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**GCSE Digital Technology**

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**Introduction**

The purpose of this Planning Framework is to support the teaching and learning of GCSE Digital Technology. The Planning Framework is based on specification content but should not be used as a replacement for the specification. It provides suggestions for a range of teaching and learning activities which provide opportunities for students to develop their:

* + - * Knowledge and understanding
      * Subject specific skills
      * The Cross-Curricular Skills
      * Thinking Skills and Personal Capabilities

The Planning Framework is not mandatory, prescriptive or exhaustive. Teachers are encouraged to adapt and develop it to best meet the needs of their students.

## Subject Skills Assessed through Digital Technology

The following skills are assessed in GCSE Digital Technology:

Teachers must assess the following skills through controlled assessment:

* investigating and analysing problems;
* designing effective solutions;
* developing solutions;
* testing and implementing solutions; and
* evaluating solutions.

There may also be external assessment of elements of all these skills.

**Supporting the Development of Statutory Key Stage 4 Cross-Curricular Skills and Thinking Skills and Personal Capabilities**

This specification builds on the learning experiences from Key Stage 3 as required for the statutory Northern Ireland Curriculum. It also offers opportunities for students to contribute to the aim and objectives of the Curriculum at Key Stage 4, and to continue to develop the Cross-Curricular Skills and the Thinking Skills and Personal Capabilities. The extent of the development of these skills and capabilities will be dependent on the teaching and learning methodology used.

**Cross-Curricular Skills at Key Stage 4**

**Communication**

Students should be able to:

* communicate meaning, feelings and viewpoints in a logical and coherent manner, for example discussing the ethical impact of software piracy such as purchasing a pirated video game;
* make oral and written summaries, reports and presentations, taking account of audience and purpose, for example creating a database report showing monthly sales figures grouped by product; and
* interpret, analyse and present information in oral, written and ICT formats, for example creating a website to advertise an organisation’s products.

**Using Mathematics**

Students should be able to:

* use mathematical language and notation with confidence, for example using mathematical and logical operators within a programme method;
* use mental computation to calculate, estimate and make predictions in a range of simulated and real-life contexts, for example evaluating the storage capacity of a range of storage devices;
* select and apply mathematical concepts and problem-solving strategies in a range of simulated and real-life contexts, for example using what-if analysis in a spreadsheet;
* interpret and analyse a wide range of mathematical data, for example inputting data into a spreadsheet containing formulae and absolute cell referencing to interpret the effect; and
* present mathematical data in a variety of formats which take account of audience and purpose, for example using a variety of graphical formats, such as pie charts and scatter graphs, in a spreadsheet to present results of a subject test.

**Using ICT**

Students should be able to make effective use of information and communications technology in a wide range of contexts to access, manage, select and present information, including mathematical information, for example interrogating a database by using complex queries to find a sorted list of all customers from a particular area who brought a product in the second half of the year.

**Thinking Skills and Personal Capabilities at Key Stage 4**

**Self-Management**

* plan work; for example creating a storyboard solution to a website design brief;
* set personal learning goals and targets to meet deadlines, for example learning the skills for each subsection of the controlled assessment task and allocating adequate time to complete each task within the overall time frame;
* monitor, review and evaluate their progress and improve their learning, for example refining and evaluating the design solution, following feedback from the end user and/or teacher; and
* effectively manage their time, for example ensuring they manage their time effectively within controlled assessment time limit.

**Working with Others**

Students should be able to:

* learn with and from others through co-operation, for example beta testing each other’s solutions; and
* listen actively to others and influence group thinking and decision-making,
* taking account of others’ opinions, for example holding a group discussion on ethical considerations relating to social media.

**Problem Solving**

Students should be able to:

* identify and analyse relationships and patterns, for example recognising repetition of coding structures;
* propose justified explanations, for example justifying a chosen approach to a software solution;
* reason, form opinions and justify their views, for example evaluating whether or not a solution has met user requirements;
* analyse critically and assess evidence to understand how information or evidence can be used to serve different purposes or agendas, for example
* explaining the principles of the Data Protection Act 1998 and their effect on individuals and organisations;
* analyse and evaluate multiple perspectives, for example using feedback from beta testing to evaluate a solution;
* weigh up option and justify decisions, for example analysing test results and considering alternative solutions; and
* apply and evaluate a range of approaches to solve problems in familiar and novel contexts, for example suggesting improvements to a developed solution.

Although not statutory at Key Stage 4 this specification also allows opportunities for further development of the Thinking Skills and Personal Capabilities of Managing Information and Creativity.

**Manage Information**

Saving and storing information, for example PowerPoint presentations produced.

**Creativity**

Design of group and individual resources, for example posters and presentations.

**Assessment for Learning**

Where reference is made to past papers throughout this Planning Framework, teachers will recognise opportunities for formative assessment activities.

**Key Stage 4 Statutory Skills and Personal Capabilities**

Communication Skills Comm – T&L (Talking & Listening) W (Writing) R (Reading)

Using Mathematics UM Working with Others WO

Using ICT UICT Self-Management SM

Problem Solving PS

**Key Features**

The Planning Framework:

* Includes suggestions for a range of teaching and learning activities which are aligned to the GCSE Construction and the Built Environment Unit 1: Introduction to the Built Environment specification content.
* Highlights opportunities for inquiry-based learning.
* Indicates opportunities to develop subject knowledge and understanding and specific skills
* Indicates opportunities to develop the Cross-Curricular Skills and Thinking Skills and Personal Capabilities.
* Provides relevant, interesting, motivating and enjoyable teaching and learning activities which will enhance the student’s learning experience.
* Suggests the time required to teach units/options
* Makes reference to supporting resources.

**Prior Learning:** There is no specific requirement for prior learning although it is envisaged that many candidates will have already gained relevant skills, knowledge and understanding throughout Key Stage 3. Some candidates may have completed or be completing other accredited courses before embarking on this GCSE award

**Background Reading:** All definitions of Digital Technology terminology should be taken from the *BCS Academy Glossary Working Party (2013), “BCS Glossary of Computing and ICT, 13th ed.”, Swindon, BCS*

**Unit 1**

**Digital Technology**

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| **Planning Framework for GCSE Digital Technology** | **Unit 1** | **Core Unit** |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data** | Students should be able to: |  |  |
| Representing data | * describe the difference between information and data; | * Using the resources below, students research the following: * Draw a table on the white board with various labels and numbers, identify whether a given valve is itself data or information; using spreadsheet software. * Produce examples of data/information without being given a source; * Interpret a given data source to yield information or examples of data; and * Formally define the meaning of the terms “data” and “information”. | Comm-R, W  PS |
| **Resources** | 1. FACT FILE – Digital Data: Representing Data 2. Definitions and examples: [www.diffen.com/difference/Data\_vs\_Information](http://www.diffen.com/difference/Data_vs_Information) 3. BCS Glossary p323 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Representing data (cont.) | * describe how data is stored in the following units: * bit; * nibble; * byte; * kilobyte; * megabyte; * gigabyte; and * terabyte; and | Using example of Binary 0 or 1, true or false, yes or no, understand that digital data is expressed in binary and that this is implemented in hardware  State the size of each unit in terms of bits (b) or bytes (B) using the correct notation and case, including when it is expressed in powers of 2  Identify equivalent values expressed in different units (e.g. ½B = 1 nibble and 2 nibbles = 1B) as a matching exercise  Convert the capacities of various contemporary devices (e.g. SSD/HDD) into a common unit in order to compare them  Choose an appropriate unit to use in a given situation (e.g. GB or TB for mass storage, KB for typed essays)  Calculate how many copies of a file with a fixed size (e.g. a digital photograph) would fit on to a storage device with a given capacity (e.g. a CD-ROM)  Develop a spreadsheet that enables you to see an equivalent value in other units | UM  PS  UM, PS  UICT |
| **Resources** | 1. FACT FILE – Digital Data: Representing Data 2. Notes on storage units: <http://techterms.com/help/data_storage_units_of_measurement> 3. Unit converter tool: [www.unitconversion.org/unit\_converter/data-storage.html](http://www.unitconversion.org/unit_converter/data-storage.html) 4. Task to identify largest/smallest capacity: [www.tes.com/teaching-resource/storage-capacity-starter-activity-largest-smallest-amount-ict-computing-ks3-to-gcse-11162022](http://www.tes.com/teaching-resource/storage-capacity-starter-activity-largest-smallest-amount-ict-computing-ks3-to-gcse-11162022) 5. BCS Glossary pp12 & 423-425 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Representing data (cont.) | * identify the following data types: * numeric (integer and real); * date/time; * character; and * string. | Explain the difference between an integer and a real number in denary  Explain that some real numbers (such as one third) cannot be stored precisely whilst others (such as one quarter) can  Argue why telephone numbers are stored as strings rather than numbers, whereas numbers to be used in calculations get stored numerically  Explore the range of date/time presentation formats available in a word processor or spreadsheet package, but understand that they are stored and managed as numbers by the underlying machine  Explain the difference between a character (1 character) and a string (0 or more characters stored together)  Choose whether string or character would be suitable in a given scenario  In pairs, choose a suitable data type for spreadsheet or database values in a given scenario  SEE ALSO “Unit 1: Database applications” which covers data types in detail | Comm-W  Comm-W, SM  WO, Comm-T&L    SM, UICT  Comm-W  PS, WO  PS, WO |

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| **Resources** | 1. FACT FILE – Digital Data: Representing Data 2. What is a data type? <http://techterms.com/definition/datatype> 3. Definitions of integers and real numbers: [www.eskimo.com/~scs/cclass/mathintro/sx1.html](http://www.eskimo.com/~scs/cclass/mathintro/sx1.html) 4. Video (1 min 45 sec) explaining “integer”: [www.youtube.com/watch?v=uk21BHjWR0I](http://www.youtube.com/watch?v=uk21BHjWR0I) 5. Venn diagrams for “real”, “integer” and other sets of numbers:   <https://d2gne97vdumgn3.cloudfront.net/api/file/KXtngwmzROmEtgDrYvtr>  <http://images.tutorvista.com/cms/images/113/real-numbers11.png>   1. Wrong data type crashing a program: [www.bbc.co.uk/education/guides/zghbgk7/revision/2](http://www.bbc.co.uk/education/guides/zghbgk7/revision/2) 2. Notes on characters and strings: [www.bbc.co.uk/education/guides/zc6s4wx/revision/4](http://www.bbc.co.uk/education/guides/zc6s4wx/revision/4) 3. BCS Glossary:   Numeric: pp334 & 338  Date/Character/String: p331 |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: | Students: |  |
| Representing images | * demonstrate understanding of how pixels are used in image representation; | * Research the meaning of the word “pixel” * Construct an image of a plant in 60 seconds in a spreadsheet, online tool or graphics package, then explain how this image could be encoded as a grid of numbers. [See Resource 1] * Understand the concept of colour depth by using conditional formatting in a spreadsheet to vary the colour of the cell depending on whether 0 or 1 and subsequently 00, 10, 01 or 11 is entered as the value, then extending this to 3 bits and arriving at a conclusion | Comm-R, W  UICT  UICT |
| **Resources** | 1. Draw in pixels: <http://pixelartmaker.com/> 2. BCS Glossary pp205 & 211 3. FACT FILE – Digital Data: Representing Images | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** |  |  |  |
| Representing images (cont.) | * demonstrate understanding of how image resolution affects file size; | Zoom in and out of a graphic using a graphics package to inspect it in an extreme close up view  In groups, research and define “resolution”. [See Resource 1]  Calculate the resolution of a screen given the number of pixels and the length across which that number was counted, distinguishing between ppi and ppcm as measures of resolution so that the right unit is used accordingly, and be aware that printers use dpi  Save various copies of a high-resolution photograph at decreasing resolutions using a graphics package and compare the exact file sizes | UICT  WO  UM  UICT, PS |
| **Resources** | 1. Explaining image resolution: [www.digital-slr-guide.com/define-megapixels.html](http://www.digital-slr-guide.com/define-megapixels.html) 2. BCS Glossary pp208-209 3. FACT FILE – Digital Data: Representing Images | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital Data (cont.)** |  |  |  |
| Representing images (cont.) | * describe how vector-based graphics and bitmap graphics are stored; | Without prior knowledge of vector graphics, write down all the information needed by a computer to display a circle on a screen (e.g. radius, centre coordinate, thickness, circumference colour, shading colour), then ask students to construct a circle using squared paper. Repeat the task for a rectangle and then an unusual shape such as a wave. Derive conclusions and link to how photographs are constructed from pixels and not deconstructed into shapes  Research how OCR software works and relate this to the concept of a bitmap  Look for and list examples of bitmap and vector graphics in the school environment  Construct a vector-based flowchart of how to do a household task using an online editor (e.g. Draw.io or Inkscape) | Comm-R, PS, SM  Comm-R, Comm-W, UICT  PS, Comm-W  UICT, SM |
| **Resources** | 1. General explanation video: [www.youtube.com/watch?v=fy9Pby0Gzsc](http://www.youtube.com/watch?v=fy9Pby0Gzsc) 2. Comprehensive notes: [www.prepressure.com/library/file-formats/bitmap-versus-vector](http://www.prepressure.com/library/file-formats/bitmap-versus-vector) 3. <http://vector-conversions.com/vectorizing/raster_vs_vector.html> 4. Draw vector flowchart shapes online:   [www.draw.io/](http://www.draw.io/) - Flowchart drawing tool; vector based  <https://inkscape.org/en/> - Vector art program   1. BCS Glossary pp38-40 2. FACT FILE – Digital Data: Representing Images | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital Data (cont.)** |  |  |  |
| Representing images (cont.) | * describe the difference between vector-based and bitmap graphics; and | Sort a list of properties into those attributed to bitmap graphics and those attributed to vector graphics  Upon seeing a graphic, students propose which category they believe it is and why  Prepare a 2-column list of advantages and disadvantages of bitmap versus vector graphics  For given scenarios, identify and justify why a bitmap or vector graphic would be most appropriate  Produce a slide where a bitmap enlarges when clicked | WO, Comm-T&L  Comm-T&L, PS  Comm-W  Comm-W, PS  UICT, PS, SM |
| **Resources** | 1. BCS Glossary pp38-40 2. FACT FILE – Digital Data: Representing Images | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital Data (cont.)** | Students should be able to: |  |  |
| Representing images (cont.) | * demonstrate understanding of how buffering and streaming are used to support the transfer of moving image files. | Video production activity:   1. Role play the buffering process in groups using jars of e.g. beads 2. Individually create a narrated, captioned video each using the footage made in groups to relate it back to moving image file transfer 3. Use a numbered list of the captions as a written summary of the process   Using a desktop publishing or multimedia authoring package, produce a storyline of how streaming works when watching a video  In groups, given a set of cards, place them into 4 categories:   * Benefits of downloading * Drawbacks of downloading * Benefits of streaming   Drawbacks of streaming | Comm-T&L, UICT, Comm-W  UICT, Comm-W  PS, WO |
| **Resources** | 1. Buffering:   [www.pcmag.com/encyclopedia/term/39024/buffering](http://www.pcmag.com/encyclopedia/term/39024/buffering)  <http://techterms.com/definition/buffer>  [www.bandwidthplace.com/what-is-buffering-a-simple-buffering-definition-article/](http://www.bandwidthplace.com/what-is-buffering-a-simple-buffering-definition-article/)  BCS Glossary pp372-373   1. Streaming:   <https://en.wikipedia.org/wiki/Streaming_media> (paragraph 1 only)   1. BCS Glossary pp38 & 57 2. FACT FILE – Digital Data: Representing Images | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital Data (cont.)** | Students should be able to: |  |  |
| Representing sound | * describe factors that affect sound quality, including: * sample rate; * bit depth; and * bit rate;   when recording sound; and | Draw a large diagram (on A3 paper) of a sound wave and visually illustrate the sampling process using straight lines set out at well-spaced regular intervals and measure samples as whole numbers only. Show a table underneath of the values of the first c. 12 samples taken. Plot these as a separate column chart to visualise the difference between the original wave and its digital interpretation  Explain that the sample rate is the number of samples each second, and that increasing the sample rate will improve sound quality, which can be visualised by taking samples at the midway points between the previous samples and thus sketching a column chart with c. 24 columns  Explain how increasing the bit depth will improve the sound quality by repeating all amplitude measurements using 2 decimal places, and conclude that this is effectively the resolution of each individual sample  Explain that bit rate = bit depth × sample rate, and conclude that this means that when either the bit depth or sample rate rise, so does the bit rate | Comm-W, UM  Comm-W, UM    Comm-W, UM    Comm-R, PS |
| **Resources** | 1. Sample rate notes:   [www.bbc.co.uk/education/guides/z7vc7ty/revision/2](http://www.bbc.co.uk/education/guides/z7vc7ty/revision/2)  [www.hardwaresecrets.com/how-analog-to-digital-converter-adc-works/2/](http://www.hardwaresecrets.com/how-analog-to-digital-converter-adc-works/2/)   1. Bit depth notes: [www.bbc.co.uk/education/guides/z7vc7ty/revision/3](http://www.bbc.co.uk/education/guides/z7vc7ty/revision/3) 2. Bit rate notes: www.bbc.co.uk/education/guides/z7vc7ty/revision/4 (includes notion of 2 channels) 3. BCS Glossary pp55-56 4. FACT FILE – Digital Data: Representing Sound | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Representing sound (cont.) | * explain the need for analogue-to-digital conversion in sound recording. | Research the meaning of “analogy”, “analogous” and “analogue” and surmise as to what it means in the context of computers and sound. Use the BBC Bitesize video to check the correct explanation ([www.bbc.co.uk/education/guides/z7vc7ty/revision/2](http://www.bbc.co.uk/education/guides/z7vc7ty/revision/2))  Identify the issue with storing sound on analogue media in the later section of the BBC Bitesize video ([www.bbc.co.uk/education/guides/z7vc7ty/revision/2](http://www.bbc.co.uk/education/guides/z7vc7ty/revision/2)) | Comm-R, PS  Comm-R, PS |
| **Resources** | 1. Notes and video: [www.bbc.co.uk/education/guides/z7vc7ty/revision/1](http://www.bbc.co.uk/education/guides/z7vc7ty/revision/1) 2. Notes: <http://courses.me.berkeley.edu/ME102B/Past_Proj/f03/Proj6/TMS320LF2407A_Documents/Intro-ADC.pdf> (first paragraph) 3. Notes: [www.bbc.co.uk/education/guides/zpfdwmn/revision/3](http://www.bbc.co.uk/education/guides/zpfdwmn/revision/3) 4. Detailed notes: [www.ramelectronics.net/analog-digital.aspx](http://www.ramelectronics.net/analog-digital.aspx) 5. BCS Glossary pp222-223 6. FACT FILE – Digital Data: Representing Sound | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital Data (cont.)** | Students should be able to: |  |  |
| Portability | * demonstrate understanding of data portability and the following file formats that support it: * jpeg, tiff, png, pict, gif; * txt, csv, rtf, pdf; * mp3, midi, wav, wma; and * mp4, mpeg, avi; | Construct a list of the given acronyms and abbreviations and their accurate expansions, focusing on singulars, plurals and spellings [See Resource 2]  Play a memory game where the acronyms and abbreviations are on cards and their expansions are on other cards and players turn 2 at a time to find their match  Starting with a definition of portability, explain how it is relevant to: images, word processed documents, audio files and video files [See Resource 3]  Explain how a file can be converted between given file types and what the implications would be  Convert a high-quality bitmap photograph into other file types in a graphics package and observe the visual differences, save options and file size changes  Choose appropriate file types for given scenarios from web authoring, domestic/hobbyist and high-end professional contexts where the needs of the user are specified | Comm-W  Comm-T&L, WO  Comm-W, PS  Comm-W  UICT, Comm-W, SM  PS, Comm-R, Comm-W |

