*all highlighted content below is either new or has come from AS, or has changed from J275</p> <p>Wired and wireless networks</p> <ul style="list-style-type: none"> types of networks: <ul style="list-style-type: none"> LAN (Local Area Network) WAN (Wide Area Network) factors that affect the performance of networks the different roles of computers in a client-server and a peer-to-peer network the hardware needed to connect stand-alone computers into a Local Area Network: <ul style="list-style-type: none"> wireless access points routers/switches NIC (Network Interface Controller/Card) transmission media the internet as a worldwide collection of computer networks: <ul style="list-style-type: none"> DNS (Domain Name Server) hosting the cloud the concept of virtual networks. 	<p>A451 Networks</p> <p>(b) describe the hardware needed to connect stand-alone computers into a local area network, including hub/switches, wireless access points</p> <p>(e) describe the differences between a local area network and a wide area network such as the Internet</p> <p>The internet</p> <p>(j) describe the hardware needed to connect to the internet including modems, routers</p> <p>(k) explain the need for IP addressing of resources on the internet and how this can be facilitated by the role of DNS services</p>
<p>Network topologies, protocols and layers</p> <ul style="list-style-type: none"> star and mesh network topologies Wifi: <ul style="list-style-type: none"> frequency and channels encryption ethernet the uses of IP addressing, MAC addressing, and protocols including: <ul style="list-style-type: none"> TCP/IP (Transmission Control Protocol/Internet Protocol) HTTP (Hyper Text Transfer Protocol) HTTPS (Hyper Text Transfer Protocol Secure) FTP (File Transfer Protocol) POP (Post Office Protocol) IMAP (Internet Message Access Protocol) SMTP (Simple Mail Transfer Protocol) the concept of layers packet switching. 	<p>A451 Networks</p> <p>(f) explain the terms IP addressing, MAC addressing, packet and protocols</p>

New Spec (J276)	Old Spec (J275)
<p>*all highlighted content below is either new or has come from AS, or has changed from J275</p> <p>System Security</p> <ul style="list-style-type: none"> • forms of attack • threats posed to networks: <ul style="list-style-type: none"> • malware • phishing • people as the 'weak point' in secure systems (social engineering) • brute force attacks • denial of service attacks • data interception and theft • the concept of SQL injection • poor network policy • Identifying and preventing vulnerabilities: <ul style="list-style-type: none"> • penetration testing • network forensics • network policies • anti-malware software • firewalls • user access levels • passwords • encryption. 	<p>A451 Networks</p> <p>(g) explain the need for security measures in networks, such as user access levels, suitable passwords and encryption techniques</p>
<p>System Software</p> <ul style="list-style-type: none"> • the purpose and functionality of systems software • operating systems: <ul style="list-style-type: none"> • user interface • memory management/ multitasking • peripheral management and drivers • user management • file management • utility system software: <ul style="list-style-type: none"> • encryption software • defragmentation • data compression • the role and methods of backup: <ul style="list-style-type: none"> • full • incremental. 	<p>A451 Software</p> <p>(b) describe the purpose and use of common utility programs for computer security (antivirus, spyware protection and firewalls), disk organisation (formatting, file transfer, and defragmentation), and system maintenance (system information and diagnosis, system cleanup tools, automatic updating)</p>

New Spec (J276)	Old Spec (J275)
<p>*all highlighted content below is either new or has come from AS, or has changed from J275</p> <p>Ethical, legal, cultural and environmental concerns</p> <ul style="list-style-type: none"> • how to investigate and discuss Computer Science technologies while considering: <ul style="list-style-type: none"> • ethical issues • legal issues • cultural issues • environmental issues • privacy issues. • how key stakeholders are affected by technologies • environmental impact of Computer Science • cultural implications of Computer Science • open source vs proprietary software • legislation relevant to Computer Science: <ul style="list-style-type: none"> • The Data Protection Act 1998 • Computer Misuse Act 1990 • Copyright Designs and Patents Act 1988 • Creative Commons Licensing • Freedom of Information Act 2000. 	<p>A451</p> <p>Computer systems (e) explain the importance of ethical, environmental and legal considerations when creating computer systems.</p>
Comp 2	
<p>Algorithms</p> <ul style="list-style-type: none"> • computational thinking: <ul style="list-style-type: none"> • abstraction • decomposition • algorithmic thinking • standard searching algorithms: <ul style="list-style-type: none"> • binary search • linear search • standard sorting algorithms: <ul style="list-style-type: none"> • bubble sort • merge sort • insertion sort • how to produce algorithms using: <ul style="list-style-type: none"> • pseudocode • using flow diagrams • interpret, correct or complete algorithms. 	<p>A451</p> <p>Algorithms</p> <p>(a) understand algorithms (written in pseudocode or flow diagram), explain what they do, and correct or complete them (b) produce algorithms in pseudocode or flow diagrams to solve problems.</p>

