GCE AS MARKING SCHEME

SUMMER 2019

**AS (NEW)
COMPUTER SCIENCE - COMPONENT 1
B500U10-1**

INTRODUCTION

This marking scheme was used by WJEC for the 2019 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.

Q	Answer	Marks	AO1	AO2	AO3	Tot
1(a)	Award one mark for each of the following: • Half-duplex • Data can travel in both directions but only in one direction at any given time	 1 1		 2.1b 2.1b		2
1(b)	Award one mark for each of the following: • Simplex • Data can only travel in one direction	 1 1		 2.1b 2.1b		2
1(c)	Award one mark for each of the following: • Full duplex • Data can travel in both directions at the same time	 1 1		 2.1b 2.1b		2

Q	Answer	Marks	AO1	AO2	AO3	Tot
2	Award one mark for each name and one for each description of the following up to a maximum of eight (4x2) CIR • Register that holds the instruction currently being executed. Registers • A small amount of fast access storage • Normally used for a specific purpose where data or control information is temporarily stored. • Control Unit o Directs the flow of instructions and/or data o Coordinates the other parts of the CPU o Generates clock ticks or controls the clock • Arithmetic Logic Unit o The ALU performs all the mathematical calculations and logical operations in the CPU. • MDR o Register of a computer's control unit that contains the data to be stored in the computer storage (e.g. RAM), or the data after a fetch from the computer storage. • MAR o Register that either stores the memory address from which data will be fetched to the CPU or the address to which data will be sent and stored. In other words, MAR holds the memory location of data that needs to be accessed. • PC o Processor register that indicates where a computer is in its program sequence. • Buses o Connects all the internal components of a computer, such as CPU and memory, to the motherboard. • Cache memory o stores copies of the data from frequently used main memory locations. o Most CPUs have different independent caches, including instruction and data caches, where the data cache is usually organized as a hierarchy of more cache levels (L1, L2, etc.)	8	1.1b			8

Q	Answer	Marks	AO1	AO2	AO3	Tot
3	Award one mark for each of the following up to a maximum of two marks for each method:					6
	• File backup • A data backup is a copy or archive of files and folders for the purpose of being able to restore them in case of data loss. ○ This involves storage of three of the most recent versions of master file. (grandfather – father - son) ○ Useful if one version is corrupted: the previous version(s) is still available. ○ Data should be stored off site in case of a disaster.	2	1.1b			
	Access Rights • Users can be given rights to certain files or file structures that prevent them from accessing them / changing them / deleting them. • File attributes	2	1.1b			
	Firewall • Prevents unauthorised access	2	1.1b			
	Encryption • Users are unable to access data within a file without the correct key / decryption	2	1.1b			
	Passwords • Users are unable to access data within a file without the correct password	2	1.1b			

Q	Answer	Marks	AO1	AO2	AO3	Tot
4(a)(i)	**One mark for each correct answer up to a maximum of three**					3
	• Relational database	1		2.1b		
	• Uses a primary key in each table which is a unique identifier, such as Customer ID in the Customers Table	1		2.1b		
	• Uses a foreign key, which is a primary key from another table, forming a link between the tables. For example, Customer ID in the Bookings Table.	1		2.1b		
	• 1:M relationships are used to link tables	1		2.1b		
4(a)(ii)	**Award one mark for each of the following up to a maximum of two.** Benefit: • Avoids data duplication • Avoids inconsistent records • Saves storage space	2		2.1b		4
	Award one mark for each of the following up to a maximum of two. Drawback: • Data Complexity when data resides in multiple tables, which are linked to each other through shared key values. • Maintaining / modifying relational databases can be difficult • Broken keys and records producing errors in other tables / queries	2		2.1b		
4(b)	• Database view allows a number of tables and records to be **restricted** so only certain users can see / amend certain sets of data.	1		2.1b		2
	Award one mark for any of the following: • For example, certain staff should not be able to see / amend salary information, but someone from management could. Other examples accepted where the restriction of sensitive data is illustrated.	1		2.1b		