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| --- | --- |
| **Resources** | 1. BCS Glossary:   Graphics pp36-37  Sound pp57-58  Video p36   1. Acronyms and meanings: [www.ict4u.net/software/file-types.php](http://www.ict4u.net/software/file-types.php) 2. Portability concept: [www.ict4u.net/software/data-portability.php](http://www.ict4u.net/software/data-portability.php) 3. Visualisation of the use of JPEG: [www.data-compression.com/image.shtml](http://www.data-compression.com/image.shtml) 4. Reasons for converting between video file types: [www.movavi.com/support/how-to/how-to-convert-video.html](http://www.movavi.com/support/how-to/how-to-convert-video.html) 5. FACT FILE – Digital Data: Portability |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Software | * describe the functions of system software, referring to: * allocating memory; * storage; and * processing time; | Label a stacked box diagram using given labels to show where system software sits in relation to the user, the hardware and the application software  Draw a tree diagram showing types of software and use it to explain the relationship between system software and application software  Research the names of some operating systems that are in use in a variety of contexts  Conduct this group activity to visualise the use of memory by different programs and files as they are opened and closed:   * The group takes on the responsibility of the system software * Have a sheet of squared paper per group and cut-outs of different sized pieces that need to be placed into the “memory” grid  1. A sequence of tasks is read aloud by the teacher, e.g. “The user runs MS Word”, so the group must place the block of memory onto the grid 2. Groups must decide how to cope when pieces don’t fit (cut the job into smaller blocks, move other jobs out etc.) 3. In conclusion, groups describe what happens, e.g. fragmentation, everything slowing down while the memory is organised | Comm-W  Comm-W  UICT, Comm-W  WO, Comm-T&L, PS |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** |  |  |  |
| Software (cont.) |  | Create an animation where a file is created, saved for the first time, further edited, saved again, closed, retrieved, edited, saved again and closed. The animation should emphasise what happens in RAM and the hard disk. Replay the animation and ask what would happen if the file got too large for the RAM or the hard disk to hold  From a list of key words, choose those which do and do not lead to reduced processing time, e.g. caching | UICT, SM  Comm-R, PS |
| **Resources** | 1. Diagram showing layers of software types: [www.webopedia.com/TERM/S/systems\_software.html](http://www.webopedia.com/TERM/S/systems_software.html) 2. Roles of different categories of system software: <http://whatis.techtarget.com/definition/system-software> 3. Memory management: <http://whatis.techtarget.com/definition/memory-management> 4. Memory management: [www.bbc.co.uk/education/guides/ztcdtfr/revision](http://www.bbc.co.uk/education/guides/ztcdtfr/revision) 5. Storage: [www.bbc.co.uk/education/guides/ztcdtfr/revision/6](http://www.bbc.co.uk/education/guides/ztcdtfr/revision/6) 6. Processing time: [www.bbc.co.uk/education/guides/ztcdtfr/revision/3](http://www.bbc.co.uk/education/guides/ztcdtfr/revision/3) 7. BCS Glossary pp8 & 355-365 8. FACT FILE – Software | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Software (cont.) | * describe the following modes of processing: * real-time; * batch processing; and * multi-user; | Using screenshots of GUIs and photographs of users engaged with computers, visually identify which mode of processing is in use in a given scenario  Match given definitions with the 3 processing modes  Produce a comparison table that outlines the benefits of the various processing modes and their disadvantages compared to other modes  Given a set of scenarios, state which processing mode would be best suited in each case and justify the decision  Draw a flowchart for the processing of utility bills using a flowchart drawing tool. Use it to carry out the batch processing of a small batch of gas bills given the previous transaction file and the new gas meter readings for each customer. Incorporate batch totals | Comm-R, PS  Comm-R, PS  Comm-W  Comm-R, Comm-W, PS  PS, UICT, UM |
| **Resources** | 1. Batch v Real-time: [www.reference.com/technology/real-time-processing-batch-processing-c826045d62c483ac](http://www.reference.com/technology/real-time-processing-batch-processing-c826045d62c483ac) 2. Examples of batch and real-time: [www.igcseict.info/theory/7\_2/modes/](http://www.igcseict.info/theory/7_2/modes/) 3. Multi-user: [www.quora.com/What-are-time-sharing-and-multiuser-operating-systems-and-what-are-some-examples](http://www.quora.com/What-are-time-sharing-and-multiuser-operating-systems-and-what-are-some-examples) 4. All 3 modes of processing: [www.tutorialspoint.com/operating\_system/os\_types.htm](http://www.tutorialspoint.com/operating_system/os_types.htm) 5. BCS Glossary: p16 6. FACT FILE – Software | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Software (cont.) | * describe the following tasks carried out by the utility applications: * disk defragmenting; * task scheduling; * backup; and * restoring data; | Create a series of screenshots at home showing where each of these utilities can be found  State the problems with a fragmented file store and what exactly disk defragmentation achieves. Sketch a diagram to illustrate the file store before and after defragmentation  Research and name tasks that are commonly scheduled by scheduling utilities  Explain the importance of backup for an individual and an organisation. Define the term backup. Explain how it could be done with or without a utility. State the benefits of using a utility to do it  Explain the importance of having a procedure for restoring data in the event of a disaster | UICT, SM  Comm-W  UICT, PS  Comm-R, SM  Comm-W |
| **Resources** | 1. Disk defragmenting: <http://threadwheel.com/disk-defragmenter/> 2. Task scheduling: [www.top5freeware.com/windows-task-scheduler](http://www.top5freeware.com/windows-task-scheduler) 3. Backup: <http://searchdatabackup.techtarget.com/definition/data-backup-software> 4. Backup: <https://en.wikipedia.org/wiki/Backup_software> 5. Restore data: [www.howtogeek.com/howto/1838/using-backup-and-restore-in-windows-7/](http://www.howtogeek.com/howto/1838/using-backup-and-restore-in-windows-7/) 6. BCS Glossary: pp81-82 & 343-344 7. FACT FILE – Software | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Software (cont.) | * describe the role of antivirus software and the importance of regular updates; and | Define the term virus  Explain how antivirus software works by creating an illustrative comic strip, animation or poster. Emphasise the impact on performance but the importance of it being on  Write a short story about two computers: one who got its antivirus updates and one that didn’t  SEE ALSO “Unit 1: Cyberspace, network security and data transfer” | Comm-R, Comm-W  Comm-W, SM  Comm-W |
|  | * distinguish between the following types of application software: * Productivity programs; and * End user programs. | Construct and complete a table with the 2 types of application software as headings and the following 2 rows:   * Explanation of the term * Examples | UICT, Comm-W |
| **Resources** | 1. Viruses explained: <https://en.wikipedia.org/wiki/Computer_virus> 2. Viruses explained: [www.bbc.co.uk/guides/zcmbgk7](http://www.bbc.co.uk/guides/zcmbgk7) 3. Anti-virus software: [www.howtogeek.com/125650/htg-explains-how-antivirus-software-works/](http://www.howtogeek.com/125650/htg-explains-how-antivirus-software-works/) 4. Why update anti-virus software: [www.computerhowtoguide.com/2012/05/why-update-antivirus-software-frequently.html](http://www.computerhowtoguide.com/2012/05/why-update-antivirus-software-frequently.html) 5. BCS Glossary: pp171-172 6. FACT FILE – Software | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Database applications | * demonstrate understanding of and explain basic database concepts such as: * table; * record; * field; * key field; * query; * form; * report; * macro; * relationship; and * importing data; | Looking at a table constructed in a database package, label the table, a record, a field and a key field. Looking at a page containing multiple tables, answer questions such as “Which table has more records than fields?” to develop fluency with the use of the vocabulary  For a given situation, produce a suitable field structure, e.g. how would you break down a standard Northern Irish domestic postal address into fields? How far would you break it down? If the property wasn’t known by a number but used a name instead, would this be a problem?  Present a formal definition of a key field. With reference to examples, select a suitable key field for the table  Using 2 tables, one containing a key field, show that the other table can be made to point to one record of the other table by using a foreign key, and that the foreign key values can occur more than once, unlike key fields. Show that this establishes a one-to-many relationship  Using a pre-fabricated .csv or spreadsheet file, perform importation of data into a database file. Note down what considerations are necessary during importation, e.g. data types and key fields | Comm-W  PS, Comm-W  Comm-W, PS  SM, PS, Comm-R  UICT, Comm-W |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** |  |  |  |
| Database applications (cont.) |  | Initially, show how one table’s data can be queried by performing suitable operations manually and comparing the results with those produced by an actual query. Perform sorting, searching for a unique value, searching for records conforming to one criterion and subsequently those conforming to two or more criteria. Showcase other querying techniques such as summation to show the power of queries. Progress to queries involving two related tables so that the relationship must be traversed and criteria could apply to either or both tables  SEE ALSO later in “Unit 1: Databases” for more on queries  Looking at a table, sketch a diagram of how a data entry form may look. Use a prescribed table to construct the form by following the design. Elicit what operations might be performed such as deletion, adding a new record and saving, and show how buttons can be introduced.  SEE ALSO “Unit 2: Designing solutions” to link in with form wireframes  Looking at a table, sketch a diagram of how a grouped report may look. Use a prescribed table to construct the report by following the design. Elicit what variants could have been produced, e.g. sorting, 2 levels of grouping and page layout changes  SEE ALSO “Unit 2: Designing solutions” to link in with report wireframes | UM, Comm-R, SM  Comm-W, PS, Comm-T&L, WO    Comm-W, PS, Comm-T&L, WO |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** |  |  |  |
| Database applications (cont.) |  | Looking at printouts of forms and reports, label them with the key features shown, e.g. action buttons on forms and grouping headings on reports. In both cases, be able to cross-reference the form/report to the fields of the original table, including the cross-referencing of the grouping headings  Demonstrate how functions can be incorporated into forms and reports to insert commonly used features such as dates and page numbering  Create a macro to run a report and send it to the default printer. Incorporate this on to a form as a button to see it in action. Create a more complex macro and adjust some settings. Conclude by considering what a general definition of a macro might be. Try constructing one in a word processor and in a spreadsheet to show their breadth of applications and that the generic definition applies beyond the database context  SEE ALSO “Unit 1: Spreadsheet applications” for the study of macros | Comm-R, SM, PS  PS, SM, UICT  PS, SM, UICT |
| **Resources** | 1. Relational databases overview: [www.bbc.co.uk/schools/gcsebitesize/ict/databases/2databasesrev2.shtml](http://www.bbc.co.uk/schools/gcsebitesize/ict/databases/2databasesrev2.shtml) 2. Macros: <https://support.office.com/en-gb/article/Introduction-to-macros-a39c2a26-e745-4957-8d06-89e0b435aac3> 3. Relationships (useful for diagrams and progressive explanations, but generally above GCSE level): <http://etutorials.org/SQL/Database+design+for+mere+mortals/Part+II+The+Design+Process/Chapter+10.+Table+Relationships/Types+of+Relationships/> 4. Import: [www.ip2location.com/how-to-import-csv-into-ms-access](http://www.ip2location.com/how-to-import-csv-into-ms-access) 5. BCS Glossary: pp90-103 6. FACT FILE – Database Applications 1 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Database applications (cont.) | * identify and use appropriate data types when creating a database structure; | Using a range of examples and counter-examples, discern between the numeric data types, focusing on distinguishing integers from real numbers, but also showing that there can be other categories of integer and other categories of real number, and that there can be settings applied such as the number of decimal places to which a real number will be rounded  For a set of numeric values, suggest which categories of number would be best for storing each one  Given a database design, students should write down why the data type was a better idea than a stated alternative  Explain the importance of storing values with leading zeros as text  Demonstrate that underlying the date format is a numeric representation, and as such, choosing Date/Time as a data type means that subsequently data can be validated with Boolean expressions and queried with Boolean and arithmetic operations, which would not be as straightforward to achieve were Text to be used as the data type  Explain the meaning of Boolean data and the different ways in which it can be represented | Comm-W, SM  UM, Comm-R  Comm-R, Comm-W, PS  Comm-W  UICT, SM, PS  Comm-W |