New Spec (J276)	Old Spec (J275)
<p>*all highlighted content below is either new or has come from AS, or has changed from J275</p> <p>Programming techniques</p> <ul style="list-style-type: none"> • the use of variables, constants, operators, inputs, outputs and assignments • the use of the three basic programming constructs used to control the flow of a program: <ul style="list-style-type: none"> • sequence • selection • iteration (count and condition controlled loops) • the use of basic string manipulation • the use of basic file handling operations: <ul style="list-style-type: none"> • open • read • write • close • the use of records to store data • the use of SQL to search for data • the use of arrays (or equivalent) when solving problems, including both one and two dimensional arrays • how to use sub programs (functions and procedures) to produce structured code • the use of data types: <ul style="list-style-type: none"> • integer • real • Boolean • character and string • casting • the common arithmetic operators • the common Boolean operators. 	<p>A451</p> <p>Binary Logic</p> <p>(e) understand and produce simple logic diagrams using the operations NOT, AND and OR</p> <p>(h) understand and use selection in an algorithm (IF and CASE statements)</p> <p>(i) understand and use iteration in an algorithm (FOR, WHILE and REPEAT loops).</p> <p>Handling data in algorithms</p> <p>(j) define the terms variable and constant as used in an imperative language</p> <p>(m) select and justify appropriate data types for a given program</p> <p>(n) perform common operations on numeric and Boolean data</p> <p>(o) use one-dimensional arrays.</p>
<p>Producing robust programs</p> <ul style="list-style-type: none"> • defensive design considerations: <ul style="list-style-type: none"> • input sanitisation/validation • planning for contingencies • anticipating misuse • authentication • maintainability: <ul style="list-style-type: none"> • comments • indentation • the purpose of testing • types of testing: <ul style="list-style-type: none"> • iterative • final/terminal • how to identify syntax and logic errors • selecting and using suitable test data. 	

New Spec (J276)	Old Spec (J275)
<p>*all highlighted content below is either new or has come from AS, or has changed from J275</p> <p>Computational Logic</p> <ul style="list-style-type: none"> • why data is represented in computer systems in binary form • simple logic diagrams using the operations AND, OR and NOT • truth tables • combining Boolean operators using AND, OR and NOT to two levels. • applying logical operators in appropriate truth tables to solve problems • applying computing-related mathematics: <ul style="list-style-type: none"> • + • - • / • * • Exponentiation (^) • MOD • DIV 	<p>A451</p> <p>Binary Logic</p> <p>(d) explain why data is represented in computer systems in binary form</p> <p>(e) understand and produce simple logic diagrams using the operations NOT, AND and OR</p> <p>(f) produce a truth table from a given logic diagram</p>
<p>Translators and facilities of languages</p> <ul style="list-style-type: none"> • characteristics and purpose of different levels of programming language, including low-level languages • the purpose of translators • the characteristics of an assembler, a compiler and an interpreter • common tools and facilities available in an integrated development environment (IDE): <ul style="list-style-type: none"> • editors • error diagnostics • run-time environment • translators. 	<p>A451</p> <p>Programming languages</p> <p>(c) explain the difference between high level code and machine code</p> <p>(d) explain the need for translators to convert high level code to machine code</p> <p>(e) describe the characteristics of an assembler, a compiler and an interpreter</p> <p>(f) describe common tools and facilities available in an integrated development environment (IDE): editors, error diagnostics, run-time environment, translators, auto-documentation.</p>

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<p>Data representation</p> <p>Units</p> <ul style="list-style-type: none"> bit, nibble, byte, kilobyte, megabyte, gigabyte, terabyte, petabyte how data needs to be converted into a binary format to be processed by a computer. <p>Characters</p> <ul style="list-style-type: none"> the use of binary codes to represent characters the term 'character-set' the relationship between the number of bits per character in a character set and the number of characters which can be represented (for example ASCII, extended ASCII and Unicode). <p>Images</p> <ul style="list-style-type: none"> how an image is represented as a series of pixels represented in binary metadata included in the file the effect of colour depth and resolution on the size of an image file. <p>Sound</p> <ul style="list-style-type: none"> how sound can be sampled and stored in digital form how sampling intervals and other factors affect the size of a sound file and the quality of its playback: <ul style="list-style-type: none"> sample size bit rate sampling frequency. <p>Compression</p> <ul style="list-style-type: none"> need for compression types of compression: <ul style="list-style-type: none"> lossy lossless. 	<p>A451</p> <p>Representation of data in computer systems</p> <p>(a) define the terms bit, nibble, byte, kilobyte, megabyte, gigabyte, terabyte</p> <p>(b) understand that data needs to be converted into a binary format to be processed by a computer.</p> <p>(c) convert positive denary whole numbers (0-255) into 8-bit binary numbers and vice versa</p> <p>(d) add two 8-bit binary integers and explain overflow errors which may occur</p> <p>(e) convert positive denary whole numbers (0-255) into 2-digit hexadecimal numbers and vice versa</p> <p>(f) convert between binary and hexadecimal equivalents of the same number</p> <p>(g) explain the use of hexadecimal numbers to represent binary numbers.</p> <p>(h) explain the use of binary codes to represent characters</p> <p>(i) explain the term character set</p> <p>(j) describe with examples (for example ASCII and Unicode) the relationship between the number of bits per character in a character set and the number of characters which can be represented.</p> <p>(k) explain the representation of an image as a series of pixels represented in binary</p> <p>(l) explain the need for metadata to be included in the file such as height, width and colour depth</p> <p>(m) discuss the effect of colour depth and resolution on the size of an image file.</p> <p>(n) explain how sound can be sampled and stored in digital form</p> <p>(o) explain how sampling intervals and other considerations affect the size of a sound file and quality of its playback.</p> <p>(o) describe the differences between lossy and lossless compression.</p>
Comp 3	

