



GCE A LEVEL MARKING SCHEME

SUMMER 2022

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

INTRODUCTION

This marking scheme was used by WJEC for the 2022 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.

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Guidance for examiners

Positive marking

It should be remembered that learners are writing under examination conditions and credit should be given for what the learner writes, rather than adopting the approach of penalising him/her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Marks should not be deducted for a less than perfect answer if it satisfies the criteria of the mark scheme.

For questions that are objective or points-based the mark scheme should be applied precisely. Marks should be awarded as indicated and no further subdivision made.

For band marked questions mark schemes are in two parts.

Part 1 is advice on the indicative content that suggests the range of computer science concepts, theory, issues and arguments which may be included in the learner's answers. These can be used to assess the quality of the learner's response.

Part 2 is an assessment grid advising bands and associated marks that should be given to responses which demonstrate the qualities needed in AO1, AO2 and AO3. Where a response is not credit worthy or not attempted it is indicated on the grid as mark band zero.

Banded mark schemes

Banded mark schemes are divided so that each band has a relevant descriptor. The descriptor for the band provides a description of the performance level for that band. Each band contains marks.

Examiners should first read and annotate a learner's answer to pick out the evidence that is being assessed in that question. Once the annotation is complete, the mark scheme can be applied.

This is done as a two-stage process.

Stage 1 – Deciding on the band

When deciding on a band, the answer should be viewed holistically. Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptor for that band. Examiners should look at the descriptor for that band and see if it matches the qualities shown in the learner's answer. If the descriptor at the lowest band is satisfied, examiners should move up to the next band and repeat this process for each band until the descriptor matches the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content. Examiners should not seek to mark candidates down as a result of small omissions in minor areas of an answer.

Stage 2 – Deciding on the mark

Once the band has been decided, examiners can then assign a mark. During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

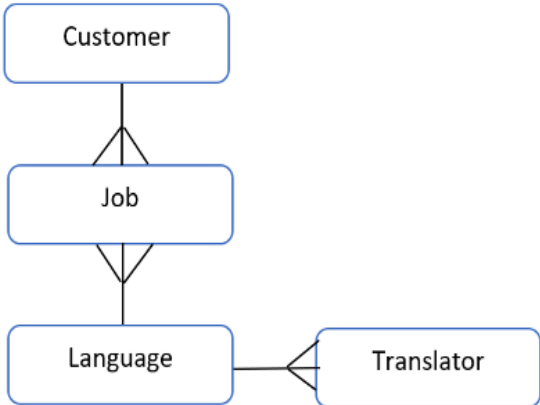
When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

Indicative content is also provided for banded mark schemes. Indicative content is not exhaustive, and any other valid points must be credited. In order to reach the highest bands of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that is contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

Question	Answer	Mark	AO1	AO2	AO3	Total
1.	<p>1 mark for description and 1 mark for storage requirement for each data type, to a maximum of 4 marks:</p> <p>Indicative content</p> <p>Boolean.</p> <ul style="list-style-type: none"> • A data type that may have one of two possible values, intended to represent the values of logic and Boolean algebra as true or false, • May be stored in a single Bit as 1 if true and 0 if false. <p>Fixed length string.</p> <ul style="list-style-type: none"> • A series of characters where the number of characters is fixed by the programmer when declaring the string as a variable. • The storage requirement of a fixed length string is a factor of the character set used e.g. 8 Bit ASCII. Storage requirement = 8 x maximum number of characters. 	4	1b			4

Question	Answer	Mark	AO1	AO2	AO3	Total
2. (a)	<p>1 mark for each correct conversion, 1 mark for correct binary addition.</p> <ul style="list-style-type: none"> • 127 0111 1111 • -126 1000 0010 • + 0000 0001 = 1_{10} 	3		2b		3
(b) (i)	<p>1 mark for correct number, 1 mark for correct fraction</p> <ul style="list-style-type: none"> • 00100001 . 1010 0000 	2		2b		2
(ii)	<p>1 mark for correct normalised mantissa, 1 mark for correct exponent.</p> <p>0.10000110100 0110</p>	2		2b		2
(c)	<p>1 mark for each correct point to a maximum of 3 marks.</p> <p>Floating point</p> <ul style="list-style-type: none"> • has set number of bits for mantissa and exponent • trade-off between accuracy v range • larger mantissa leading to greater accuracy, • larger exponent leading to greater range of numbers being represented • not possible to represent zero. <p>Fixed point</p> <ul style="list-style-type: none"> • not flexible and has a set range and level of accuracy, • is less complex. 	3	1b			3
(d)	<p>1 mark for each correct point to a maximum of 2 marks and 1 mark for a correct example</p> <ul style="list-style-type: none"> • Occurs when the result of a floating point calculation is smaller than the computer can represent in memory • needs to be rounded or truncated. • Suitable example 	3	1b			3