| **Resources** | 1. Data types: [www.bbc.co.uk/education/guides/zfd2fg8/revision/6](http://www.bbc.co.uk/education/guides/zfd2fg8/revision/6) 2. BCS Glossary: p330,331,338 3. FACT FILE – Database Applications 1 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Database applications (cont.) | * demonstrate understanding of the need for data validation | Hold a whole-class discussion where, using examples in particular contexts, students must explain what would happen if there was no validation applied. What further repercussions may follow?  Students prepare written responses to the question: Generally speaking…   * What is validation? * Why do we need it? | Comm-T&L  Comm-W |
| **Resources** | 1. BCS Glossary p75 2. FACT FILE – Database Applications 1 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Database applications (cont.) | * describe the following types of validation checks: * presence; * length; * type; * format; and * range; | Work in groups to come up with definitions for each term that do not use the word itself within the definition  Presence: Students decide whether a presence check would be appropriate for each field in a table  Length: Students set suitable lengths for text fields in a table  Type: Students list possible data types for a named field and then justify their final decision, e.g. using Text instead of Number for a phone number, or Boolean instead of Text for membership status  Format: Students interpret given input masks by stating sample data and expressing the mask in words. Students construct suitable input masks given the rules  Range: Students set suitable upper/lower boundaries on quantifiable fields and use comparison operators appropriately  SEE ALSO the querying tools (next section) where the comparison operators also feature | WO, Comm-T&L, Comm-W  PS  PS, UM  Comm-W  Comm-R, Comm-W, PS  Comm-W, UM |
| **Resources** | 1. BCS Glossary p75-76 2. FACT FILE – Database Applications 1 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** |  |  |  |
| Database applications (cont.) | * extract data from a database structure using simple query structures and using the following logical operators: * <; * >; * =; * <=; * >=; * AND; * OR; and * BETWEEN; | Match query expressions to their results  Practise writing out query expressions and writing sentences that have the same meaning as query expressions  Use a test case to determine whether BETWEEN includes or excludes the stated values, and therefore write the equivalent expression using other operators from the prescribed list | UM, PS, Comm-R  UM, Comm-W  UM, PS, SM |
| **Resources** | 1. MS Access support: <https://support.office.com/en-us/article/Examples-of-query-criteria-3197228c-8684-4552-ac03-aba746fb29d8> 2. BCS Glossary pp102-103 3. FACT FILE – Database Applications 2 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** |  |  |  |
| Database applications (cont.) | * demonstrate understanding of big data, referring to volume, velocity and variety; and | Students use a graphics package to create an interesting graphical presentation of the 3 Vs of big data | UICT, Comm-W |
|  | * demonstrate understanding of the need for data analytics to interpret big data. | Students build slideshows that deconstruct the ideas behind data analytics using a range of online resources and upload these to a common storage area for others to see  Students read through other slideshows and present an individually-written essay on data analytics with a minimum of 3 paragraphs:   * what it is * why it is needed * how it is achieved | WO, UICT, Comm-R, Comm-W |
| **Resources** | 1. Data mining: BCS Glossary p104 2. Big data (includes the 3 Vs): [www.sas.com/en\_us/insights/big-data/what-is-big-data.html](http://www.sas.com/en_us/insights/big-data/what-is-big-data.html) 3. Big data (includes the 3 Vs): [www.oracle.com/uk/big-data/index.html](http://www.oracle.com/uk/big-data/index.html) 4. Data analytics: [www.burrus.com/2015/10/why-your-company-needs-data-analytics/](http://www.burrus.com/2015/10/why-your-company-needs-data-analytics/) 5. Data analytics: [www.technologytransfer.eu/article/98/2012/1/What\_Is\_Big\_Data\_and\_Why\_Do\_We\_Need\_It\_.html](http://www.technologytransfer.eu/article/98/2012/1/What_Is_Big_Data_and_Why_Do_We_Need_It_.html) 6. FACT FILE – Database Applications 2 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Spreadsheet applications | * describe the following basic structures of spreadsheet software: * cells; * rows; * columns; | Label a sheet with an exemplar spreadsheet on it. | Comm-R, Comm-W |
| **Resources** | 1. Suitable spreadsheet screenshot image: [www.allthingsgym.com/wp-content/uploads/2013/09/Smolov-Squat-Program-Spreadsheet-Screenshot.png](http://www.allthingsgym.com/wp-content/uploads/2013/09/Smolov-Squat-Program-Spreadsheet-Screenshot.png) 2. FACT FILE – Spreadsheet Applications | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Spreadsheet applications (cont.) | * describe and use the following features of spreadsheet software: * data types; * conditional formatting; * validation; * templates; * importing data; * headers and footers; * entering text, numbers and formulae; * formatting cells, rows and columns; * creating and replicating formulae; * creating a simple template for others to use; | Work through practical spreadsheet tasks that can be followed up with paper-based questions (e.g. as homework tasks) to reinforce the vocabulary developed and the memorisation of concepts   * Initially, work from existing templates shared with the class so that everyone works on their own copy of the file towards defined goals * Later, progress to tasks where students need to identify the tool to be used and decide which settings to apply   Teach absolute addressing [Resource 2] and =IF() functions [Resource 3] separately and later combine them  Teach =VLOOKUP() [Resource 4] after teaching absolute addressing and later combine them [Resource 5]  Conclude by trying some teacher-set questions | UICT, UM, PS, SM, Comm-W  PS, UM  PS, UM  PS |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Spreadsheet applications (cont.) | * simple functions; * relative and absolute cell referencing; * IF statements; and * VLOOKUP; |  |  |
| **Resources** | 1. BCS Glossary pp83-88 2. [www.ablebits.com/office-addins-blog/2014/11/26/if-function-excel/](http://www.ablebits.com/office-addins-blog/2014/11/26/if-function-excel/) 3. VLOOKUP trouble shooter: <http://quadexcel.com/troubleshoot-vlookup-formula-the-common-mistakes/> 4. VLOOKUP combined with absolute addressing: [www.youtube.com/watch?v=CtHJrjW31cA](http://www.youtube.com/watch?v=CtHJrjW31cA) 5. FACT FILE – Spreadsheet Applications | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Spreadsheet applications (cont.) | * use a spreadsheet for data modelling; | Do a live demonstration of what-if analysis using goal seeking and let the class repeat it on their own computers  Students come up with a school-based scenario of their own | UICT  SM, PS, Comm-W, UICT |
| **Resources** | 1. Basics of modelling explained: [www.bbc.co.uk/education/guides/znjmn39/revision](http://www.bbc.co.uk/education/guides/znjmn39/revision) 2. BCS Glossary p106 3. FACT FILE – Spreadsheet Applications | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Spreadsheet applications (cont.) | * create, label and format charts; | Given a spreadsheet and a chart, students should identify which cells were used to produce the chart, giving due regard to any legends/axes values  Chart formatting options should be explored for basic column and pie charts in the first instance, and later applied to other types of chart.  Define what is meant by a macro  Work through a variety of tutorials to illustrate how they are constructed, named and executed | Comm-R  UICT  Comm-W  UICT |
|  | * select areas of a spreadsheet for printing; and |
|  | * create simple macros. |
| **Resources** | 1. Chart video: [www.youtube.com/watch?v=o2Dvhi8wcF0](http://www.youtube.com/watch?v=o2Dvhi8wcF0) 2. Set a print area: <https://support.office.com/en-gb/article/Set-a-print-area-on-a-worksheet-27048af8-a321-416d-ba1b-e99ae2182a7e> 3. Build basic macros: [www.excel-easy.com/vba/create-a-macro.html](http://www.excel-easy.com/vba/create-a-macro.html) 4. FACT FILE – Spreadsheet Applications | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Computer Hardware | * explain the purpose of the central processing unit (CPU); | Practise constructing written explanations of the purpose of the CPU  Provide students with an unlabelled diagram of the CPU and ask them to identify the components  Complete a “true or false” activity to determine what the CPU does and does not do | Comm-W  PS  Comm-R, PS |
|  | * describe the role of the following components of the CPU: * the arithmetic logic unit (ALU); * the control unit; and * the immediate access store; | Create interactive presentations where clicking the mouse on the CPU component causes a text box and/or audio voiceover to explain what that component does | UICT, PS |
| **Resources** | 1. BCS Glossary pp366-373 2. Overview of components of the CPU: [www.bbc.co.uk/education/guides/zws8d2p/revision](http://www.bbc.co.uk/education/guides/zws8d2p/revision) 3. Animation of cycle (note the title is in the wrong order): [www.youtube.com/watch?v=04UGopESS6A](http://www.youtube.com/watch?v=04UGopESS6A) 4. FACT FILE – Computer Hardware 1 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Computer Hardware (cont.) | * describe the role played by the following in the fetch-execute cycle: * program counter; * memory address register (MAR); * memory data register (MDR); * instruction address register (IAR); and * ALU; | Conduct a live demonstration of how data values and instructions are retrieved from memory and processed by working in large groups and taking on a role each. Using paper or hand-held mini whiteboards, show step-by-step how the values change upon each tick of the clock | PS, WO, Comm-T&L |
|  | * describe the impact on CPU performance of: * clock speed; * cache size; and * number of cores; | Look at computer advertisements and try to determine which computer offers the best value for money in terms of these 3 criteria alone  Present the meaning and impact of each of these 3 in a summary poster | PS, Comm-R, W |
| **Resources** | 1. BCS Glossary pp366-373 2. Overview of components of the CPU: [www.bbc.co.uk/education/guides/zws8d2p/revision](http://www.bbc.co.uk/education/guides/zws8d2p/revision) 3. Animation of cycle (note the title is in the wrong order): [www.youtube.com/watch?v=04UGopESS6A](http://www.youtube.com/watch?v=04UGopESS6A) 4. FACT FILE – Computer Hardware 1 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Computer Hardware (cont.) | * describe the characteristics, typical uses, advantages and disadvantages of the following input, output and storage devices: * microphone; * mouse; * graphics digitiser; * touch screens; * speakers; * printers (laser and 3D); * hard disc drive (HDD); * high definition (HD) storage media; and * solid state storage devices; and | All students should individually create a landscape table of devices where the name and an image of the device get placed in the first column, and the remaining columns are:   * Technical features * How it works * Uses * Benefits * Drawbacks   To populate the table, the class should choose a device each and then print off their table. They can then do an each-one-teach-one approach to sharing their research with others by e.g. sharing it in a network drive and presenting their work to the class. All students are personally responsible for collating their peers’ work into their notes  Teachers can supplement what has been researched with fact files, textbooks and past paper mark schemes | Comm-T&L, Comm-W, WO, SM |
| **Resources** | 1. BCS Glossary:  * Microphone p55 * Mouse p189 * Graphics digitiser & Touch screen p190 * Printer p204-206 & 212-218 * HDD pp195-198 * HD storage pp45-46 * SSD p198  1. FACT FILE – Computer Hardware 2 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Computer Hardware (cont.) | * explain the purpose of: * RAM; * ROM; and * Cache. | Students work in groups of 3. Each group member takes responsibility for studying one of these memory types and feeding back to the group in this order: ROM, RAM, cache  Students should look at contemporary computer advertisements and identify typical sizes of each of the 3 types of memory | Comm-R, Comm-T&L, WO, SM  Comm-R, UM |
| **Resources** | 1. Cache: [www.bbc.co.uk/education/guides/zmb9mp3/revision/3](http://www.bbc.co.uk/education/guides/zmb9mp3/revision/3) 2. BCS Glossary: pp193-194 & 201-202 3. FACT FILE – Computer Hardware 2 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Network technologies | * describe the main features of a: * Local area network (LAN); and * Wide area network (WAN); | Given a list of network features, students sort them into those characterising LANs and those characterising WANs [Resources 1-2] | WO, PS |
|  | * describe the difference between: * the World Wide Web; * the Internet of Things; and * intranets; | Students work in groups of 3. Each group member takes responsibility for studying one of these topics and feeding back to the group. [Resource 3]  Students read sample past paper responses to the question “What is an intranet?” and award marks to the answer based on a standard mark scheme | WO, Comm-T&L  Comm-R |