<p style="text-align: center;">New Spec (J276)</p> <p style="text-align: center;">*all highlighted content below is either new or has come from AS, or has changed from J275</p>	<p style="text-align: center;">Old Spec (J275)</p>
<p>Programming techniques</p> <ul style="list-style-type: none"> • how to identify and use variables, operators, inputs, outputs and assignments • how to understand and use the three basic programming constructs used to control the flow of a program: Sequence; Selection; Iteration • how to understand and use suitable loops including count and condition controlled loops • how to use different types of data including Boolean, string, integer and real appropriately in solutions to problems • how to understand and use basic string manipulation • how to understand and use basic file handling operations: open, read, write and close • how to define and use arrays (or equivalent) as appropriate when solving problems. • how to understand and use functions/sub programmes to create structured code 	<p>A453</p> <p>Programming techniques</p> <p>(a) identify and use variables, operators, inputs, outputs and assignments</p> <p>(b) understand and use the three basic programming constructs used to control the flow of a program: Sequence; Conditionals; Iteration</p> <p>(c) understand and use suitable loops including count and condition controlled loops</p> <p>(d) use different types of data including Boolean, string, integer and real appropriately in solutions to problems</p> <p>(e) understand and use basic string manipulation</p> <p>(f) understand and use basic file handling operations: open, read, write and close</p> <p>(g) define and use arrays as appropriate when solving problems.</p>
<p>Design</p> <ul style="list-style-type: none"> • how to analyse and identify the requirements for a solution to the problem • how to design suitable algorithms to represent the solution to a problem • how to design suitable input and output formats and navigation methods for their system • how to use abstraction to design the solution to a problem • how to identify the data requirements for their system • how to identify suitable variables and structures with appropriate validation for their system • how to use appropriate data types in their system • how to use functions/sub programmes to produce structured re-usable code • how to identify test procedures to be used during and after development to check their system against the success criteria • how to select suitable techniques for the development of their solution 	<p>A452</p> <p>Practical Activity</p> <p>(a) plan and carry out a practical investigation of a topic</p> <p>Effectiveness and efficiency</p> <p>(a) select suitable techniques for the development of their solution</p> <p>A453</p> <p>Design</p> <p>(a) analyse and identify the requirements for a solution to the problem</p> <p>(b) design suitable algorithms to represent the solution to a problem</p> <p>(c) design suitable input and output formats and navigation methods for their system</p> <p>(d) identify the data requirements for their system</p> <p>(e) identify suitable variables and structures with appropriate validation for their system</p> <p>(f) identify test procedures to be used during and after development to check their system against the success criteria.</p>

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<p>Development</p> <ul style="list-style-type: none"> • how to develop a solution to the identified problem using a suitable programming language(s) • how to demonstrate testing and refinement of the code during development • how to explain the solution using suitable annotation and evidence of development • how to use suitable techniques to solve all aspects of the problem • how to deploy practical techniques in an efficient and logical manner • how to show an understanding of the relevant information by presenting evidence of the development of their solutions • how to show an understanding of the technical terminology/concepts that arise from their investigation through their analysis of the data collected • how to use the terminology/concepts surrounding their topic and contained in the information collected correctly when it comes to producing their analysis in the supporting script 	<p>A452</p> <p>Practical activity</p> <p>(b) use practical skills effectively and efficiently to develop solutions to problems</p> <p>(c) test their solutions</p> <p>(d) evaluate and modify these solutions in light of test results.</p> <p>Effectiveness and efficiency</p> <p>(b) use suitable techniques to solve all aspects of the problem</p> <p>(c) deploy practical techniques in an efficient and logical manner.</p> <p>Technical understanding</p> <p>(a) show an understanding of the relevant information by presenting evidence of the development of their solutions</p> <p>(b) show an understanding of the technical terminology/concepts that arise from their investigation through their analysis of the data collected</p> <p>(c) use the terminology/concepts surrounding their topic and contained in the information collected, correctly when it comes to producing their analysis in the supporting script.</p> <p>A453</p> <p>Development</p> <p>(a) develop a solution to the identified problem using a suitable programming language</p> <p>(b) demonstrate testing and refinement of the code during development</p> <p>(c) explain the solution using suitable annotation and evidence of development.</p>

