GCE A LEVEL MARKING SCHEME

**SUMMER 2017**

**A LEVEL (NEW)**

**COMPUTER SCIENCE - COMPONENT 2 A500U20-1**

# INTRODUCTION

This marking scheme was used by WJEC for the 2017 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

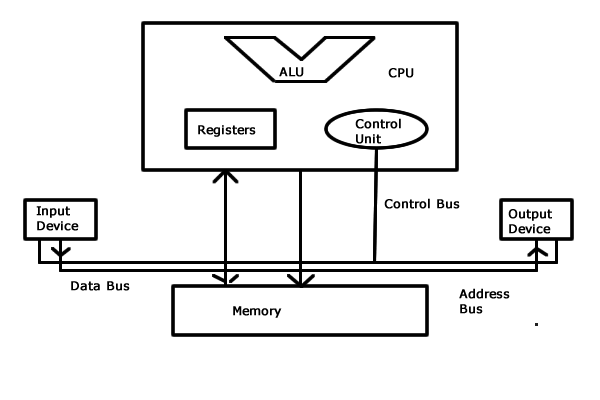
WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

# GCE A LEVEL COMPUTER SCIENCE SUMMER 2017 MARK SCHEME

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Mark | AO1 | AO2 | AO3 | Total |
| 1a | Accept either: |  |  |  |  | 4 |
|  | CREATE TABLE Order |  |  |  |
|  | ( |  |  |  |
|  | orderNo int NOT NULL, |  |  |  |
|  | customerNo int NOT NULL, |  |  |  |
|  | orderDate datetime, |  |  |  |
|  | handlingCost numeric(5,2), |  |  |  |
|  | PRIMARY KEY (orderNo) |  |  |  |
|  | ) |  |  |  |
|  | or |  |  |  |
|  | CREATE TABLE Order |  |  |  |
|  | ( |  |  |  |
|  | orderNo int NOT NULL PRIMARY KEY, |  |  |  |
|  | customerNo int NOT NULL, |  |  |  |
|  | orderDate datetime, |  |  |  |
|  | handlingCost numeric(5,2), |  |  |  |
|  | ) |  |  |  |
|  | **Award one mark for each of the following:** |  |  |  |
|  | * Correct construct (CREATE TABLE with | 1 | b |  |
|  | brackets in correct places)   * Identifying PRIMARY KEY * NOT NULL on key field * Numeric(x,2), 2 has to be present x can be | 1  1  1 | b b b |  |
|  | any sensible number representing pounds |  |  |  |
| 1bi | SELECT customerName, customerPhone FROM Customer ORDER BY customerPostcode  1 mark for SELECT, 1 for ORDER BY | 2 |  |  | b | 2 |
| 1bii | SELECT customerName, customerPhone FROM Customer WHERE customerNo = (SELECT customerNo FROM Order WHERE orderDate < 01/03/2016)  1 mark for each SELECT…. FROM… WHERE  …  Accept but not expect:  SELECT customerName, customerPhone FROM Customer JOIN Order WHERE orderDate < 01/03/2016 | 2 |  |  | b | 2 |

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| --- | --- | --- | --- | --- | --- | --- |
|  |  | Mark | AO1 | AO2 | AO3 | Total |
| 1biii | SELECT \* FROM Order WHERE  customerNo = 27 ORDER BY handlingCost DESC  Or  SELECT orderNo, orderDate, handlingCost FROM Order WHERE customerNo = 27 ORDER BY handlingCost DESC  1 mark for SELECT, 1 mark for ORDER BY with DESC | 2 |  |  | b | 2 |
| 2 | Example working solution |  |  |  |  | 6 |
|  | CLR |  |  |  |
|  | LDA 1B |  |  |  |
|  | STA 20 |  |  |  |
|  | ROW: LDA 1B |  |  |  |
|  | STA 21 |  |  |  |
|  | COL: OUT 1A |  |  |  |
|  | LDA 21 |  |  |  |
|  | DEC 1C |  |  |  |
|  | STA 21 |  |  |  |
|  | JGT COL |  |  |  |
|  | LDA 20 |  |  |  |
|  | DEC 1C |  |  |  |
|  | STA 20 |  |  |  |
|  | OUT 1D |  |  |  |
|  | JGT ROW |  |  |  |
|  | CLR |  |  |  |
|  | Or any other working solution. |  |  |  |
|  | **Award one mark for each of the following:** |  |  |  |
|  | * Output newline character and star * Inner loop for printing stars | 1  1 | b b |  |
|  | * Correct number of columns * Outer loop for printing rows * Correct number of rows * Working solution | 1  1  1  1 | b  b b b |  |