| **Resources** | 1. World Wide Web: [www.bbc.co.uk/guides/z2nbgk7](http://www.bbc.co.uk/guides/z2nbgk7) 2. Internet of Things: [www.theguardian.com/technology/2015/may/06/what-is-the-internet-of-things-google](http://www.theguardian.com/technology/2015/may/06/what-is-the-internet-of-things-google) 3. FACT FILE – Network Technologies | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Network technologies (cont.) | * describe and evaluate the effectiveness of the following network communications technologies: * Wi-Fi; * Bluetooth; * optical fibre; and * mobile communication technology (4G and 5G); | Students build slideshow presentations on each of these topics using these headings:   * Title slide (1 slide) * What is it? (1-2 slides) * How does it work? (2 slides) * What is it used for? (1-2 slides) * How well does it work? (2 slides) * How could it be improved? (1-2 slides)   These slideshows should then be set to run autonomously using timings. As an extension exercise, students could embed MP3 voiceovers of themselves recorded reading out the text  Given a set of scenarios, students should identify which one or more of the given technologies would be suitable and justify it | UICT, Comm-W  Comm-R, PS |
| **Resources** | 1. Fibre optic: www.bbc.co.uk/schools/gcsebitesize/science/edexcel\_pre\_2011/waves/sendinginformationrev1.shtml 2. 4G and 5G:   [www.bbc.co.uk/newsbeat/article/38313919/what-2g-3g-4g-and-5g-actually-means](http://www.bbc.co.uk/newsbeat/article/38313919/what-2g-3g-4g-and-5g-actually-means)  [www.bbc.co.uk/education/guides/zp9jpv4/revision/4](http://www.bbc.co.uk/education/guides/zp9jpv4/revision/4)  [www.trustedreviews.com/opinions/what-is-5g-a-rough-guide-to-the-next-generation-of-mobile-networks](http://www.trustedreviews.com/opinions/what-is-5g-a-rough-guide-to-the-next-generation-of-mobile-networks)  [www.belpercomputing.com/year-11/year-11-edexcel-gcse-ict/topic-1-personal-digital-devices/gsm-mobile-networks-roaming-and-using-phones-abroad/](http://www.belpercomputing.com/year-11/year-11-edexcel-gcse-ict/topic-1-personal-digital-devices/gsm-mobile-networks-roaming-and-using-phones-abroad/)   1. FACT FILE – Network Technologies | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Network technologies (cont.) | * describe the function of the following network resources: * network interface card; * network cables; * switch; and * router; | In building a digital set of notes on these, students should use 2 columns: one with the name and image of the chosen technology, and one with a description of how it is used  Students should be able to look at a network diagram and be able to identify where these components can be found | UICT, Comm-W  Comm-R, PS |
| **Resources** | Overview of all 4 resources: [www.igcseict.info/theory/4/hware/](http://www.igcseict.info/theory/4/hware/)  NIC:   * [www.bbc.co.uk/education/guides/zh4whyc/revision/6](http://www.bbc.co.uk/education/guides/zh4whyc/revision/6)   Network cables:   * Coaxial: <http://teach-ict.com/glossary/C/coaxial.htm> * Fibre optic (also covered in previous section): [www.bbc.co.uk/education/guides/zp9jpv4/revision/3](http://www.bbc.co.uk/education/guides/zp9jpv4/revision/3)   Switch:   * [www.bbc.co.uk/education/guides/zh4whyc/revision/5](http://www.bbc.co.uk/education/guides/zh4whyc/revision/5)   Router:  FACT FILE – Network Technologies | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital Data (cont.)** | Students should be able to: |  |  |
| Network technologies (cont.) | * describe the following network topologies: * bus; * star; and * ring; and | Students build notes (with diagrams) on each of these topologies using diagrams and these headings:   * The physical cabling * How data is transmitted * How a node is added * The impact of node failure * The impact of cable failure   ...taking care to cover all possibilities, e.g. different types of cable in a bus network and different types of node in a star network | Comm – R, W  SM |
|  | * describe the advantages and disadvantages of using a network in an organisation. | Teachers can present this is a sorting exercise where the sentences are broken in half, so students firstly have to rejoin the sentence fragments before categorising them as advantageous or not | PS |
| **Resources** | 1. FACT FILE – Network Technologies 2. BCS Glossary pp132-136 3. Bus: [www.bbc.co.uk/schools/gcsebitesize/ict/datacomm/2networksrev4.shtml](http://www.bbc.co.uk/schools/gcsebitesize/ict/datacomm/2networksrev4.shtml) 4. Ring: [www.bbc.co.uk/schools/gcsebitesize/ict/datacomm/2networksrev5.shtml](http://www.bbc.co.uk/schools/gcsebitesize/ict/datacomm/2networksrev5.shtml) 5. Star: [www.bbc.co.uk/schools/gcsebitesize/ict/datacomm/2networksrev6.shtml](http://www.bbc.co.uk/schools/gcsebitesize/ict/datacomm/2networksrev6.shtml) 6. Advantages and disadvantages of networks: [www.bbc.co.uk/schools/gcsebitesize/ict/datacomm/2networksrev2.shtml](http://www.bbc.co.uk/schools/gcsebitesize/ict/datacomm/2networksrev2.shtml) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Cyberspace, network security and data transfer | * define the term cybercrime and give examples of threats to cybersecurity, including: * hacking; * pornography; * cyber stalking; * data theft; * denial of service; * digital forgery; * cyber defamation; * spamming; and * phishing; | Construct a definition of cybercrime  Given a short description of a scenario, identify which of these threats is being described  Describe the negative impact upon users of computer technology of each of the threats listed  Individual task: Write a short story where one of these cybersecurity threats is the central plot and a serious issue arises for the main character. Explain what they do to resolve it  Group task: Each group takes 1 threat and devises a scenario. They discuss with the rest of the class how it may be resolved | Comm-W  Comm-R  Comm-W, WO  Comm-R, PS  Comm-T&L, PS |
| **Resources** | 1. Hacking: [www.hak5.org](http://www.hak5.org) 2. Pornography: [www.freshbusinessthinking.com/porn-still-tops-cyber-security-risks-taken-by-workers/](http://www.freshbusinessthinking.com/porn-still-tops-cyber-security-risks-taken-by-workers/) 3. Cyberstalking: <https://uk.norton.com/cyberstalking/article> 4. Data theft: <https://usa.kaspersky.com/internet-security-center/threats/data-theft#.WH4t0k1F0dU> 5. Denial of service attack case study: <https://en.wikipedia.org/wiki/October_2016_Dyn_cyberattack> 6. Digital forgery: [www.strathclydeforensics.co.uk/digital-forgery.html](http://www.strathclydeforensics.co.uk/digital-forgery.html) 7. Cyber defamation: <https://wikispaces.psu.edu/display/IST432TEAM4/Cyber+and+Online+Defamation> (first 4 paragraphs) 8. Spamming: [www.webopedia.com/TERM/S/spam.html](http://www.webopedia.com/TERM/S/spam.html) 9. Phishing: [www.anti-abuse.org/phishing-general-information/](http://www.anti-abuse.org/phishing-general-information/) 10. FACT FILE – Cyberspace, Network Security and Data Transfer | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Cyberspace, network security and data transfer (cont.) | * define the term malware and describe the following forms of malware: * virus; * Trojan horse; * worm; * key logger; and * spyware; | Present a definition of a virus  Draw a mind map summarising the types of malware and their key features  Complete CCEA past paper questions on viruses from GCSE and AS-Level papers  Match a short description to each of the 5 key terms | Comm-W  Comm-W, SM  Comm-W  Comm-R, PS |
| **Resources** | 1. Virus: CCEA GCSE ICT Past Paper Friday 1 June 2012, Question 2a-d, Page 7 2. Trojan horse: <http://searchsecurity.techtarget.com/definition/Trojan-horse> 3. Worm: CCEA AS ICT Past Paper Tuesday 29 May 2012, Question 3a, Page 7 4. Key logger:   <https://securingtomorrow.mcafee.com/consumer/family-safety/what-is-a-keylogger/>  [www.howtogeek.com/180615/keyloggers-explained-what-you-need-to-know/](http://www.howtogeek.com/180615/keyloggers-explained-what-you-need-to-know/)   1. Spyware: [www.bbc.co.uk/webwise/guides/about-spyware](http://www.bbc.co.uk/webwise/guides/about-spyware)   FACT FILE – Cyberspace, Network Security and Data Transfer | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Cyberspace, network security and data transfer (cont.) | * explain how networks and data can be protected using: * encryption; * passwords; * level of access; * backup; and * firewalls; | Synthesise some CCEA past paper mark schemes from GCSE and A-Level ICT papers and the current CCEA fact file into a slide show that fully describes the:   * meaning * technical features * usage/implementation   ...of one of these security methods. Present this to the class in small groups so that there is at least one presentation on each keyword, but ideally there will be two | Comm-T&L, WO, Comm-W, UICT |
| **Resources** | 1. BCS Glossary:   Encryption pp168-170  Passwords and levels of access pp167-168  Backup pp81-82  Firewall pp165-166   1. FACT FILE – Cyberspace, Network Security and Data Transfer | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Cyberspace, network security and data transfer (cont.) | * describe the role of a protocol in data transfer; and | By exploring the different factors affecting the choice of protocol, explain the different facets of a protocol  Look briefly at the TCP/IP stack as a case study of protocol design and implementation | Comm-R  Comm-R |
|  | * describe the purpose of the following protocols: * File Transfer Protocol (FTP); * Hypertext Transfer Protocol (HTTP); and * Hypertext Transfer Protocol Secure (HTTPS). | Working in groups of 3 on an each-one teach-one basis, gather notes and diagrams to explain the key technical features of each protocol and share these with one another verbally and digitally. Each individual can use the video resources [see Resources below] to learn quickly, particularly if given specific comprehension questions to answer at certain pause points in the video | Comm-W, WO, UICT |
| **Resources** | 1. FTP: [www.youtube.com/watch?v=dtTJgc6Vroo](http://www.youtube.com/watch?v=dtTJgc6Vroo) 2. HTTP: [www.youtube.com/watch?v=SzSXHv8RKdM](http://www.youtube.com/watch?v=SzSXHv8RKdM) 3. SSL: [www.youtube.com/watch?v=SJJmoDZ3il8](http://www.youtube.com/watch?v=SJJmoDZ3il8) 4. HTTPS: [www.youtube.com/watch?v=JCvPnwpWVUQ](http://www.youtube.com/watch?v=JCvPnwpWVUQ) 5. BCS Glossary: FTP p124 6. FACT FILE – Cyberspace, Network Security and Data Transfer | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Digital Data (cont.)** | Students should be able to: |  |  |
| Cloud technology: Implementation and application, security and impact on local systems | * define the term cloud computing; | Summarise the paragraph on cloud computing from the BCS Glossary | Comm-R, Comm-W |
| * describe the advantages and disadvantages of cloud computing to an organisation; and | Using a graphics package, construct a printable composite image of found images and key words to visualise the various services provided via cloud computing | Comm-W, UICT |
| * describe the impact of cloud computing on: * gaming; * file storage; and * file sharing (including collaborative tools). | Research gaming on demand and the changes in contemporary games technology and use a collaborative document writing tool to construct a summary of findings (best done in small subgroups)  Research prices of hosting files online  Have a whole-class debate about whether or not all data should be held on cloud storage and whether file sharing rules should be relaxed or tightened | UICT, Comm-W  UICT  WO, Comm-T&L, PS |
| **Resources** | 1. BCS Glossary: p123 2. Collaborative writing tool: <http://collabedit.com> (set the language to Plain Text if it does not do so automatically) 3. FACT FILE – Cloud Technology | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Ethical, legal and environmental impact of digital technology on wider society** | Students should be able to: |  |  |
| Legislation | * demonstrate knowledge and understanding of: * the Consumer Contracts (Information, Cancellation and Additional Charges) Regulations 2013; * the Copyright, Designs and Patents Act 1988; * the Data Protection Act 1998; and * the Computer Misuse Act 1990; | Find and download copies of each set of regulations/act. Skim read it to get a flavour of how legal documents are written  Identify the key principles of each of the 4 named regulations/acts  State exemptions to any of the regulations/acts  Through group discussions, identify the groups of people who need to be aware of the 4 named regulations/acts | UICT, Comm-R  Comm-R, Comm-W  Comm-W  Comm-T&L, WO, PS |
| **Resources** | 1. Consumer Contracts Regulations: [www.legislation.gov.uk/uksi/2013/3134/contents/made](http://www.legislation.gov.uk/uksi/2013/3134/contents/made) 2. Copyright, Designs and Patents Act: [www.legislation.gov.uk/ukpga/1988/48/contents](http://www.legislation.gov.uk/ukpga/1988/48/contents) 3. Data Protection Act: [www.legislation.gov.uk/ukpga/1998/29/contents](http://www.legislation.gov.uk/ukpga/1998/29/contents) 4. Computer Misuse Act: [www.legislation.gov.uk/ukpga/1990/18/contents](http://www.legislation.gov.uk/ukpga/1990/18/contents) 5. FACT FILE – Legislation | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Ethical, legal and environmental impact of digital technology on wider society (cont.)** | Students should be able to: |  |  |
| Legislation (cont.) | * identify typical breaches of the Copyright, Designs and Patents Act 1988, including software piracy and software licensing infringements; | Define the term piracy  Given a set of scenarios, identify in writing which principle or principles of the CDPA has been breached. Verbally debate what a suitable sanction/punishment would be in each case | Comm-W  Comm-R, Comm-W, Comm-T&L, PS |