New Spec (J276)	Old Spec (J275)
<p>*all highlighted content below is either new or has come from AS, or has changed from J275</p> <p>Testing, evaluation and conclusions</p> <ul style="list-style-type: none"> • how to produce a full report covering all aspects of the investigation • how to present the information in a clear form which is understandable by a third party and which is easily navigatable • how to critically appraise the evidence that they have presented • how to test their own solution • how to present their evaluation in a relevant, clear, organised, structured and coherent format • how to use specialist terms correctly and appropriately • how to present a conclusion to the report • how to justify their conclusions based on the evidence provided 	<p>A451 Testing</p> <p>(p) describe syntax errors and logic errors which may occur while developing a program (q) understand and identify syntax and logic errors (r) select and justify test data for a program, stating the expected outcome of each test.</p> <p>A452 Practical activity</p> <p>(d) evaluate and modify these solutions in light of test results. (a) produce a full report covering all aspects of the investigation (b) present the information in a clear form which is understandable by a third party and which is easily navigatable (c) critically appraise the evidence that they have presented (d) test their own solution (e) present their evaluation in a relevant, clear, organised, structured and coherent format (f) use specialist terms correctly and appropriately (g) present a conclusion to the report (h) justify their conclusions based on the evidence provided.</p> <p>A453 Testing and evaluation</p> <p>(a) use a suitable test plan and data to test the function of the system (b) test the system against the success criteria (c) provide good evidence of test procedures (d) modify the system, if required, to meet success criteria where these are not met (e) evaluate the system against the success criteria to establish how successful, or otherwise, their implementation has been.</p>

Old spec that is not in the new one explicitly:**A451****Computer Systems:**

- (a) define a computer system
- (b) describe the importance of computer systems in the modern world
- (c) explain the need for reliability in computer systems
- (d) explain the need for adherence to suitable professional standards in the development, use and maintenance of computer systems

Memory

- (h) explain the need for ROM in a computer system
- (j) explain how the amount of RAM in a personal computer affects the performance of the computer
- (k) explain the need for virtual memory
- (l) describe cache memory
- (m) describe flash memory
- (n) discuss how changes in memory technologies are leading to innovative computer designs

Input Process Output

- (o) understand the need for input and output devices
- (p) describe suitable input devices for a wide range of computer controlled situations
- (q) describe suitable output devices for a wide range of computer controlled situations
- (r) discuss input and output devices for users with specific needs.

Software

- (a) explain the need for the following functions of an operating system: user interface, memory management, peripheral management, multi-tasking and security
- (c) discuss the relative merits of custom written, off the shelf, open source and proprietary software.

Instructions

- (p) explain how instructions are coded as bit patterns
- (q) explain how the computer distinguishes between instructions and data.

Databases

- (a) describe a database as a persistent organised store of data
- (b) explain the use of data handling software to create, maintain and interrogate a database.
- (c) describe how a DBMS allows the separation of data from applications and why this is desirable
- (d) describe the principal features of a DBMS and how they can be used to create customised data handling applications.
- (e) understand the relationship between entities and tables
- (f) understand the components of a relational database, such as tables, forms, queries, reports and modules
- (g) understand the use of logical operators in framing database queries
- (h) explain the use of key fields to connect tables and avoid data redundancy
- (i) describe methods of validating data as it is input.

Networks

- (a) explain the advantages of networking stand-alone computers into a local area network
- (c) explain the different roles of computers in a client-server and a peer-to-peer network
- (d) describe, using diagrams or otherwise, the ring, bus and star network topologies
- (h) describe and justify network policies such as acceptable use, disaster recovery, failover, back up, archiving.

The internet

- (i) describe the nature of the internet as a worldwide collection of computer networks
- (l) explain the importance of HTML and its derivatives as a standard for the creation of webpages
- (m) describe common file standards associated with the internet such as JPG, GIF, PDF, MP3, MPEG
- (n) explain the importance of compressing files that are transmitted via the internet

Control flow in imperative languages

- (g) understand and use sequence in an algorithm

Handling data in algorithms

- (k) use variables and constants
- (l) describe the data types integer, real, Boolean, character and string

A452

All in Comp 3

A453

All in Comp 3



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