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|  |  | Mark | AO1 | AO2 | AO3 | Total |
| 3a | **Award one mark for each of the following:**   * Labelling the data, address and control bus paths correctly (arrows need not be shown) * Identifying all the components correctly * Using the accepted drawing convention for components in the CPU (as detailed in the specification) | 1  1  1 | a  a a |  |  | 3 |
| 3b | **Award one mark for each of the following, up to a maximum of four marks:**   * Cache memory attempts to solve the “Von Neumann Bottleneck” where the processor runs much faster than the memory by acting as a middleman between main memory and the registers. * Cache is small, extremely fast memory * Placed near or on the processor. * Data and instructions that are used regularly are stored in cache and retrieved by the processor when necessary. * When the cache is full least recently used data is discarded. * Algorithms try to avoid a cache miss (when   data has to be fetched from main memory rather than cache). | 4 | b |  |  | 4 |



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|  |  | Mark | AO1 | AO2 | AO3 | Total |
| 4 | **Advantages (Award one mark for each of the following, up to a maximum of four marks [six marks in total]):**   * Speech is a very natural way to interact, and it is not necessary to use a keyboard or work with a remote control * No training required for users * Voice is hands-free making it suitable for use in a variety of environments e.g. driving * Suitable for the disabled (qualified) * Can be used to drive several apps in a sequence e.g. Find John Smith and give me directions to him. * Faster than typing on a keyboard (must be qualified not just faster).   **Disadvantages (Award one mark for each of the following, up to a maximum of four marks [six marks in total]):**   * Even the best speech recognition systems sometimes make errors e.g. homophones * If there is noise or some other sound in the room (e.g. the television or a kettle boiling), the number of errors will increase * Regional accents can affect the outcome * Requires data connection to interpret speech and return results * Delivering sensitive information e.g. credit card details could be a security risk. * Only understands certain foreign languages   Any other credible advantage / disadvantage.  Advantages and disadvantages can’t be the reverse of each other. | 6 |  | b |  | 6 |

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|  |  | Mark | AO1 | AO2 | AO3 | Total |
| 5a | **TCP/IP**   * **Use:** allows any networked computers to communicate with each other * **Importance:** TCP/IP creates packets of data and specifies how packets are routed and transported around a network   **FTP**   * **Use:** allows the transfer of(large) files over a network. * **Importance:** the FTP protocol has in-built error checking / re-transmission request as necessary. | 1  1  1  1 | b b  b b |  |  | 4 |
| 5b | **Award one mark for each of the following, up to a maximum of four marks:**   * Handshaking is the process by which two devices establish their readiness to communicate * Device 1 will send a signal (SYN) to device 2 * Device 2 will acknowledge the signal (SYN- ACK) * Device 1 sends another signal of acknowledgement * Device 1 begins transmission. | 4 | b |  |  | 4 |
| 6a | **Award one mark for each of the following:**  C16 -> 000011002  916 -> 000010012  000011002 + 000010012 -> 000101012 | 1  1  1 |  | a a  a |  | 3 |
| 6b | **Award one mark for each of the following:**  B16 -> 000010112  7 -> 000001112  -7 -> 111110012  000010112 + 111110012 -> 000001002 | 1  1  1  1 |  | a  a a  a |  | 4 |
| 6c | **Award one mark for each of the following:**  45.7510 -> 101101.11002  -> 0.101101110002 with 01102  -> 01011011100001102 | 1  1  1 |  | a  a a |  | 3 |
| 6d | **Award one mark for each of the following:**  Calculate exponent: 510  Move binary point: 010010.112 Decimal Equivalent: 18.7510 | 1  1  1 |  | a a  a |  | 3 |