| **Resources** | 1. Copyright, Designs and Patents Act: <http://www.legislation.gov.uk/ukpga/1988/48/contents> 2. Definition of piracy: [www.computerhope.com/jargon/s/softpira.htm](http://www.computerhope.com/jargon/s/softpira.htm) 3. Other information sources: 4. [www.sqa.org.uk/e-learning/ProfIssues02CD/page\_13.htm](http://www.sqa.org.uk/e-learning/ProfIssues02CD/page_13.htm) 5. [www.bbc.co.uk/schools/gcsebitesize/ict/legal/2copyrightrev1.shtml](http://www.bbc.co.uk/schools/gcsebitesize/ict/legal/2copyrightrev1.shtml) 6. <http://literacy.kent.edu/Oasis/Pubs/techtalk6-1.pdf> 7. FACT FILE – Legislation | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Ethical, legal and environmental impact of digital technology on wider society (cont.)** | Students should be able to: |  |  |
| Legislation (cont.) | * demonstrate and apply knowledge and understanding of: * the eight principles of the Data Protection Act 1998; and * the rights of the data subject and the responsibilities of the data controller and Information Commissioner in ensuring the Data Protection Act 1998 is enforced; | Construct a digital dictionary of meanings of the following terms in the context of the DPA: data subject, data user, data controller, Information Commissioner, ICO  Formulate a mnemonic/acrostic to help remember the 8 key principles of the Act by firstly condensing each principle down to 1 word  Summarise the DPA in a mind map  Complete a crossword built from the various key words associated with the principles, personnel, rights/responsibilities and exemptions from the DPA | UICT, Comm-W  WO, PS, Comm-W  Comm-W, SM  PS, Comm-W |
| **Resources** | 1. Data Protection Act: [www.legislation.gov.uk/ukpga/1998/29/contents](http://www.legislation.gov.uk/ukpga/1998/29/contents) 2. BCS Glossary pp160-163 3. FACT FILE – Legislation | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Ethical, legal and environmental impact of digital technology on wider society (cont.)** | Students should be able to: |  |  |
| Legislation (cont.) | * describe the terms: * hacker; * virus; and * spyware;   …and how these relate to the Computer Misuse Act 1990. | Elicit clear definitions of each of the terms  Construct scenarios where each is involved in violating the CMA | Comm-T&L, WO  Comm-W, WO, PS |
| **Resources** | 1. Computer Misuse Act: [www.legislation.gov.uk/ukpga/1990/18/contents](http://www.legislation.gov.uk/ukpga/1990/18/contents) 2. Virus: CCEA GCSE ICT Past Paper Wednesday 18 May 2016, Q1d Page 3 3. Spyware: [www.bbc.co.uk/webwise/guides/about-spyware](http://www.bbc.co.uk/webwise/guides/about-spyware) 4. BCS Glossary: pp164-172 (includes law and threats in detail); p128 deals with spyware 5. FACT FILE – Legislation | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Ethical, legal and environmental impact of digital technology on wider society (cont.)**  Moral and ethical considerations | Students should be able to:   * describe the ethical impact of technology on society, referring to the following: * internet misuse; * access to personal information; * social media misuse * the implications of GPS (Global Positioning System) and tracking; and * concerns about the security of personal data. | Internet misuse: Place large pieces of paper throughout the room labelled with headings such as:   * What sort of things do people share on the Internet? * Where does your data live? Do you need to know this? * Who can see your data and how? Is this OK? * How can data end up in the wrong hands?   After students make written contributions and draw arrows from other people’s contributions to respond to them, the pages are discussed one at a time with the whole class. Follow this with further questioning about how people and companies misuse the Internet’s resources  Access to personal information: Do a standing debate where students form a continuum from YES to MAYBE to NO across the room in response to questions such as:   * Should social networking sites ban/restrict young users? * Should schools allow you to see all the data they hold about you? * Should parents have full control over their child’s data?   Social media misuse: Look at case studies of individuals who have been defamatory on social media and what happens to them. Rank them in order of perceived severity of their offence. Pair up and explain the justification to your partner | WO, Comm-T&L, Comm-W  Comm-T&L  Comm-T&L, WO  Comm-R, WO, Comm-T&L, PS |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Ethical, legal and environmental impact of digital technology on wider society (cont.)**  Moral and ethical considerations (cont.) |  | Tracking:   * Write down all the places you feel you have been tracked recently * What are the benefits to consumers of tracking (e.g. automated location tagging of photographs taken on a mobile phone)? * What are the issues (e.g. stalking behaviour)? * Build a tutorial for your mobile phone’s settings to reduce tracking data being sent   Security of personal data: Examine website news links discussing high-profile hacking cases. Explore in writing (after a whole-class discussion):   * What can the IT industry learn from this case? * What can consumers learn from this case? Should their behaviour change? | Comm-W, UICT    UICT, Comm-W, PS |
|  |  |  |  |
| **Resources** | 1. FACT FILE – Moral and Ethical Considerations 2. BCS Glossary: pp128-129 andpp160-174 3. [www.quora.com/What-are-the-uses-and-misuses-of-the-Internet](http://www.quora.com/What-are-the-uses-and-misuses-of-the-Internet) 4. <http://socialmedia.umich.edu/blog/hacked/> | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Ethical, legal and environmental impact of digital technology on wider society (cont.)**  Changes in employment opportunities, skills requirements and work practices | Students should be able to:   * describe the impact of digital technology on employment, including: * increased job opportunities in the digital technology and computing sector; * job displacement; * changes in work patterns; and * the need for upskilling | Quick warm-up activity: Go online and look for jobs in Northern Ireland in the ICT sector. What are the job titles? Who are the employers?  Whole-class discussion: What jobs are newer to society? Which jobs are being replaced by technological developments? What is the impact on employees, customers and society in general of these new trends?  Define job displacement  Hold a forum discussion on the school VLE where questions are argued throughout the week and opinions are expressed  Complete CCEA past papers from GCSE, AS and A2 on the themes of changing work patterns and teleworking | UICT, Comm-R  Comm-T&L, WO  Comm-W, PS  UICT, Comm-W, Comm-R, Comm-T&L  Comm-W |
|  |  |  |  |
| **Resources** | 1. FACT FILE – Changes in Employment Opportunities, Skills Requirements and Work Practices 2. BCS Glossary p126 (Teleworking) 3. Changes in work patterns (Teleworking): CCEA GCSE ICT Past Paper Thursday 6 June 2013, Question 3c, Pages 10-11 | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Ethical, legal and environmental impact of digital technology on wider society (cont.)**  Health and safety | Students should be able to:   * demonstrate an understanding of digital technology-related health and safety issues, including * repetitive strain injury (RSI); * back strain; and * eye strain; and | Label a diagram of a poor-postured ICT worker who is susceptible to developing the named conditions  Explain the conditions under the headings:   * Causes * Preventative measures * What an employer has to do by law | Comm-W  Comm-W, PS |
|  | * identify the measures that both the employee and employer should take to promote good health and safety practice in the workplace. | Produce safety advisory bookmarks that can be distributed to employees and print a set of them and distribute them to staff/parents | UICT |
|  |  |  |  |
| **Resources** | 1. Employers’ responsibilities: [www.bbc.co.uk/education/guides/zkyg87h/revision](http://www.bbc.co.uk/education/guides/zkyg87h/revision) 2. Diagram of seated ICT user: [www.bbc.co.uk/education/guides/zkyg87h/revision/3](http://www.bbc.co.uk/education/guides/zkyg87h/revision/3) 3. FACT FILE – Health and Safety | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Ethical, legal and environmental impact of digital technology on wider society (cont.)**  Digital applications | Students should be able to:   * describe the main features of: * gaming applications; * simulations\*; and * mobile phone applications;   ...and how they can be used to support the following:   * education and training; * social interactions\*; and * work practices; and   (\* *NB: simulations in terms of social interactions can be skipped*) | To investigate FEATURES, construct mind maps in digital form using textbooks, fact files and other found assets, augmented with online research to fill gaps  To look at the idea of SUPPORT, on A3 paper, construct a 3x3 grid and put the headings:   * gaming applications * simulations * mobile phone applications   …along the top and the context headings:   * education and training * social interactions * work practices | UICT, Comm-W  Comm-W, WO, Comm-T&L |
|  | Tip*: Simple, generic examples will suffice. E.g. Calendar, video conferencing, social media and file sharing apps can impact upon work practices. Avoid references to lesser-known or paid-for apps as far as possible* | …down the left, and populate all relevant boxes with comments on how the two intersect. (*NB: The central cell will be the intersection of simulations and social interactions which can be left blank*). Walk around the room discussing this with others and gathering bullet-pointed ideas. Students should give examples of how each application area can be used appropriately in each context |  |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Ethical, legal and environmental impact of digital technology on wider society (cont.)** |  |  |  |
| Digital applications (cont.) |  | The advantages and disadvantages of each digital application within each relevant scenario area should be listed, i.e. revisit each of the 8 cells of the grid and identify what the merits and drawbacks of that technology would be in that context | SM |
| **Resources** | FACT FILE – Digital Applications  Computer games: CCEA ICT for GCSE: Chapter 7, Hodder Education, S Matthewson, G Lynch & M Debbadi  Computer games: [www.bbc.co.uk/guides/zw96tfr](http://www.bbc.co.uk/guides/zw96tfr)  Computer games and education: <https://badgeville.com/wiki/education>  Computer games and social interaction: [www.raisesmartkid.com/3-to-6-years-old/4-articles/34-the-good-and-bad-effects-of-video-games](http://www.raisesmartkid.com/3-to-6-years-old/4-articles/34-the-good-and-bad-effects-of-video-games)  Simulations: [www.bbc.co.uk/education/guides/zvxp34j/revision](http://www.bbc.co.uk/education/guides/zvxp34j/revision)  Simulations: [www.ictlounge.com/html/modelling\_applications.htm](http://www.ictlounge.com/html/modelling_applications.htm)  Mobile phones in the workplace: [www.clicksoftware.com/blog/mobile-apps-in-the-workforce-overcoming-challenges-to-reap-the-benefits-of-a-fully-mobile-workforce/](http://www.clicksoftware.com/blog/mobile-apps-in-the-workforce-overcoming-challenges-to-reap-the-benefits-of-a-fully-mobile-workforce/) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Ethical, legal and environmental impact of digital technology on wider society (cont.)**  Digital applications (cont.) | Students should be able to:   * evaluate the impact of the following digital applications on our everyday lives: * online banking; * online training; and * e-commerce. | Approach this as an essay writing task with a research element where a student chooses one of the 3 topics  Provide planning guides where students identify factual content starting with key points about what technology is involved in the named online service and also what people do when they engage with it  Look online at the broad picture of how society has changed due to this technology. Look for positives and negatives and bookmark or save the URLs of the sites in a basic bibliography  Construct the essay under given subheadings  Read and mark two other essays so that:   * a standard mark scheme is applied * all students read the 2 topics that they did not do themselves | Comm-R, SM  UICT  Comm-W  Comm-R, WO, PS |
| **Resources** | 1. FACT FILE – Digital Applications 2. Online banking advantages: CCEA AS ICT Past Paper Tuesday 29 May 2012, Question 1c, Page 3 3. Online banking security threats: CCEA AS ICT Past Paper Thursday 14 January 2010, Question 4b, Page 13 4. Online banking failure story: [www.bbc.co.uk/news/business-38594058](http://www.bbc.co.uk/news/business-38594058) 5. Online training (how it works): <http://people.howstuffworks.com/how-online-training-works.htm> 6. Online training (including advantages): [www.litmos.com/blog/training-management/can-online-training-help-company](http://www.litmos.com/blog/training-management/can-online-training-help-company) 7. Online training (advantages): [www.mindflash.com/elearning/benefits-of-online-learning/](http://www.mindflash.com/elearning/benefits-of-online-learning/) 8. Online training (disadvantages): [www.le.ac.uk/users/rjm1/etutor/elearning/disadvofelearning.html](http://www.le.ac.uk/users/rjm1/etutor/elearning/disadvofelearning.html) 9. E-commerce: [www.youtube.com/watch?v=AhgtoQIfuQ4](http://www.youtube.com/watch?v=AhgtoQIfuQ4) 10. E-commerce: [www.businessnewsdaily.com/4872-what-is-e-commerce.html](http://www.businessnewsdaily.com/4872-what-is-e-commerce.html) 11. E-commerce: [www.youtube.com/watch?v=FAyit\_s9eY0](http://www.youtube.com/watch?v=FAyit_s9eY0) 12. E-commerce (impact): [www.bbc.co.uk/schools/gcsebitesize/ict/implications/2workpatternsrev4.shtml](http://www.bbc.co.uk/schools/gcsebitesize/ict/implications/2workpatternsrev4.shtml) 13. E-commerce: BCS Glossary pp127-12 | | |