Question	Answer	Mark	AO1	AO2	AO3	Total
3.	<p>1 mark for each correct method identified, 1 mark for a correct description, to a maximum of 6 marks.</p> <ul style="list-style-type: none"> • Sequential access. Information / records in the file are processed / read in order. • Direct or random access. The file is organised via an index that enables access to specific records / The index will be based on key fields and will point to a specific location in the file which can be accessed directly without need to read previous records. • Indexed sequential access. A combination of sequential and direct access methods where indexes are located directly and then searched sequentially for the next level index or actual record. 	6	1b			6

Question	Answer	Mark	AO1	AO2	AO3	Total
4. (a)	<p>1 mark for each correct benefit to a maximum of 4 marks</p> <ul style="list-style-type: none"> • Avoids data duplication • Avoids inconsistent records • Data can be readily edited and updated • Data can be added and deleted as required • Can support complex queries • Enables different access levels to different data. 	4	1b			4
(b) (i)	<p>1 mark for each correct one to many relationship.</p> <p>Indicative content:</p>  <pre> graph TD Customer[Customer] --- Job[Job] Job --- Language[Language] Language --- Translator[Translator] </pre>	3		2b		3
(ii)	<p>1 mark for 4 suitable primary keys. 1 mark for each foreign key field identified in Job table. 1 mark for foreign key field identified in Translator table.</p> <p>Indicative content:</p> <ul style="list-style-type: none"> • Customer (CustomerID [P], Name, Address, TelephoneNo, Email). • Job (JobID [P], CustomerID [F], LanguageID [F], Description). • Languages (LanguageID [P], Name). • Translator (TranslatorID [P], LanguageID [F], Name, ContactNo.). <p>Ignore additional fields.</p>	4		2b		4

Question	Answer	Mark	AO1	AO2	AO3	Total
5. (a)	<p>Award one mark for each of the following:</p> <ul style="list-style-type: none"> • Correct construct (CREATE TABLE with brackets in correct places) • Identifying PRIMARY KEY • NOT NULL on at least one key field (should be present everywhere) • numeric has to be present <p>Indicative content CREATE TABLE Booking (bookingID char NOT NULL, holidayID char NOT NULL, bookingDate DateTime NOT NULL, holidayDate DateTime NOT NULL, customerID char NOT NULL, cost numeric(4,2) NOT NULL, PRIMARY KEY (bookingID));</p> <p>OR</p> <p>CREATE TABLE Booking (bookingID char NOT NULL PRIMARY KEY, holidayID char NOT NULL, bookingDate holidayDate DateTime NOT NULL, customerID char NOT NULL, cost numeric(4,2) NOT NULL);</p>	4			3b	4
(b) (i)	<p>1 mark for SELECT 1 mark for ORDER BY</p> <p>Indicative content SELECT destinationName, hotelName FROM Destination ORDER BY country;</p>	2			3b	2
(ii)	<p>1 mark for bookingID and customerID 1 mark for 'From Booking' and Between (Accept >= / <= / > / < for range).</p> <p>Indicative content SELECT bookingID, customerID FROM Booking WHERE ((holidayDate) BETWEEN '01/07/2022' AND '31/07/2022');</p>	2			3b	2
(iii)	<p>1 mark for INSERT INTO, 1 mark for correct fields in correct order</p> <p>Indicative content INSERT INTO Booking VALUES (ID1066, S198, 27/02/2022, 23/06/2022, C2001, 3125)</p>	2			3b	2