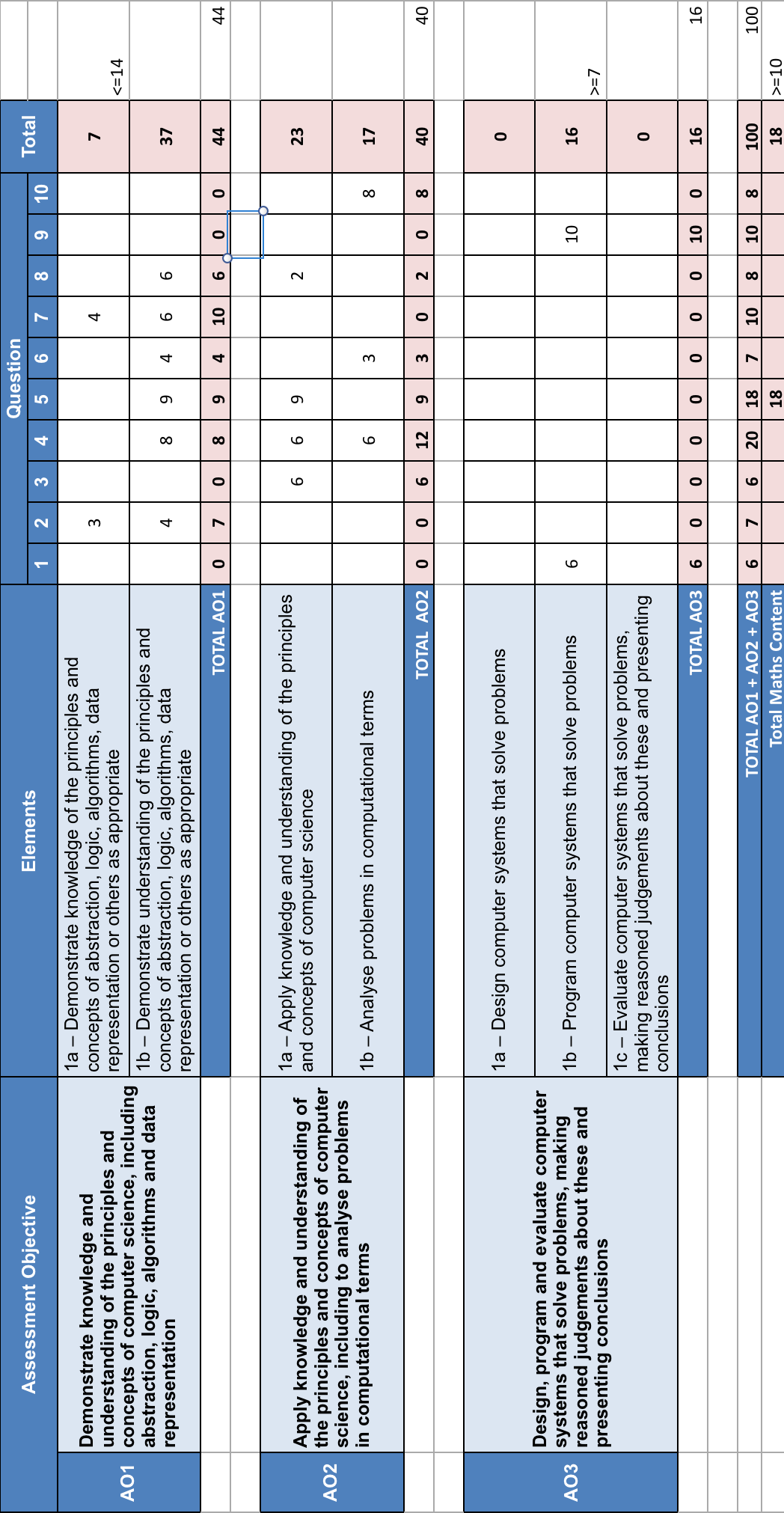
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Mark | AO1 | AO2 | AO3 | Total |
| 7a | **Award one mark for each of the following, up to a maximum of 4:**  Normalisation:   * is a way of structuring data according to theoretical rules * normalising data usually reduces data duplication/redundancy * avoids danger of inconsistency / maintains integrity * avoids danger of data being lost during update * avoids wasting processing time * probably enables easier maintenance of the database * allows different views of the data. * 1NF makes field atomic, avoids duplication of items * 2NF Each field depends on the whole primary key * 3NF All data items depend on nothing but the primary key | 4 | b |  |  | 4 |
| 7b | **Award one mark for each of the following:**   * Pupil to Subject (many-to-many accept not expect intermediate table) * Teacher to Subject (many-to-one) * Room to Subject (many-to-one) | 1  1  1 |  | b b  b |  | 3 |