**Unit 2**

**Digital Authority Concepts**

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| **Planning Framework for GCSE Digital Technology** | **Unit 2** | **Digital Authority Concepts** |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Designing solutions** | Students should be able to: |  |  |
|  | * describe an end user’s role when developing a prototype for a digital system; | Preliminaries:  The following unit is designed to give knowledge of both database and website design in preparation for Unit 3 |  |
|  | * know and understand the purpose of the following elements of multimedia design documentation; * Target audience and user requirements; * Navigation structure design; * Storyboard; * Image sources; * Movie timeline; and * Descriptions of any scripted elements of the solution and the source of the script; | Teacher exposition:  Students should be able to create a complex database solution to a given problem and a website based on end user requirements. Solutions should be tested at different points of the creation by someone other than the creator e.g. another member of class, this will assist with the understanding of the end user’s role and why it is necessary to create prototypes   * For definition of End User and Prototypes students can refer to fact file | WO, SM, PS  Comm-R, SM |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Designing solutions (cont.)** | Students should be able to: |  |  |
|  | * know and understand the purpose of the following elements of database design documentation; * Data dictionary; * Form and report wireframes; and * Navigational structure diagram; and | Students will create a website of their own choosing for example: a family business, rugby club, hockey club, Gaelic club, a hobby. If students cannot find their own example they could use previous CCEA Controlled Assessment tasks (but these would have to be developed further to included more complex skills)   * Teacher could show different websites to get students to decide on target audience and user requirements * Students create a storyboard and navigational structure for their website after deciding on their target audience and user requirements * Students research the best sources for images – allows the opportunity to take own photos and compare against quality of images available online * Students evaluate and annotate example scripts to demonstrate understanding * Students will create a short movie for their website for example an advert for the organisation, special offers the business may have, activities the organisation may offer, special events they hold. Students must demonstrate an understanding of the importance of planning and create timeline for the movie | UICT, Comm – W,  Comm – R, PS, SM |
|  | * entity-relationship diagram (ERD). |  |
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| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Designing solutions (cont.)** | Students should be able to: |  |  |
|  |  | Students will create a database of their own choosing perhaps linking it to their website example   * Students refer to Factfile for definition of Data Dictionary * Students decide on information needed for their database. They should plan/draw/design what forms are needed to gather information * Students should also design a menu system for their database   To understand ERD’s and how their own database will be related students could evaluate example ERD’s annotating the types of relationships | Comm – R  PS, UICT  SM |
| **Resources** | Factfile  Previous CCEA ICT Controlled Assessment Unit 1 Files – for practical activities and ERD’s  Scripting resource: [www.javascriptkit.com/script/cut163.shtml](http://www.javascriptkit.com/script/cut163.shtml)  Wireframe resource: <https://webdesignledger.com/wireframing-prototyping-web-forms/> | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital development considerations** | Students should be able to: |  |  |
|  | * describe and evaluate the following interfaces for operating digitally developed packages; * Graphical User Interface (GUI); * Natural language interface; * Motion tracking interface; and * Touchscreen; | Teacher exposition:  Students research User Interfaces - make notes on the advantages and disadvantages of each type. [www.webopedia.com/TERM/U/user\_interface.html](http://www.webopedia.com/TERM/U/user_interface.html)  Students refer to Factfile  Students create a table of advantages and disadvantages of touchscreen based on their own knowledge of tablet computers and smart phones  Students create notes about accessible design from the government website [www.gov.uk/service-manual/user-centred-design/user-research/accessibility-testing.html](http://www.gov.uk/service-manual/user-centred-design/user-research/accessibility-testing.html)  [www.usabilityfirst.com/glossary/cross-platform-compatibility.html](http://www.usabilityfirst.com/glossary/cross-platform-compatibility.html) | Comm – W  Comm - W |
|  | * describe issues associated with accessible design when developing a digital application; |  |
|  | * describe issues associated with developing packages that are compatible across a variety of platforms; and |  |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital development considerations (cont.)** | Students should be able to: |  |  |
|  | * describe how each of the following improves cross-platform compatibility: plugins, Portable Document Format (PDFs) and optimised file formats. | [www.creativepublic.com/file\_types\_optimization.php](http://www.creativepublic.com/file_types_optimization.php)  Students complete practical exercises on bottom of above web page and discuss the experience | SM, Comm – T&L |
| **Resources** | [www.teach-ict.com/glossary/P/plugin.html](http://www.teach-ict.com/glossary/P/plugin.html) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Multimedia Applications** | Students should be able to: |  |  |
|  | * identify and evaluate key multimedia and interactive features used in: * Websites supporting e-commerce; * Social media; and * Gaming; | Teacher exposition:  Students research and evaluate a number of different websites using CCEA WEG. Students can choose own websites or be given examples from the teacher  Students evaluate chosen websites stating strengths, weaknesses and what they would improve | SM, Comm-R, Comm-W |
| **Multimedia Authoring** | * define the term multimedia authoring | Students refer to Factfile | SM, Comm-R |
|  | * demonstrate understanding of the following features and their role in multimedia authoring: * Hypertext; * Video; * Animation; * Sound; and * Scripting; | Students will now begin to create a small website using designer software For example Dreamweaver, Microsoft Expression 4. The website should follow the navigation structure and storyboard previously created  Students ensure that their website contain all of the required features | SM, Comm-W, UICT |
|  | * use scripting to implement sequencing, selection, repetition, and event programming in multimedia authoring software; and | Students should ensure that their website contains some event scripting: [www.w3schools.com/js/js\_htmldom\_events.asp](http://www.w3schools.com/js/js_htmldom_events.asp) | SM, UICT |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Multimedia Authoring (cont.)** | Students should be able to: |  |  |
|  | * demonstrate understanding of how Hypertext Mark-up Language (HTML) tags are used to manage the following elements in website creation: * Titles; and * Page body, including the following:   Colours and fonts  Headers;  Lines of text;  Paragraphs;  Images;  Sound;  Video;  Tables;  Links; and  Lists; | Students create a one page website using HTML on a topic of their choice  [www.w3schools.com/html/html\_basic.asp](http://www.w3schools.com/html/html_basic.asp) | UICT, SM |
|  | * interpret logic behind a short extract of HTML code; | Students complete the series of task on [www.w3schools.com/html/html\_basic.asp](http://www.w3schools.com/html/html_basic.asp)  creating short descriptions of each piece of code | UICT, SM, PS |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Multimedia Authoring (cont.)** | Students should be able to: |  |  |
|  | * demonstrate understanding of how folders can assist in asset management; | Demonstrate using prepared examples the importance of folder management. It would be beneficial to show good folder use and poor folder use. Students can then **explain** the differences and **describe** how folder management is assists creation of a website  Students create a short video based on their storyboard previously created. Video should include sound in the form of either a voice over or music | UICT, SM, PS |
|  | * create and use the following media types: video; animation and sound; |  |
|  | * integrate different optimised media into a multimedia solution, including animation, video, sound, images and text; and | Students evaluate and compare different multimedia files to decide which is best for their video and website. Example Sound files MP3, WAV, AVI, AIFF. Example Video files OGG, FLV, AVI, WMV. Students need to be able to justify their choice. Students need to be aware of Lossy Compression vs Lossless Compression  <http://computer.howstuffworks.com/file-compression3.htm> | UICT, SM, PS |
|  | * describe the impact of non-optimised resources on package performance. |  |
| **Resources** | Factfile  [www.w3schools.com/html/html\_basic.asp](http://www.w3schools.com/html/html_basic.asp)  [www.w3schools.com/js/js\_htmldom\_events.asp](http://www.w3schools.com/js/js_htmldom_events.asp)  <http://computer.howstuffworks.com/file-compression3.htm>  CCEA WEG | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Database development** | Students should be able to: |  |  |
|  | * develop a database solution to a given problem by applying appropriate relationships, such as one-to-one and one-to-many, within the database structure; | Teacher exposition:  Students will begin create a database solution based on their previous planning. They must ensure that they have at least 2 tables to create a relational database | SM, UICT, PS |
|  | * create complex queries that: * Use two or more criteria; * Incorporate calculations, selecting and sorting; and * Use SELECT, FROM, and WHERE structured query language (SQL) statements; | Students determine what information they wish to find out from their created database and create queries. Queries should range from simple to complex, using all tables, and incorporating 2 or more criteria. If using the previous CCEA controlled assessment examples students must include more queries other than those stated  Students can attempt the tutorials on [www.w3schools.com/sql/](http://www.w3schools.com/sql/) to understand SQL. Students can then test examples on their own database  Students create letters and labels using previous controlled assessment scenarios | Comm-R, SM, UICT, PS  UICT, SM |
|  | * use mail merging to select and sequence recipients; | Students create a menu system for their database. Students can use the following website to assist their understanding of Macros - <https://support.office.com/en-gb/article/Create-a-macro-c1ae8cc4-4464-4dc6-9bac-9e1651230eb3#bmmacrobuilderfeatures> | UICT, PS, SM  Comm-R |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Database development (cont.)** | Students should be able to: |  |  |
|  | * create macros to automate tasks in a database solution; and | Students research and create a database using the merits example from the following website [www.advanced-ict.info/databases/access.html](http://www.advanced-ict.info/databases/access.html)  Students discuss the consequences of Data Redundancy and lack of data integrity using examples provided by the teacher |  |
|  | * describe how relational databases reduce data redundancy and increase data integrity. |  |
| **Resources** | Previous CCEA ICT Controlled Assessment Unit 1 Files – for practical activities and ERD’s  Macros - <https://support.office.com/en-gb/article/Create-a-macro-c1ae8cc4-4464-4dc6-9bac-9e1651230eb3#bmmacrobuilderfeatures>  Relational databases - [www.advanced-ict.info/databases/access.html](http://www.advanced-ict.info/databases/access.html) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Significance of testing and developing of appropriate test plans** | Students should be able to: |  |  |
|  | * explain the role of testing in the development process, including an iterative approach; | Teacher exposition: | Comm-R, Comm-W, SM, UICT |
|  | * describe the features of an effective test plan; | Students refer to Factfile and research examples of test plans. [www.codeproject.com/Articles/394071/Agile-Case-Study-Cayen-Systems](http://www.codeproject.com/Articles/394071/Agile-Case-Study-Cayen-Systems) | Comm-R, Comm-W, SM, UICT |
|  | * explain the following approaches to testing: * White box; * Black box; * System; * Alpha; * Beta; and * A/B; | Students research and make notes using GCSE Computing Revision, Guru99, Optimizley. (see links below) | Comm-R, Comm-W, SM, UICT |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Significance of testing and developing of appropriate test plans (cont.)** | Students should be able to: |  |  |
|  | * describe how to test the following in a multimedia package: * Navigation; * Multimedia asset operation; * Load times; and * Script testing. | Students create own testing table to test a series of websites, for example they could compare 3 commercial websites, 3 school websites, 3 business websites, 3 government websites  Students evaluate a range of websites to test their navigation, load times and multimedia content. Students can choose their own sites to evaluate but they should include a range of different types e.g. commercial, gaming, information based, social media |  |
| **Resources** | GCSE Computing Revision Types of Testing – <https://mattg99.wordpress.com/2011/05/11/gcse-computing-revision-types-of-testing-and-types-of-test-data/>  Guru99 - [www.guru99.com/system-testing.html](http://www.guru99.com/system-testing.html)  Guru99 - [www.guru99.com/alpha-beta-testing-demystified.html](http://www.guru99.com/alpha-beta-testing-demystified.html)  Optimizley - [www.optimizely.com/ab-testing/](http://www.optimizely.com/ab-testing/) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Evaluation of digitally authored systems against a set of user requirements** | Students should be able to: |  |  |
|  | * explain how to use an evaluation to ensure that a solution: * Meets the original design specification; * Is a full and complete solution; * Is an efficient solution; and * Operates on an appropriate platform | Teacher exposition:  Students should use both self and peer evaluation to ensure that both their website and database meets the end user requirements  Students discuss why it is important to meet end user requirements and match the original design | SM, WO, Comm-W |

**Unit 3**

**Digital Authoring Practice**

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| **Planning Framework for GCSE Digital Technology** | **Unit 3** | **Digital Authoring Practice** |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Designing solutions using appropriate tools** | Students should be able to: |  |  |
|  | * specify the user requirements and target audience to design a solution to a given problem; | Link to Unit 2: Recap approaches to software development with emphasis on prototyping  Whole Class activity  Read through controlled assessment task for the Solutions Company  Students to identify the target audience and their needs | Comm-W  UICT  PS  SM |
|  | * use storyboards and prototyping to design a solution to a given problem using suitable input, output, processing, data and navigation design; | Individual activity - Website  Use exemplar storyboards to identify what a good/bad storyboard requires  Students to create detailed planning documents:   * navigational structure diagram * storyboards * image sources * movie timeline * descriptions of any scripted element of the solution and the source of script |  |
|  | * refine and evaluate the design solution; |  |  |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Designing solutions using appropriate tools**  **(cont.)** |  |  |  |
|  | * use suitable testing method, for example A/B testing, to ensure the design solution meets user requirements, after considering end user feedback; and | **Individual activity – Database**  Students should plan their database by identifying all inputs, outputs and processing elements   * Identify a range of relevant validation checks to used including length, lookup list and input masks * Form Designs * Report Designs making us of grouping, sorting, calculations, headers & footers * Query Designs (simple and complex queries) * Macro Design   Students should evaluate designs for both website and database making refinements if necessary. Peer assessment could be considered.  Students to choose an appropriate method of testing e.g. A/B testing to check their website meets the end user requirements  Students create two prototype home pages for their website and use peer assessment to review both home pages | Comm-W  UICT  PS  SM  WO |
| **Resources** | Factfile  Previous CCEA ICT Controlled Assessment Tasks  A/B Testing: [www.optimizely.com/ab-testing/](http://www.optimizely.com/ab-testing/)  A/B Testing: <https://vwo.com/ab-testing/> | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Building a solution tools** | Students should be able to: |  |  |
|  | * use the following features of a multimedia authoring package to support the creation of an interactive solution from a design document: * templates; * hypertext that supports internal and external navigational links; * optimised media types, which should include:   an original video;  an original animation;  and appropriate sound;   * scripted elements that aid the interactivity of the package. | Link to Unit 2: Recap what students learned during the creation of their practice website  Individual Activity (may involve whole class demonstration)  Using web authoring software and their designs students should create a website for the Solutions company making sure to include:   * pages * images * original video * appropriate sound * animation * accessibility features * templates e.g. form * hypertext which supports internal and external navigational links * scripted elements which add interactivity of the solution   Emphasis to be placed on the use of folders to categorise website content and the use of appropriate file names for graphic elements used as part of the website. All images should be sourced | UICT  PS  SM |
| **Resources** | BBC Bitesize: Development and Testing: [www.bbc.co.uk/education/guides/z8n3d2p/revision/3](http://www.bbc.co.uk/education/guides/z8n3d2p/revision/3)  Teach ICT: FrontPage Tutorial: [www.teach-ict.net/software/front\_page/frontpage.htm](http://www.teach-ict.net/software/front_page/frontpage.htm)  iGCSE: FrontPage Support: [www.ictlounge.com/html/webauthoring.htm](http://www.ictlounge.com/html/webauthoring.htm) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Building a solution tools (cont.)** | Students should be able to: |  |  |
|  | * use the following features of a database application to support the implementation of a solution from a design document: * relationships; * simple and complex queries; * menus and macros; * validation; * lookup lists; * input masks; * forms and subforms; and * reports (incorporating grouping, sorting, calculations, and headers and footers); | Link to Unit 2: Database Development  Recap what students have learned when creating their practice database  Download appropriate Excel file from CCEA website  Students to complete the Controlled Assessment Task for Solutions  Using their designs, students should:   * import data from a spreadsheet to a database; * create tables which uses appropriate validation such as length checks, lookup lists and input masks; * create a relationship between tables; * create forms for data input; * create a menu system for navigation; * create a range of complex and simple queries; * create reports which include the use of grouping, calculations and headers & footers; and * use macros | UICT  PS  SM  Comm-W |
| **Resources** | Factfile  Previous CCEA Database Activities  [www.gcflearnfree.org/access2016/designing-your-own-database](http://www.gcflearnfree.org/access2016/designing-your-own-database) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Testing a system** | Students should be able to: |  |  |
|  | * create a test plan that: * is presented in tabular format; * tests all navigational elements, all interactive elements, and the loading time of any assets used in the solution; * tests the accessibility elements of the application; * uses appropriate test data; * shows expected output; * identifies errors and performance issues; * reflects the general robustness of the system; and | Link to Unit 2: Recap what was learned during website and database testing in Unit 2  Whole Class Activity - Website  Students to design a questionnaire to gather end user feedback. Students to test each other’s websites and complete questionnaire for each other.  Individual Activity - Website  Students to create a test plan (presented in tabular form) to fully test their website including navigation, interactive elements, loading time, accessibility, performance and robustness. Students need to identify expected and actual outcome and show evidence the test works. Students should include evidence of any errors which occurred and any corrective action that took place  Individual Activity - Database  Students to create a test plan (presented in tabular form) to fully test their database. Students need to identify expected and actual outcome and show evidence for each test. Appropriate test data should be used. Students should include evidence of any errors which occurred and any corrective action that took place | Comm-W  WO  UICT  WO  SM  Comm - W  UICT  WO  SM  Comm - W |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Testing a system** | Students should be able to: |  |  |
|  | * measures the extent to which the user requirements have been met; * test the solution using the test plan and document the observed outcomes from each test. |  |  |
| **Resources** | Factfile on testing  BBC Bitesize Development & Testing: [www.bbc.co.uk/education/guides/z8n3d2p/revision/5](http://www.bbc.co.uk/education/guides/z8n3d2p/revision/5) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Evaluating a solution** | Students should be able to: |  |  |
|  | * evaluate the solution, referring to the following: * user requirements; * performance and robustness during testing; * refinements required following testing; and * possible improvements to the solution. | Link to Unit 2: Recap what was covered when evaluating their practice website and database  Task  Teacher provides students with a variety of evaluations. Students (in groups or individually) should be encouraged to identify and discuss the difference between factual description and evaluative comments.  Individual Activity  Students to evaluate the Solutions website by:   * reflecting on original user requirements and whether the solution meets the end user needs; * reflecting on testing; * reflect on end user feedback; * identifying any refinements which were completed after testing and why; and * suggest possible improvements to the website   Individual Activity  Students to evaluate the Solutions Database by:   * reflecting on the original user requirements and whether the solution meets the end user needs; * identifies limitations of the solutions; * reflect on testing; * discuss if any refinements were required; and * suggest possible improvements to the solution | Comm – R, WO  Comm – R, Comm - W |
| **Resources** | BBC Bitesize: Evaluating Solutions: [www.bbc.co.uk/education/guides/zssk87h/revision](http://www.bbc.co.uk/education/guides/zssk87h/revision) | | |