Q	Answer	Marks	AO1	AO2	AO3	Tot
5	**Indicative content**					7
| | ```
1   Declare PTArray[18,7] (accept 17,6)
2   Group is integer
3   Period is integer
4   Element is string
5
6   input Period
7   input Group
8
9   if PTArray [Group, Period] = Null then
10  (accept reverse order indexing)
11      Output "Error, not found"
12  else
13      Element = PTArray[Group, Period]
14      Output "Element is:" , Element
15  end if
``` | | | | | |
	Award one mark for each of the following:					
	• Declare / initialise variables	1			3.1b	
	• Input Period	1			3.1b	
	• Input Group	1			3.1b	
	• Look up for Error (blank, null, error, zero)	1			3.1b	
	• Output Error message	1			3.1b	
	• Lookup value	1			3.1b	
	• Output value	1			3.1b	
6	Award one mark for each of the following:					6
	$$R.\left(\overline{S}+R\right)+Q.\left(\overline{Q}+P\right)+Q.\left(1+P\right)$$ $$R.\left(\overline{S}+R\right)+Q.\left(\overline{Q}+P\right)+Q$$ $$R.\overline{S}+R.R+Q.\overline{Q}+Q.P+Q$$ $$R.\overline{S}+R+0+Q.P+Q$$ $$R.\left(\overline{S}+1\right)+Q.\left(P+1\right)$$ $$R.\left(\overline{S}+1\right)+Q$$ $$R+Q$$ Or • Other methods equally accepted. **DO NOT** accept truth table solution.	1 1 1 1 1 1		2.1b 2.1b 2.1b 2.1b 2.1b 2.1b		

Q	Answer	Marks	AO1	AO2	AO3	Tot
7	Award one mark for each of the following up to a maximum of two for each: • **File indexing** o An indexed file is a computer file with an index that allows easy random access to any record given its file key. • **File conversion** o Convert a sound file from WAV to MP3 • **Defragmentation** o is the process where files are physically re-arranged on disk so that they are no longer fragmented and the parts of each file are stored together. • **Compression** o software reduces file sizes using less space • **Task management** o can see how much disk % a given program is using, can shut it down if dominating. • **Disk scanning and repair** o fixes problems on disk. • **Anti-virus software** o to scan for viruses which could be causing issues with the disk access speed / damaging data • **Backup** o software allows users to archive files and delete files on the hard disk to free up space Accept other types of utility software	6	1.1b			6

Q	Answer	Marks	AO1	AO2	AO3	Tot
8(a)	o Minimum value (award one mark for each of the following) **Unsigned Example** Mantissa: `0.1000000`$_2$ • Exponent: `0000`$_2$ • Denary value: 0.5_{10} x 2^0 = 0.5_{10} Maximum (award one mark for each of the following) Mantissa: `0.1111111`$_2$ • Exponent: `1111`$_2$ • Denary value: 0.9921875_{10} x 2^{15} = $32,512_{10}$ **Signed example** Mantissa: `0.1000000`$_2$ • Exponent: `0000`$_2$ • Denary value: 0.5^{10} x 2^0 = 0.5_{10} Maximum (award one mark for each of the following) Mantissa: 0.1111111_2 • Exponent: 0111_2 • Denary value: 0.9921875_{10} x 2^7 = 127_{10}	1 1 1 1 1 1 1 1 1 1 1 1		2.1b 2.1b 2.1b 2.1b 2.1b 2.1b 2.1b 2.1b 2.1b 2.1b 2.1b 2.1b		6
8(b)	**Original** `11.101111`$_2$ = 3.71875_{10} **Truncation** • `11.101111`$_2$ = `11.10`$_2$ = 3.5_{10} Error = `0.001110`$_2$ = 0.21875_{10} **Rounding** • `11.101111`$_2$ = `11.11`$_2$ = 3.75_{10} Error = `0.000010`$_2$ = 0.03125_{10} Accept answers in either binary or denary	1 1 1 1		2.1a 2.1b 2.1a 2.1b		4

Q	Answer	Marks	AO1	AO2	AO3	Tot
9(a)	Lexical analysis	1		2.1b		1
9(b)	One mark for each of the following: • There is an error with the word `ipnut` • Syntax analysis	1 1		2.1b 2.1b		2
9(c)	Code generation / Lexical Analysis	1		2.1b		1
9(d)	Code optimisation	1		2.1b		1
9(e)	**Award one mark for each of the following up to a maximum of 3 marks for each language type:** **High level** • They are easier to understand, learn and program as commands are more English-like • Identifiers can be long and meaningful • They allow the use of powerful commands that perform quite complex tasks • Allows creation of modules that can be re-used and accessed by other parts of the program **Low level** • Ideal when the execution speed is critical, e.g. boot strap loader • Less resource intensive than high level language programs • Requires less time for translation into machine code • Generally results in smaller executable programs (more machine code than necessary)	3 3	1.1b 1.1b			6

Q	Answer	Marks	AO1	AO2	AO3	Tot