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| --- | --- | --- | --- | --- | --- | --- |
|  |  | Mark | AO1 | AO2 | AO3 | Total |
| 8a | **Award one mark for each of the following:**   * Over time, the file system fills up then file changes may result in blocks no longer being contiguous as they won’t fit back into the space vacated * Files are then split and physically stored on different parts of the disk * Defragmentation consolidates data on a disk * By moving all parts of files to an empty contiguous area. | 4 | b |  |  | 4 |
| 8b | **Master file**   * Holds descriptive data; the actual data that is supposed to be processed and holds the resultant data after the process is completed   i.e. long term data records which contain data which does not change or data which is periodically updated   * Data is held sequentially, in key field order. * **Example**: Customer details for electricity company | 1  1  1 | b  b b |  |  | 6 |
| **Transaction file**   * Contains the transactions i.e. changes that are supposed to be made to the data in the master file * Data is held serially in temporal order i.e. in the order it was collected * **Example**: Customer meter readings for electricity company | 1  1  1 | b  b b |
| 9a | **Award 1 mark for each:**   * Records are stored in key sequence order (within each data block) * An index allows data to be accessed directly   / index contains key field and disk address of record / the key field and index are used to locate the correct position   * Advantage - faster access - can use index to access required data directly | 3 | b |  |  | 3 |
| 9b | **Award 1 mark for each:**   * The physical location of the record is calculated using a hashing algorithm * This calculation is carried out on data in the key field(or other mandatory data item) * A data collision occurs when two data items are hashed to the same location * In this case there needs to be overflow areas where the latest data is stored * When there are many items in the overflow area, access may become slow * In which case a new hashing algorithm is required and a larger file may be needed. | 6 | b |  |  | 6 |

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| --- | --- | --- | --- | --- | --- | --- |
|  |  | Mark | AO1 | AO2 | AO3 | Total |
| 10 | **Award one mark for each of the following, up to a maximum of six marks:**   * Asymmetric algorithms have two keys - a private and a public key * Symmetric algorithms have one key that has to be at both ends of a transmission * With asymmetric algorithms a shared secret key does not have to be exchanged over an insecure medium such as the Internet as it does with symmetric algorithms * Asymmetric keys are far slower to use and not feasible for use in transmitting large amounts of data because of the increase in transmission times * Symmetric is best used for data on your own disks as it’s fast * Asymmetric is best used for keys, digital signatures, data sent over the web e.g. bank details etc. * In many cases, the public and private key pairs in an asymmetric system can remain intact for many years without compromising the security of the system. E.g. SSL certificates * Asymmetric keys are harder to generate. | 6 | b |  |  | 6 |
| 11a | **Truncation**  0.102 -> 0.510  **Rounding**  0.112 -> 0.7510  **Original number**  0.101100002 -> 0.687510 | 1  1  1 |  | a  a a |  | 3 |
| 11b | **Errors**  Absolute = original – new Relative = absolute / original  **Truncation**  Absolute = 0.687510 – 0.510 = 0.187510  Relative = 0.187510 / 0.687510  27.27%  **Rounding**  Absolute = 0.687510 – 0.7510 = -0.062510  Relative = -0.062510 / 0.687510  9.09%  Therefore rounding is more accurate in this instance (only award if at least 2 correct values) | 1  1  1  1  1 |  | a a  a a  b |  | 5 |

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| --- | --- | --- | --- | --- | --- | --- |
|  |  | Mark | AO1 | AO2 | AO3 | Total |
| 12 | **Indicative content**   * Weather forecasts are made by collecting quantitative - numerical - data about the current state of the atmosphere * Data is captured by using a variety of sensors * In the case of weather models, data such as rain fall, temperature and wind speed are fed into a computer * Data is transmitted and collected centrally from thousands of sensors * This data is then put into a mathematical model * Predictions are made based on current conditions * A series of calculations is performed on the raw data on it to determine how it will change over time * Normally, mathematical modelling is done by powerful computers, which can carry out many calculations per second * The computer uses equations produced from the scientific understanding of atmospheric   processes |  |  | b |  | 10 |
| * Such as fluid dynamics and thermodynamic equations * The more sophisticated and up-to-date your model is, the more accurate your forecast should be * Parallel processing is generally used for complex calculations in mathematical weather models * Distributed processing enables many computers to share the load * Collaboration across countries * Weather predictions are not always 100% accurate * Equipment is extremely expensive * Weather predictions cannot account for freak weather patterns |