**Unit 4**

**Digital Design Principles**

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| **Planning Framework for GCSE Digital Technology** | **Unit 4** |  |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Contemporary trends in software development** | Students should be able to: |  |  |
|  | * describe the following programming paradigms: * procedural programming; and * object-oriented programming; | Teacher should formally define the meaning of procedural programming and object-oriented programming  Teacher should provide short, basic examples of code for each paradigm and examples of languages which are categorised as procedural or object-oriented  Students, in groups, should discuss the advantages and disadvantages of procedural and object-oriented approaches  Students should identify characteristics of languages which are procedural or object-oriented  Teachers should show examples/screenshots of software development environments and students should identify common features. Teacher may choose to compare historical examples e.g. MS-DOS vs modern IDEs  Students should have opportunities to use an IDE and show understanding of it’s features when completing activities for Unit 5. Refer to Unit 5, Activity 2a | Comm-T&L  PS  UICT  PS |
|  | * explain the significance of the following aspects of software development environments: * editing features; and * high-level code translation and execution; |

|  |  |
| --- | --- |
| **Resources** | Contemporary trends in software development fact file  History of programming languages presentation (very high level): [www.bcs.org/upload/pdf/rstroud-090114.pdf](http://www.bcs.org/upload/pdf/rstroud-090114.pdf)  Definitions and examples of languages:  BBC Bitesize: Languages [www.bbc.co.uk/education/guides/zd3cwmn/revision/2](http://www.bbc.co.uk/education/guides/zd3cwmn/revision/2)  BBC Bitesize: IDE [www.bbc.co.uk/education/guides/zgmpr82/revision](http://www.bbc.co.uk/education/guides/zgmpr82/revision)  Ranking of programming languages: [www.tiobe.com/tiobe-index//](http://www.tiobe.com/tiobe-index//)  [www.completecsharptutorial.com](http://www.completecsharptutorial.com)  ccea.org.uk/digital-technology support tab + video resources  [www.codeacademy.com/learn/python](http://www.codeacademy.com/learn/python) |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital Data** | Students should be able to: |  |  |
|  | * describe how a number is converted to a binary pattern for storage in a computer; | Some aspects of this topic build on content contained in Unit 1 representing data. Students should understand that data is stored in binary  Teachers should explain the process of how a number is converted to a binary pattern. Students should practice converting a number to binary and binary to number | UM |
|  | * demonstrate understanding of the following units of data: * bit; * nibble; * byte; * kilobyte; * megabyte; * gigabyte; and * terabyte; | State the size of each unit in terms of bits (b) or bytes (B) using the correct notation and case, including when it is expressed in powers of 2  Convert the capacities of various contemporary (e.g. SSD) and obsolete (e.g. floppy disk) storage devices into a common unit in order to compare them  Calculate how many copies of a file with a fixed size (e.g. a digital photograph) would fit on to a storage device with a given capacity (e.g. a CD-ROM)  Identify equivalent values expressed in different units (e.g. ½B = 1 nibble and 2 nibbles = 1B) as a matching exercise  Choose an appropriate unit to use in a given situation (e.g. GB or TB for mass storage, KB for typed essays)  Develop a spreadsheet that enables you to see an equivalent value in other units | UM  UM, PS  UM, PS  UM, PS  PS |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital Data (cont.)** | Students should be able to: |  |  |
|  | * demonstrate understanding of the following types of character representation: * ASCII (7-bit and 8-bit); and * Unicode; | Teachers should explain the process for how a character is encoded and should demonstrate the use of an ASCII chart  Students should be able to identify the groups of characters that can be represented by ASCII  Students should be able to convert a character to decimal to binary and reverse  Teachers should explain the development of ASCII 8-bit as an extension of 7-bit representation as a result of hardware developments. Students should be asked to consider the reasons for further developing character representation (e.g. the need to represent non-English characters)  Teachers should lead class discussion on the need for a universal standard for characters and for backwards/forwards compatibility and relate this to the development of Unicode/UTF-8 | UM, PS, UICT  UM  UICT  PS  Comm-T&L  PS |
|  | * demonstrate understanding of and use number representation and convert between denary, binary and hexadecimal; | Students should practice the conversion of numbers between decimal, binary and hexadecimal formats  Students should be able to use these formats to convert number to ASCII character with the use of an ASCII table  Teachers should demonstrate the addition of two bytes  Students should practice the addition of two bytes | UM  PS  UM  PS |
|  | * perform the addition of two bytes and explain the meaning of overflow; |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital Data (cont.)** | Students should be able to: |  |  |
|  | * describe and use appropriately the following data types: numeric (integer and real), date/time, character and string; | Teachers should explain the difference between integers and real numbers, date and time formats, characters and strings  Students should choose which data type would be suitable in a given scenario, either in the context of Unit 5 or in an exam setting  Teachers should explain with examples, the use of Boolean operators and truth tables  Students should practice the use of operators and give examples of situations where they would be useful (e.g. for complex searches) | PS  PS |
|  | * demonstrate understanding of and use Boolean operators (AND, OR, NOT) and truth tables; |
| **Resources** | Digital data fact file  What is a data type?  <http://techterms.com/definition/datatype>  Notes on storage units: <http://techterms.com/help/data_storage_units_of_measurement>  Unit converter tool: [www.unitconversion.org/unit\_converter/data-storage.html](http://www.unitconversion.org/unit_converter/data-storage.html)  Task to identify largest/smallest capacity: [www.tes.com/teaching-resource/storage-capacity-starter-activity-largest-smallest-amount-ict-computing-ks3-to-gcse-11162022](http://www.tes.com/teaching-resource/storage-capacity-starter-activity-largest-smallest-amount-ict-computing-ks3-to-gcse-11162022)  Introduction to binary: [www.bbc.co.uk/education/guides/zwsbwmn/revision](http://www.bbc.co.uk/education/guides/zwsbwmn/revision)  BInary and number addition: [www.bbc.co.uk/education/guides/zjfgjxs/revision](http://www.bbc.co.uk/education/guides/zjfgjxs/revision)  Hexadecimal and character sets: [www.bbc.co.uk/education/guides/zp73wmn/revision](http://www.bbc.co.uk/education/guides/zp73wmn/revision)  BCS Glossary:  Numeric: pp334 & 338  Date/Character/String: p331  [www.completecsharptutorial.com](http://www.completecsharptutorial.com)  ccea.org.uk/digital-technology support tab + video resources  [www.codeacademy.com/learn/python](http://www.codeacademy.com/learn/python) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital Design Principles** | Students should be able to: |  |  |
|  | * explain in simple terms the underlying concepts of computational thinking – abstraction and decomposition; | The skills discussed in this topic should be developed in conjunction with Unit 5. Teachers should explore the concepts with students and model how to respond to example questions. For further practical application, refer to Unit 5, Activity 1a  Teachers should demonstrate an example of how to decompose a problem in order to make it more manageable. Students should work in groups to break a problem into smaller problems  Teachers should lead discussion, using examples, in how abstraction is useful when solving a problem. Students should work in groups to identify common characteristics within a problem | Comm-T&L  WO  PS |
|  | * design solutions using algorithms, flow diagrams and pseudo-code; | Teachers should give examples of how an algorithm can be represented in a flow diagram or pseudocode and illustrate the benefits of using pseudocode (can design solutions without getting slowed down by needing to use the correct syntax of a language)  Teachers should work collaboratively with the class to develop an algorithm, flow diagram and pseudocode for an everyday process (e.g. making toast)  Students should practice using appropriate tools or software to create flow diagrams to represent example algorithms |  |
|  | * create and evaluate algorithms, including those for basic sorting and searching; |  |
|  | * refine a solution to a problem during design; |  |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Digital Design Principles (cont.)** | Students should be able to: |  |  |
|  | * identify data requirements for a solution and develop an appropriate user interface; and | Students should be asked to match flow diagram symbols to their name and function to consolidate understanding  Students should reflect on examples of user interfaces to relate their layout to the data requirements of a system  Students should examine example solutions one step at a time to determine what will happen when the solutions run. Teachers should include a variety of solutions and look for opportunities to show that more than one working solution could be developed for a problem |  |
|  | * use a dry run to test a solution. |  |
| **Resources** | Digital design principles fact file  BBC Bitesize: Clip on abstraction [www.bbc.co.uk/education/clips/zsftwxs](http://www.bbc.co.uk/education/clips/zsftwxs)  BBC Bitesize: Background on abstraction [www.bbc.co.uk/education/guides/zttrcdm/revision/1](http://www.bbc.co.uk/education/guides/zttrcdm/revision/1)  BBC Bitesize: Dry run testing [www.bbc.co.uk/education/guides/zg4j7ty/revision/3](http://www.bbc.co.uk/education/guides/zg4j7ty/revision/3)  [www.completecsharptutorial.com](http://www.completecsharptutorial.com)  ccea.org.uk/digital-technology support tab + video resources  [www.codeacademy.com/learn/python](http://www.codeacademy.com/learn/python) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Programming constructs** | Students should be able to: |  |  |
|  | * demonstrate understanding of and use the functionality of the following constructs in a programming language: * variables, constants, and Boolean and arithmetic operators; Unicode; * input, output and assignment statements; * one-dimensional array structures; * simple sorting techniques such as the bubble sort and insertion sort; * simple searching techniques such as linear and binary searching; * string manipulation functions, including splitting, concatenating, character searching and substring searching; | Teachers should lead discussion on data that is held about students in school. Students should identify which are variables and which are constants  Teachers should explain that this data can be defined and used in input, output and assignment statements  Teachers should demonstrate programming constructs in the context of Unit 5. In particular refer to Unit 5, Activity 2a and 2b  In some cases students should be given opportunities to demonstrate the technique that they are coding, for example, students should carry out simple bubble and insertion sorting on sample data  As students develop practical skills in these areas, teachers should look for opportunities to explicitly point out the function or technique being used by name | Comms-T&L  PS  UICT |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Programming constructs (cont.)** | Students should be able to: |  |  |
|  | * controlling the flow of a program through sequence, selection and iteration; * building reusable code that refines user-defined functions or methods; and * basic file handling. |  |  |
| **Resources** | Programming constructs fact file  Variables, constants and data types [www.bbc.co.uk/education/guides/zc6s4wx/revision](http://www.bbc.co.uk/education/guides/zc6s4wx/revision)  BBC Bitesize: Arrays [www.bbc.co.uk/education/guides/z4tf9j6/revision/2](http://www.bbc.co.uk/education/guides/z4tf9j6/revision/2)  Sorting [www.toptal.com/developers/sorting-algorithms](http://www.toptal.com/developers/sorting-algorithms)  [www.tutorialspoint.com/data\_structures\_algorithms/sorting\_algorithms.htm](http://www.tutorialspoint.com/data_structures_algorithms/sorting_algorithms.htm)  [www.khanacademy.org/computing/computer-science/algorithms#sorting-algorithms](http://www.khanacademy.org/computing/computer-science/algorithms#sorting-algorithms)  Searching [www.khanacademy.org/computing/computer-science/algorithms/binary-search/a/binary-search](http://www.khanacademy.org/computing/computer-science/algorithms/binary-search/a/binary-search)  www.bbc.co.uk/education/guides/zgr2mp3/revision  [www.tutorialspoint.com/data\_structures\_algorithms/linear\_search\_algorithm.htm](http://www.tutorialspoint.com/data_structures_algorithms/linear_search_algorithm.htm)  String manipulation for Python [www.tutorialspoint.com/python/python\_strings.htm](http://www.tutorialspoint.com/python/python_strings.htm)  Sequences, selection and iteration [www.bbc.co.uk/education/guides/zsf8d2p/revision](http://www.bbc.co.uk/education/guides/zsf8d2p/revision)  [www.khanacademy.org/computing/computer-science/algorithms/recursive-algorithms/a/recursion](http://www.khanacademy.org/computing/computer-science/algorithms/recursive-algorithms/a/recursion)  File handling for C [www.w3schools.in/c-tutorial/file-handling/](http://www.w3schools.in/c-tutorial/file-handling/)  File handling for PHP [www.w3schools.in/php/file-handling/](http://www.w3schools.in/php/file-handling/)  [www.completecsharptutorial.com](http://www.completecsharptutorial.com)  ccea.org.uk/digital-technology support tab + video resources  [www.codeacademy.com/learn/python](http://www.codeacademy.com/learn/python) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Simple error handling techniques** | Students should be able to: |  |  |
|  | * demonstrate understanding of and use the following: * data validation, including presence, length, type and format checks; * detection and correction techniques for syntax, execution and logic errors; and * simple error trapping techniques; | Teachers should provide a practical session on how a system could validate data  Students should be asked to define validation and it’s purpose. Teachers should ensure that each type of validation is included in the practical session  Students should choose an appropriate check (from presence, length, type and format) for a given data type or table of data  Teachers should explain the difference between syntax, execution/runtime and logic errors. Students could be given an example piece of code and asked to identify syntax errors or logic errors  Teachers should provide example solutions and ask students to identify how an error could be detected and corrected by using a debugger in an IDE | UICT  UM  PS  PS  PS |
| **Resources** | Simple error handling techniques fact file  BBC Bitesize: Types of errors  [www.bbc.co.uk/education/guides/zgmpr82/revision/5](http://www.bbc.co.uk/education/guides/zgmpr82/revision/5)  BBC Bitesize: Debugging  [www.bbc.co.uk/education/guides/zgmpr82/revision/6](http://www.bbc.co.uk/education/guides/zgmpr82/revision/6)  BBC Bitesize: Validation  [www.bbc.co.uk/education/guides/zdvrd2p/revision](http://www.bbc.co.uk/education/guides/zdvrd2p/revision)  Revision World: Checking Data  <https://revisionworld.com/gcse-revision/ict/security/checking-data-data-quality>  [www.completecsharptutorial.com](http://www.completecsharptutorial.com)  ccea.org.uk/digital-technology support tab + video resources  [www.codeacademy.com/learn/python](http://www.codeacademy.com/learn/python) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Developing test plans and testing a solution** | Students should be able to: |  |  |
|  | * explain the following iterative approaches to testing: * white box; * black box; and * system, unit and integration testing; | Students should discuss the reasons for testing and the consequences of testing or not testing a system. Teachers should relate this to real-world situations e.g. the testing of apps before their approval by Apple App Store  Teachers should explain the difference between white box and black box testing, and ask students to think of examples of when these approaches could be taken | Comms-T&L  WO  PS  PS |
|  | * create and use a test plan that identifies test procedures for use during and after development to check a system against success criteria; | Teachers should explain unit, system and integration as stages within the development of a working system  For a given problem or set of user requirements, students should be able to develop a test plan that ensures all functional and design requirements are met. The test plan should provide test methods for Unit, Integration and System Testing  Students in groups should look at example test plans to identify and describe typical components such as: Features to be tested, Success and Failure criteria, Test deliverables, Staff Responsibilities and Test Schedule | UICT  PS |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Developing test plans and testing a solution (cont.)** | Students should be able to: |  |  |
|  | * devise and use the following types of test data: valid, invalid and extreme; | Students should understand the need to test using different types to data: valid, invalid and extreme  Students should be able to look at an example test plan and devise valid, invalid and extreme data that could be used to perform a test  Students in groups should look at example test plans to identify and describe typical components such as: Features to be tested, Success and Failure criteria, Test deliverables, Staff Responsibilities and Test Schedule | Comms-T&L  WO  PS  UM  PS  WO  PS |
| **Resources** | Developing test plans and testing a solution fact file  BBC Bitesize: Development and Testing  [www.bbc.co.uk/education/guides/z8n3d2p/revision/3](http://www.bbc.co.uk/education/guides/z8n3d2p/revision/3)  Software Testing Fundamentals: Methodologies of Software Testing  <http://softwaretestingfundamentals.com/software-testing-methods/>  Software Testing Fundamentals: Software Testing Levels,<http://softwaretestingfundamentals.com/software-testing-levels/>  Software Testing Foundation: Software Testing Lifecycle,<http://softwaretestingfundamentals.com/software-testing-life-cycle/>  [www.completecsharptutorial.com](http://www.completecsharptutorial.com)  ccea.org.uk/digital-technology support tab + video resources  [www.codeacademy.com/learn/python](http://www.codeacademy.com/learn/python) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Evaluation of digitally authored systems against a set user of requirements** | Students should be able to: |  |  |
|  | * explain how evaluation is used to ensure that a solution: * meets the original design criteria; * is a full and complete solution; * is an efficient solution; and * is a robust solution. | Teachers should model the steps taken to evaluate a solution or system against user requirements  Teachers should provide a variety of solutions for students to evaluate. Students should be encouraged to identify each of the evaluation criteria in the samples and discuss the difference between factual description and evaluative comment  Practical development of evaluation skills could be completed using a solution developed for Unit 5 | Comms-T&L  UM  UICT  PS |
| **Resources** | BBC Bitesize: Evaluating solutions  [www.bbc.co.uk/education/guides/zssk87h/revision](http://www.bbc.co.uk/education/guides/zssk87h/revision)  [www.bbc.co.uk/education/guides/zx9wxnb/revision/3](http://www.bbc.co.uk/education/guides/zx9wxnb/revision/3)  [www.completecsharptutorial.com](http://www.completecsharptutorial.com)  ccea.org.uk/digital-technology support tab + video resources  [www.codeacademy.com/learn/python](http://www.codeacademy.com/learn/python) | | |