Question	Answer	Mark	AO1	AO2	AO3	Total
6. (a)	<p>1 mark for identifying an advantage to APT, 1 mark for correct description, to a maximum of 4 marks for 2 advantages / descriptions.</p> <ul style="list-style-type: none"> • Reliability • Software continually analysed and improved by a large community resulting in secure and stable code. • Independence from the original authors. • Code continues to be developed by its users. • Open standards • Removes the problem of incompatible formats that exists with proprietary software. <p>NOT cost</p>	4		2b		4
(b)	<p>1 mark for identification of utility and 1 mark for correct explanation to a maximum of 6 marks.</p> <p>Indicative content</p> <ul style="list-style-type: none"> • Archivers: To archive job folders for future reference. • Output a single file when provided with a directory or a set of files for long term storage. • Data conversion utilities • Transform data from a source file to some other format, such as from a text file to a PDF document for customers' distribution • Data recovery • Used to rescue good data from corrupted files. • Revision / version control utilities • Recreate a coherent structure where multiple users simultaneously modify the same file to help several translators work on a common source document. • File managers. Provide a method of performing routine data management tasks, • Assist staff in deleting, renaming, moving, copying, merging, setting write protection status, setting file access permissions, generating and modifying folders and data sets. <p>Accept: good description of defragmentation</p>	6		2b		6

Question	Answer	Mark	AO1	AO2	AO3	Total
7.	<p>1 mark for input of mark 1 mark for: subtracting pass mark from input 1 mark for: BRP and label1 1 mark for outputting 1 if passed 1 mark for outputting 0 if not passed 1 mark for correct DAT statement(s)</p> <p>Indicative content</p> <p> INP STA mark INP STA passmark LDA mark SUB passmark STA result BRP label1 BRA label2 label1 OUT 1 HLT label2 OUT 0 HLT mark DAT passmark DAT result DAT</p>	6			3b	6

Question	Answer	Mark	AO1	AO2	AO3	Total
8.	<p>1 mark for each correct point to a maximum of 2 marks for each function to a maximum of 6 marks.</p> <p>Crawling.</p> <ul style="list-style-type: none"> • The discovery process in which search engines send out a team of robots (crawlers or spiders) to find new and updated content, such as a webpage, an image, a video, etc. • The content is discovered by following links on webpages to find new URLs and then adding them to a the index of discovered URLs — to later be retrieved when a searcher is seeking information that the content on that URL is a good match for. <p>Indexing.</p> <ul style="list-style-type: none"> • Search engines process and store the information they find in an index, • The index is a large database of all the content they've discovered that is deemed suitable to serve to searchers. <p>Ranking</p> <ul style="list-style-type: none"> • During a search, search engines look through their index for highly relevant content and then orders that content by relevance to solve the searcher's query. • The higher a website is ranked, the more relevant the search engine believes that site is to the query. 	6	1b			6

Question	Answer	Mark	AO1	AO2	AO3	Total
9. (a)	<p>1 mark for correct role and 1 mark for suitable description to a maximum of 6 marks.</p> <p>Process management.</p> <ul style="list-style-type: none"> Process execution, including the allocation of processor time and termination is controlled by the kernel so the system makes efficient use of the CPU and functions properly. <p>Memory management</p> <ul style="list-style-type: none"> The kernel keeps track of the sections of memory that are currently allocated, manages the release of memory once processes have been executed and allocates / re-allocated memory to new processes that are ready for execution. <p>Device management / I/O communication.</p> <ul style="list-style-type: none"> Manages all the system's devices via communication with device driver software. All user inputs and all process outputs are handled by the kernel. <p>Interrupt handling.</p> <ul style="list-style-type: none"> Higher priority processes that are ready for execution will generate an interrupt signal, or request for CPU access. The kernel will handle the interruption of current processing, enable the CPU to process the higher priority event and then manage the return to the interrupted process 	6	1b			6
(b)	<p>1 mark for each correct point to a maximum of 4 marks</p> <ul style="list-style-type: none"> Limitation of alternative 8 bit character set Limitation related to context Scope of Unicode system. Scope related to context <p>Indicative content</p> <p>The alternative is to use 8 bit ASCII character sets which will support 256 bit patterns and only 128 characters and therefore cannot support two or more alphabets in the same document, which is a likely requirement for language translation. A standardised Unicode character set uses between 8 and 32 bits per character enabling over a million different bit combinations / codes that can be used to represent the various characters that are used in most / all of the world's languages.</p>	4		2b		4