|  |  |
| --- | --- |
| **Band** | **AO3.1c** |
| **Max 8 Marks** |
| 3 | **8-10 Marks**  The candidate has:   * written an extended response that has a sustained line of reasoning which is coherent, relevant, and logically structured * shown clear understanding of the requirements of the question and a clear knowledge of the topics as specified in the indicative content. Clear knowledge is defined as a response that makes eight to ten points in both areas signalled in the indicative content. The top of the mark range would require a clear response in both areas. * addressed the question appropriately with minimal repetition and no irrelevant material * has presented a balanced argument and justified their arguments * effectively drawn together different areas of knowledge, skills and understanding from all relevant areas across the course of study * used appropriate technical terminology referring to the indicative content confidently and accurately. |
| 2 | **4-7 Marks**  The candidate has:   * written a response that has an adequate line of reasoning with elements of coherence, relevance, and logical structure * shown adequate understanding of the requirements of the question and a satisfactory knowledge of the topics as specified in the indicative content. * Satisfactory knowledge is defined as a response that makes four to seven points in either areas signalled in the indicative content. The top of the mark range would require a satisfactory response in both areas * presented an argument with limited justification * drawn together different areas of knowledge, skills and understanding from at least two areas across the course of study * used appropriate technical terminology referring to the indicative content. |
| 1 | **1-3 Marks**  The candidate has:   * written a response that that lacks sufficient reasoning and structure * produced a discussion which is not well developed, and the justification is weak * attempted to address the question but has demonstrated superficial knowledge of the topics specified in the indicative content. Superficial knowledge is defined as a response that makes one to three points as signalled in the indicative content. The top of the mark range would require a superficial response in both areas. * used limited technical terminology referring to the indicative content. |
| 0 | **0 Marks**  Response not credit worthy or not attempted. |