**Unit 5**

**Digital Development Practice**

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| **Planning Framework for GCSE Digital Technology** | **Unit 5** |  |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Designing solutions using appropriate tools** | Students should be able to: |  |  |
|  | * use algorithms to design a fully decomposed solution to a given problem; * specify the data requirements for a proposed solution; * include suitable input, output and navigation design to enable a user to use the system successfully; * use validation and error trapping proposals in the design to improve the potential robustness of the system; * use dry runs to evaluate a solution to ensure that it will meet its original design criteria; | Preliminaries  The activities below are built around the development of an algorithmic solution for a simple problem   * Problem statement is in natural language * Solution is an algorithm, which might identify objects/classes, methods/functions, etc., and should be expressed informally using pseudocode and/or flow-diagrams |  |
|  | Reference Unit 4: *Digital Design Principles*  In choosing/designing problems for these activities remember that you really want to illustrate the problem solving *process*. Problems should be as simple as possible while maintaining the potential to illustrate aspects of process appropriate to current stage of students’ development. These might include some/all of the following:   * vagueness and ambiguity in natural language problem statement; * potential for use of abstraction and decomposition; * potential for use of particular programming constructs, such as: sequencing, repetition, branching, input and output of data, etc. * quality of user experience; * potential for unexpected data to be entered; * potential for changing user requirements |  |
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| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Designing solutions using appropriate tools (cont.)** | Students should be able to: | Consider opportunities to repeat the activities using problems of varying complexity, appropriate to different stages in students’ learning  Activity 1a: Teacher Led Problem Solving |  |
|  | * refine the design solution based on issues identified during the design process. | Demonstrate, in the context of a prepared example problem, how an algorithmic solution is developed for a simple problem statement.   * Discuss vagueness and ambiguity in the problem statement, and what this might mean for the software developer. Lead class towards refining the problem statement and developing a collection of user requirements * Lead class towards developing an algorithmic solution. Work collaboratively with students rather than presenting one you did earlier * Discuss any use of problem decomposition, and highlight instances of abstraction, sequencing, repetition and branching (if.then.else) in the proposed solution * Identify data requirements, distinguishing between: input data, output data, and stored data * Discuss different kinds of data – e.g. numbers, text, dates | Comm-T&L-R  UM  PS |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Designing solutions using appropriate tools (cont.)** |  | Reference Unit 4: *Digital Data*  It is not necessary - or even desirable - for the initial solution to be perfect. The following considerations should be taken as opportunities to identify issues and to refine and improve the solution | Comm-T&L  UM  UICT |
|  |  | * Discuss what using your solution would be like from the user’s point of view: * Is the user experience as straightforward as it might be? * Is the user required to complete unnecessary steps? * Is any data input as convenient as it might be? * Is any data output displayed in the most meaningful way? * Consider the robustness of your solution. What happens if the user enters unexpected data (e.g. negative number for age)? * Discuss the possibility of changing user requirements. Investigate the effect, on the proposed solution, of a small change in the user requirements   Reference Unit 4: *Digital Design Principles*  Discuss the need for testing, and develop some test cases (input data / expected output data). Emphasise the need to test an appropriate range of:   * values of input data; * paths through the solution.   Perform dry runs to test the solution and discuss the results | PS  Comm-T&L |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Designing solutions using appropriate tools (cont.)** |  | Activity 1b: Small Group Problem Solving  Give each group a problem statement of similar complexity to the one used in *Activity 1a*. Groups are required to develop a solution.  Activity 1c: Student Presentations   * Each group presents their problem and solution to the whole class * Class critiques the solutions presented | PS  Comm-T&L-R  SM  WO  Comm-T&L  UICT |
|  |  |  |  |
| **Resources** | BBC Bitesize: Introduction to Computational Thinking, [www.bbc.co.uk/education/guides/zp92mp3/revision](http://www.bbc.co.uk/education/guides/zp92mp3/revision)  Kahn Academy: Computer Programming, [www.khanacademy.org/computing/computer-programming](http://www.khanacademy.org/computing/computer-programming)  Sonmez, J., Solving Problems, Breaking it Down, <https://simpleprogrammer.com/2011/01/08/solving-problems-breaking-it-down/>  CEA GCSE Digital Technology, <http://ccea.org.uk/digital_technology/>  Quick Start Computing, [www.quickstartcomputing.org/secondary/index.html](http://www.quickstartcomputing.org/secondary/index.html)  Computing at School, [www.computingatschool.org.uk/](http://www.computingatschool.org.uk/)  CEA GCSE Digital Technology Fact File (Unit 5: Designing Solutions & Using Appropriate Tools) | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Building a Solution** | Students should be able to: |  |  |
|  | * use the following features of an Integrated development environment (IDE) to support the creation of a solution from a structured design: * code editor; * simple debugging tools; * compiler; * error diagnostics; * run-time environment; and GUI where appropriate. | Preliminaries  The activities below take, as their starting points, the algorithmic solutions developed in *Activity 1a* and *Activity 1b*. These solutions are now to be coded in an appropriate programming language  Activity 2a: Teacher Led Programming  Take, as your starting point, the algorithmic solution developed in *Activity 1a*. Develop corresponding code. Work collaboratively with students rather than presenting *one you did earlier*. Ideally use data projector to demonstrate:   * entering code into an IDE editor; * compiling code; * executing code; * identifying and interpreting error reports; * fixing errors   Reference Unit 4: *Contemporary Trends in Software Development*  Reference Unit 4: *Simple Error Handling Techniques*  Highlight and discuss features of the IDE editor that students might find useful, for example:   * colour coding of program text; * matching of parentheses; * relevant menu items | Com-T&L-R  UM  PS |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Building a Solution (cont.)** | Students should be able to: |  |  |
|  | * use the following features of a programming language to build a solution from a structured design: * data types: numeric; character; string; Boolean; and date/time; * control structures: conditional execution if; conditional execution with alternative if else; and looping: for, while, repeat; * functions: user-defined functions; in-built functions; and mathematical functions; * data structures: arrays and writing to text files; * string handling – using simple string handling functions; | Highlight and discuss readability aspects of the code, including:   * choice of identifier names; * inclusion of comments   Identify and discuss examples of important programming constructs and features in your code, including: data types, control structures, writing to files, functions, data structures, string handling, arithmetic, and logical operators. Not all of the above features and discussion points will be relevant or appropriate to all coding problems  Reference Unit 4: *Programming Constructs*  Look for opportunities to discuss programming features that are related to (but different from) the ones used in your example, for example:   * If < has been used, take opportunity to also introduce =<, >, >=, … * If for..next type loop has been used, take opportunity to introduce repeat...until type loop   Look for opportunities to discuss programmer choices, and consider corresponding advantages and disadvantages. For example:   * use of user defined functions vs. flatter program structure; * use of if..then..else construct vs. use of case construct; * use of for..next loops vs. use of repeat...until loops | Comm – R  UICT  P.S  Comm – R, WO |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Building a Solution (cont.)** | Students should be able to: |  |  |
|  | * basic arithmetic: addition, subtraction, multiplication and division; powers; and modulo arithmetic; and * logical and relational operators (and complex combinations of these): equal to/not equal to; <, >, <=, >=; and logical AND, OR and NOT; and | Activity 2b: Small Group Programming  Each group to take, as their starting point, the algorithmic solution developed in *Activity 1b*. Develop corresponding code  Each group may code algorithm they themselves developed in *Activity 1b*. Alternatively, groups may swap algorithms for the coding exercise  Look for opportunities to discuss how coding sometimes reveals problems in the algorithm.  Activity 2c: Student Presentations   * Each group demonstrates their program to the whole class * Class critiques the programs presented | PS  Comm-T&L-R  SM  WO  Comm-T&L  UICT |
| **Resources** | Downey, AB., Think Python: How to Think Like a Computer Scientist (2nd Edition), <http://greenteapress.com/wp/think-python-2e/>  Downey, AB., Think Java: How to Think Like a Computer Scientist, <http://greenteapress.com/wp/think-java/>  Python Software Foundation, [www.python.org/](http://www.python.org/)  Python 3.5.2 Documentation, <https://docs.python.org/3/>  Miles, R., C# Programming Yellow Book (7th Edition), University of Hull, <http://www.csharpcourse.com/> | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
| --- | --- | --- | --- |
| **Testing a solution** | Students should be able to: |  |  |
|  | * create a test plan that: * is presented in tabular format; * incorporates black box and white box testing; * uses appropriate test data; * shows expected output; * identifies run-time and logic errors; * reflects the general robustness of the system; and measures the extent to which the user requirements have been met; and * test the solution using the test plan and document the observed outcomes from each test. | Preliminaries  The activities below take, as their starting points, the software developed in *Activity 2a* and *Activity 2b*, and the test cases developed in *Activity 1a*. Test cases are now to be refined and programs are to be tested  Activity 3a: Teacher Led Testing  Take, as your starting point, the software developed in *Activity 2a* and test cases developed in *Activity 1a*. Working collaboratively with students, create a test plan.   * Review the test cases and refine them based on the details of the software that was actually developed * Look for opportunities to distinguish between black box and white box testing. Discuss relative advantages and disadvantages of each * Produce final test cases in a tabular format, including at least: * test steps; * test data; * expected results   Cary out the test plan and record actual result of each test   * Discuss any errors found * Discuss overall performance of the software | Com-T&L-R  UM  PS |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Testing a solution (cont.)** |  |  |  |
|  |  | Reference Unit 4: *Developing Test Plans and Testing a Solution*.  Look for opportunities to distinguish between *black box* and *white box* testing. Discuss relative advantages and disadvantages of each  Activity 3b: Small Group Testing  Each group to take, as their starting point, the software developed in *Activity 2b*. Test cases are to be refined and programs are to be tested  Each group may test code they themselves developed in *Activity 2b*. Alternatively, groups may swap programmes for the testing exercise. Record feedback from peer testing to include in evaluation  Activity 3c: Student Presentations   * Each group presents to the whole class: * test plan and cases; * testing process; * outcome of tests * Class critiques the testing process   Beta Testing: Students get peer classmates to test their solution and record any findings – update system and use feedback for review/evaluation | PS  Comm-T&L-R  SM  WO  Comm-T&L  UICT |
| **Resources** | BBC Bitesize: Development and Testing, [www.bbc.co.uk/education/guides/z8n3d2p/revision/3](http://www.bbc.co.uk/education/guides/z8n3d2p/revision/3)  Software Testing Fundamentals: Methodologies of Software Testing, <http://softwaretestingfundamentals.com/software-testing-methods/>  Software Testing Fundamentals: Software Testing Levels, <http://softwaretestingfundamentals.com/software-testing-levels/>  Software Testing Foundation: Software Testing Lifecycle, <http://softwaretestingfundamentals.com/software-testing-life-cycle/> | | |

| **Unit/Option content** | **Learning Outcomes** | **Suggestions for Teaching and Learning Activities** | **Supporting Cross Curricular Skills, Thinking Skills and Personal Capabilities** |
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| **Evaluating a system** | Students should be able to: |  |  |
|  | * evaluate the solution, referring to the following: * user requirements; * performance and robustness during testing; and * refinements required following testing; and make recommendations for improving the system. | Activity 4: Teacher Led Evaluation  Drawing on all of the previous Unit 5 activities:   * Discuss the need for software evaluation * Distinguish between evaluation and testing * Highlight the central role of user requirements as reference * Discuss the user experience and the user interface   Working collaboratively with the class, evaluate the software developed in *Activity 2a*. Look for opportunities to reference the user requirements and consider the user experience  Discuss any changes that may be needed. Be clear about why they are needed and how they will improve the final product  Where appropriate, implement the changes and demonstrate the improved product  Reference Unit 4: *Evaluation of Digitally Authored Systems Against a Set of User Requirements* | Com-T&L-R  UM  PS |
| **Resources** | BBC Bitesize: Evaluating Solutions, [www.bbc.co.uk/education/guides/zssk87h/revision](http://www.bbc.co.uk/education/guides/zssk87h/revision)  Software Testing Fundamentals: Verification vs. Validation, <http://softwaretestingfundamentals.com/verification-vs-validation/> | | |