10	**Award one mark for naming and one mark for describing each of the following (4x2).** • **Editor:** this allows a programmer to enter and edit source code/annotation • **Interpreter:** Translates each line/a single line of source code and executes it • **Automatic formatting**: Correctly indents code • **Automatic colour coding:** Changes key words, literals and annotation to different colours • **Linker:** this is a program which allows previously compiled code, from software libraries, to be linked together • **Loader:** this is a program which loads previously compiled code into memory. • **Debugger:** this is a program which helps locate, identify and rectify errors in a program • **Trace:** this is a facility which displays the order in which the lines of a program are executed, and possibly the values of variables as the program is being run • **Break point:** this is a facility which interrupts a program on a specific line of code, allowing the programmer to compare the values of variables against expected values. The program code can then usually be executed one line at a time. This is called single-stepping • **Variable watch:** this is a facility which displays the current value of any variable. The value can be 'watched' as the program code is single-stepped to see the effects of the code on the variable. Alternatively a variable watch may be set, which will interrupt the program flow if the watched variable reaches a specified value • **Memory inspector:** this is a facility which will display the contents of a section of memory • **Emulator:** will provide an emulator to run the code/app so no physical device required • **Context sensitive menu:** IDE suggests available options • **Statement completion**: IDE will complete a statement such as adding an 'end if' to an 'if' statement • **GUI creation:** Allows programmer to create a GUI by dragging and dropping controls (buttons, etc...) onto a form. • **Publisher:** facility to package up and deploy program as an easy to install package • **Code optimisation:** Warning message when variables have been declared but not used.	8	1.1b			8

Q	Answer	Marks	AO1	AO2	AO3	Tot
11	**Award one mark for each of the following up to a maximum of 5 marks for each document:** User documentation • step-by-step 'getting started' guides or tutorials for the main features of the system • installation guide • licence information • reference manual • online help, at the level of both individual controls, such as input fields, and at the task level • error messages and trouble-shooting guide • frequently asked questions (FAQs) detailing common questions and problems • glossary. Maintenance Documentation • Any form of diagrams used in analysis and design. • Descriptions of procedures and subroutines used. • The data structure: o What data structures have been used, database table designs and any other information about what data needs to be stored. • Algorithm designs: o Algorithms will normally be presented in pseudo-code or flowchart form. • Annotated code listings: o Code listings that abide by the coding standards set out by the development company. Normally self-documenting and/or annotated. • Variable lists: o Lists of the key variables listing their data types and purpose. More temporary variables, such as loop counters, would not be included. • Data dictionary: o This will describe all of the fields that need to be stored in the data structure including data type, size, relationship with other tables and a description. • Design documents: o Any relevant documentation from design phase. • Hardware and software requirements. o Performance o Storage o Networking	6	1.1b			6

Q	Answer	Marks	AO1	AO2	AO3	Tot
	o Compatibility					
	• Operating system					
	• Configuration guide and options:					
	• How the system can be configured, which could be through a menu system or by editing configuration files.					

Q	Answer	Marks	AO1	AO2	AO3	Tot
12(a)	**Award one mark for each of the following up to a maximum of three:** • fire, flood, lightning – natural disasters • hardware failure, e.g. power supply unit failing • software failure, e.g. virus damage • accidental damage • malicious damage, e.g. hacking, terrorism • redundancy – changes to technology resulting in obsolescence	3	1.1b			3

12(b)	**Award one mark for each of the following up to a maximum of three:**
	
	• Before the disaster: risk analysis, preventative measures including offsite backup and staff training
	   o ensure that when a disaster happens, loss of data is minimised and the company has ensured that the data can be recovered.
	• During the disaster: staff response – implement contingency plans
	   o prevents further damage to the data and begins immediate recovery of data