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|  |  | **SAM** | **2017** |  |
| **Hardware and Communication** | |  |  |  |
| Architecture | Identify and describe the hardware and communication elements of contemporary computer systems and how they are connected |  |  |  |
|  | Identify and describe the main components of computer architecture, including Von Neumann and contemporary architectures |  | 2a(3) |  |
|  | Describe different types of memory and caching |  | 2b(4) |  |
|  | Describe and explain parallel processing and the limiting factors to parallelisation |  |  |  |
|  | Calculate the runtime of given tasks as a result of parallelisation and evaluate the effect of parallelisation |  |  |  |
| Fetch-execute cycle | Describe the fetch-execute cycle, including how data can be read from RAM into registers | 2a(3) |  |  |
| Assembly language programming | Write simple programs in assembly language and demonstrate how these programs could be executed | 2b(4) | 1(6) |  |
| Input / Output | Describe the use of contemporary methods and their associated devices for input and output |  |  |  |
|  | Explain the use of these methods and devices in contemporary computer systems and their suitability in different situations |  |  |  |
|  | Describe and differentiate between voice input for command and control systems to operate a computer system, vocabulary dictation systems for verbal input and voice print recognition for security. Discuss the suitability of each system in different situations |  | 3(6) |  |
| Secondary storage | Compare the functional characteristics of contemporary secondary storage devices |  |  |  |
| Data storage on disk | Explain fragmentation and its consequences and describe the need for defragmentation |  | 7a(4) |  |
| Networking | Describe networks and how they communicate |  |  |  |
|  | Explain the importance of networking standards |  |  |  |
|  | Describe the importance and the use of a range of contemporary protocols including HTTP, FTP, SMTP, TCP/IP, IMAP, DHCP, UDP and wireless communication protocols |  | 4a(4) |  |
|  | Explain the role of handshaking |  | 4b(4) |  |
|  | Identify and describe applications where connecting a portable device to a network is required |  |  |  |
|  | Describe the hardware required to make a wireless connection and explain how this might be achieved using contemporary wireless technologies |  |  |  |
| **Data transmission** | |  |  |  |
| Communication networks | Describe serial and parallel transmission, their advantages and disadvantages |  |  |  |
|  | Describe simplex, half duplex and full duplex transmission methods | 6a(2) |  |  |
|  | Explain the need for multiplexing and switching |  |  |  |
|  | Describe using appropriate network protocols, such as TCP/IP the typical contents of a packet |  |  |  |
|  | Explain network collision, network collision detection and how these collisions are dealt with | 6b(3) |  |  |
|  | Describe methods of routing traffic on a network |  |  |  |
|  | Calculate data transfer rates on a network |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Calculate lowest cost routes on a network |  |  |  |
|  | Describe the Internet in terms of a world-wide communications infrastructure |  |  |  |
| **Data representation and data types** | |  |  |  |
| Representation data as bit patterns | Explain the terms bit, byte and word |  |  |  |
|  | Describe and use the binary number system and the hexadecimal notation as shorthand for binary number patterns | 7b(2) |  |  |
| Storage of characters | Describe how characters and numbers are stored in binary form |  |  |  |
|  | Describe standardised character sets |  |  |  |
| Data types | Describe the different primitive data types: Boolean, character,string, integer and real |  |  |  |
|  | Describe the storage requirements for each data type |  |  |  |
| Representation of numbers as bit patterns | Apply binary arithmetic techniques |  |  |  |
|  | Explain the representation of positive and negative integers in a fixed-length store using both two’s complement and sign and magnitude representation | 1ab(3) |  |  |
|  | Describe the nature and use of floating point form |  |  |  |
|  | State the advantages and disadvantages of representing numbers in integer and floating point forms | 1d(2) |  |  |
|  | Convert between real number and floating point form | 1c(2) | 5abc(9) |  |
|  | Describe truncation and rounding, and explain their effect upon accuracy |  | 5d(9) |  |
|  | Explain and use shift functions: logical and arithmetic shifts. Interpret and apply shifts in algorithms and programs | 7a(4) |  |  |
|  | Describe the causes of overflow and underflow |  |  |  |
| **Organisation and structure of data** | |  |  |  |
| File design | Explain the purpose of files in data processing |  |  |  |
|  | Define a file in terms of records and fields |  |  |  |
|  | Describe how files may be created, organised, updated and processed by programs |  |  |  |
|  | Explain fixed and variable length fields and records and give examples of the appropriate use of each type |  |  |  |
|  | Design files and records appropriate for a particular application |  |  |  |
| File organisation | Distinguish between master and transaction files |  | 7b(4) |  |
|  | Describe sequential, indexed sequential and direct(random) file access. | 4a(5) |  |  |
|  | Distinguish between the use of serial and sequential file access methods in computer applications |  |  |  |
|  | Describe and design algorithms and programs for sequential file access and update |  |  |  |
|  | Explain the purpose of, and be able to use, a hashing algorithm |  |  |  |
|  | Compare different hashing algorithms | 4b(6) |  |  |

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|  | Explain the use of multi-level indexes |  |  |  |
|  | Explain the techniques used to manage overflow and the need for file re-organisation |  |  |  |
|  | Explain the need for file security, including file backup, generations of files and transaction logs |  |  |  |
|  | Describe the need for archiving files |  |  |  |
| **Databases and distributed systems** | |  |  |  |
|  | Explain what is meant by data consistency, data redundancy and data independence |  |  |  |
|  | Describe and discuss the benefits and drawbacks of relational database systems and other contemporary database systems | 8a(3) |  |  |
|  | Explain what is meant by relational database organisation and data normalisation (first, second and third normal forms) | 3b(1) | 6a(4) |  |
|  | Restructure data into third normal form | 10b(6) |  |  |
|  | Explain and apply entity relationship modelling and use it to analyse simple problems. | 10a(3) | 6b(3) |  |
|  | Describe the use of primary keys, foreign keys and indexes | 3a(2) |  |  |
|  | Describe the advantages of different users having different views of the data in a database |  |  |  |
|  | Explain how the data can be manipulated to provide the user with useful information |  |  |  |
| Data validation and verification | Explain and apply appropriate techniques for data validation and verification of data in databases |  |  |  |
| Searching data | Explain the purpose of query languages |  |  |  |
|  | Construct and run queries using SQL | 3c(14) | 9(10) |  |
| Database Management Systems | Explain the purpose if a database management system and data dictionaries |  |  |  |
| Big Data | Explain what is meant by Big Data, predictive analytics, data warehousing and data mining | 8bc(5) |  |  |
| Distributed systems | Explain that distribution can apply to both data and processing |  |  |  |
|  | Describe distributed databases and the advantages of such distribution |  |  |  |
| **The operating system** | |  |  |  |
| Managing ressources | Describe the need for and the role of the operating systems kernel in managing resources, including peripherals, processes, memory protection and backing store |  |  |  |
| Providing an interface | Describe the need for and the role of the operating system in providing an interface between the user and the hardware |  |  |  |
| Managing Backing Store | Explain the hierarchical structure of a directory and describe file attributes |  |  |  |
| Utility software | Explain the need for and use of a range of utility software |  |  |  |
| Modes of operation | Describe the main features of batch processing, real time control and real time transaction systems | 9a(6) |  |  |
|  | Identify and describe applications that would be suitable to these modes of operation |  |  |  |