Question	Answer	Mark	AO1	AO2	AO3	Total
10. (a)	<p>1 mark for a correct point to a maximum of 2 marks and 1 mark for relevant example.</p> <ul style="list-style-type: none"> Networking standards such as Wi-Fi protocols and Ethernet ensure the interoperability of networking technologies. The standards define the rules of communication among networked devices. Standards exist to help ensure products of different vendors are able to work together in a network without risk of incompatibility. Examples include Wi-Fi protocols and Ethernet. 	3	1b			3
(b)	<p>1 mark for identified risk, 1 mark for associated description to a maximum of 6 marks.</p> <p>Data theft Company data stored on the devices may be at risk if used over an unsecured wi-fi network away from the office</p> <p>Malware infiltration Malware downloaded during private use of the device could be transferred to the company network.</p> <p>Potential legal issues Company could face blame and legal consequences if a security breach through an employee's device results in the leaking of business data / customers' details.</p> <p>Device loss or theft Loss or theft of an employee's device could lead to data being compromised if the employee has not followed company security protocols.</p> <p>Poor mobile management. Risks connected with employees moving on to other employment and not deleting private company information.</p> <p>Lack of training. Company security requirements may not be fully understood or implemented. Formal training required or is document sign off adequate?</p>	6		2b		6

Question	Answer	Mark	AO1	AO2	AO3	Total
11.	<p>1 mark for advantage, 1 mark for associated explanation to a maximum of 6 marks.</p> <p>Memory utilisation CAD requires a lot of memory to accommodate the large drawing files. A 32-bit system can access 2^{32} memory addresses, i.e. 4 GB of RAM or physical memory. A 64-bit system can access 2^{64} memory addresses and is required to handle any amount of memory greater than 4 GB.</p> <p>Improved productivity due to speed of calculations. CAD software calculates the relative sizes and positions of the various screen entities. The number of calculations per second affects the speed at which the system can complete tasks. 64-bit multi core processors allow an increased number of calculations per second which will make the system run faster and operate more efficiently, improving the productivity of the CAD work.</p> <p>Multitasking Using 64-bit helps with multi-tasking, where users can easily switch between applications, or CAD tasks, without noticeable delays.</p>	6	2a			6

Question	Answer	Mark	AO1	AO2	AO3	Total
12.	<p>1 mark up to a total of 9 marks awarded by application of mark bands</p> <p>Indicative content</p> <p>Scope Contingency planning should be developed to anticipate the loss of one or more of the following system components:</p> <ul style="list-style-type: none"> • Computer room environment (secure computer room with climate control, conditioned and backup power supply, etc.) • Hardware (networks, servers, desktop and laptop computers, wireless devices and peripherals) • Connectivity to a service provider (fibre, cable, wireless, etc.) • Software applications (electronic data interchange, electronic mail, enterprise resource management, office productivity, etc.) • Data and restoration. <p>Inventory Identify critical software applications and data and the hardware required to run them. Using standardised hardware will help to replicate and reimage new hardware. Ensure that copies of program software are available to enable re-installation on replacement equipment.</p> <p>Backup Provide for effective backup measures, ideally off site.' and anticipate that backup software can fail, or the person responsible for backing up can fail therefore advantageous to use a cloud provider. The backup plan should cover;</p> <ul style="list-style-type: none"> • What data is important / worth backing up • Frequency of backup required • Can backups be automated • Can operations be moved into the Cloud? <p>Restore. The plan must identify recovery strategies to successfully restore data in the event the backup is needed, such as assembling the right recovery environment (operating systems and servers and storage) and the right people, applications and processes to bring back the data.</p> <p>Strategies The recovery plan might involve either dual centre, internal or external recovery.</p>	9	1b			9

Band	Q12 AO1b – Max 9 marks
3	<p style="text-align: center;">7–9 marks</p> <p>The candidate has:</p> <ul style="list-style-type: none"> • 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 responses that provide relevant detailed points, which relate to an extensive amount of the indicative content. • addressed the question appropriately with minimal repetition and no irrelevant material. • has presented a balanced discussion and justified their answer with examples. • effectively drawn together different areas of knowledge, skills and understanding from all relevant areas across the course of study • used appropriate technical terminology confidently and accurately.
2	<p style="text-align: center;">4–6 marks</p> <p>The candidate has:</p> <ul style="list-style-type: none"> • 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 responses that provide relevant points, which relate to the indicative content. • presented a discussion with limited examples. • drawn together different areas of knowledge, skills and understanding from a number of areas across the course of study. • used appropriate technical terminology.
1	<p style="text-align: center;">1–3 marks</p> <p>The candidate has:</p> <ul style="list-style-type: none"> • written a response that that lacks sufficient reasoning and structure. • produced a discussion which is not well developed. • attempted to address the question but has demonstrated superficial knowledge of the topics specified in the indicative content. Superficial knowledge is defined as responses that provide limited relevant points, which relate to a limited amount the indicative content. • used limited technical terminology.
0	Response is not credit worthy or not attempted.