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| Types of Operating System | Explain the following types of system: batch, single- user(standalone), multi-user (multi-access), multi-tasking and multi-programming | 9bc(8) |  |  |
| Consideration of human-computer interaction | Explain the need to design systems that are appropriate to the variety of different users at all levels and in different environments |  |  |  |
| Interrupts | Describe a range of conditions or events which could generate interrupts |  |  |  |
|  | Describe interrupt handling and the use of priorities |  |  |  |
|  | Describe the factors involved in allocating differing priorities |  |  |  |
| Memory management and buffering | Explain the reasons for, and possible consequences of, partitioning of main memory |  |  |  |
|  | Describe methods of data transfer including the use of buffers to allow for differences in speed of devices |  |  |  |
|  | Describe buffering and explain why double buffering is used |  |  |  |
| Scheduling | Describe the principles of high level scheduling: processor allocation, allocation of devices and the significance of job priorities |  |  |  |
|  | Explain the 3 states of a process: running, ready and blocked |  |  |  |
|  | Explain the role of time-slicing, polling and threading |  |  |  |
| **The need for different types of software systems and their attributes** | |  |  |  |
| Types of software | Explain the use of a range of types of software, including open source software, bespoke and off the shelf |  |  |  |
| Safety related systems | Explain that some computer applications are safety related and require a high level of dependability, and hence that the development of safety critical systems is a highly specialised field | 11(13) |  |  |
| Industrial, technical and scientific | Describe the role of the computer in weather forecasting, computer aided design, robotics and the use of computer generated graphics and animation |  | 10(8) |  |
| Control systems | State the nature and scope of computer control and automation |  |  |  |
|  | Describe the benefits and implications of automation |  |  |  |
| Expert systems | Explain the purpose, use and significance of expert systems |  |  |  |
|  | Discuss the possible effects of expert systems on professional groups and the wider community |  |  |  |
| Internet and internet | Describe the use of search engines on the internet |  |  |  |
|  | Describe common contemporary applications |  |  |  |
|  | Discuss the possible effects of the internet upon professional groups and the wider community |  |  |  |
| **Data security and integrity processes** | |  |  |  |
| Protecting data integrity | Explain the special security and integrity problems which can arise during online updating of files |  |  |  |
| Privacy and security | Describe the dangers that can arise from the use of computers to manage files of personal data |  |  |  |
|  | Describe contemporary processes that protect the security and integrity of data including standard clerical procedures, levels of permitted access, passwords for access and write-protect mechanisms |  | 8a(2) |  |

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| Cryptography | Describe the need for and the purpose of cryptography |  |  |  |
|  | Describe techniques of cryptography and their role in protecting data |  |  |  |
|  | Follow algorithms and programs using in cryptography |  |  |  |
|  | Compare cryptographic methods and their relative strength |  | 8b(6) |  |
| Biometrics | Describe the purpose and use of contemporary biometric technologies |  |  |  |
|  | Describe the benefits and drawbacks of biometrics technologies |  |  |  |
|  | Describe the complexities of capturing, storing and processing biometric data |  |  |  |
| Disaster planning | Describe the various potential threats to computer systems |  |  |  |
|  | Describe contingency planning to recover from disasters |  |  |  |
| Malicious and accidental damage | Describe malicious and accidental damage to data and identify situations where either could occur |  |  |  |
| Malicious software and mechanisms of attack and defence | Describe types and mechanisms of malicious software and their vectors |  |  |  |
|  | Describe black hat hacking, white hat hacking and penetration testing |  |  |  |

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