	• After the disaster: recovery measures, purchasing replacement hardware, re-installing software, restoring data from backups
	   o restores normal running and recovers all data.
		3	1.1b			3

Q	Answer	Marks	AO1	AO2	AO3	Tot
13	**Indicative content** **Consideration of Human Computer Interaction** • Consideration of an appropriate user interface e.g. GUI / CLI / Menus to assist Human Computer Interaction • Common interface devices, including keyboards and mice, are still in widespread use but are starting to be superseded by other human-computer interaction methods. • Voice input makes use of spoken language to allow interaction with a computer. • Touch screens are a feature of most new devices and can take advantage of gestures. • Force feedback offers haptic feedback to the user which is adding a new dimension to human-computer interactions • Virtual reality uses headsets to immerse the end user in an alternate world where they can interact by moving their bodies. Sensors track a user's movement and translate it into changes in the world the user is seeing. • Augmented reality overlays details onto a live camera feed or projects onto glass. It will make use of sensors and other data to give the user a more immersive experience. • New system design must be validated before being used to ensure that its implementation will match the requirements. • Prototypes can be used to test out an interface design. • Feedback in initial stages of a new design can be used to improve it before implementation. • Evaluation allows the development company and the customer to decide whether a project has been successful. The key issues that need to be part of any evaluation are: o Ensuring the requirements are met. o Ensuring the system responds in an acceptable timeframe. o Ensuring the product is robust. o Review if the product was developed on cost and on time. o Assess how useable the system is by the end user.	11	1.1b			11

Q	Answer	Marks	AO1	AO2	AO3	Tot
	Changeover Direct "big bang" approach can be adopted - sudden change to new system • Could be used where a failure would not be catastrophic • Can be cheaper to implement • New system is available immediately if required • Can be the least disruptive if implemented well • New system may not work as well until staff are fully used to using it • If new system fails organisation have no system which could be costly or dangerous Parallel running - both systems running together for a time • Safest option as if new system fails they still have existing system • New system is available immediately if required • The outputs from the old and new systems can be compared to check that the new system is running correctly • Expensive as require temporary staff or overtime for current staff to operate both systems • Could cause confusion for staff / customers having two systems Phased changeover - part-by-part (by functionality) • Allows users to gradually get used to the new system • Staff training can be done in stages • All staff can focus on one area to resolve any problems • Problems can be fixed quicker as more experts to resolve one functionality problem at a time • Difficulties identified in one area can be resolved and managed in next area • Might cause problems in the changeover period when they need to communicate with each other and have different systems • Slower to get new system up and running compared to some other methods • If a part of the new system fails, there is no back-up system, so data can be lost • Some systems cannot easily be broken down by functionality Pilot changeover - part-by-part (by part of the organisation) • All features of the new system can be fully trialled • If something goes wrong with the new system, only a small part of the organisation is affected					

Q	Answer	Marks	AO1	AO2	AO3	Tot
	• The staff who were part of the pilot scheme can help train other staff. • All staff can focus on one area to resolve any problems • Difficulties identified in one area can be resolved and managed in next area • For the office / department doing the pilot, there is no back-up system if things go wrong • Might cause problems in the changeover period when they need to communicate with each other and have different systems o Slower to get new system up and running compared to some other methods.					

Q	Answer	Marks	AO1	AO2	AO3	Tot
Band	**AO1.1b** • **Max 11 marks**					
3	**9 - 11 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 indicative content. Clear knowledge is defined as a response that provides nine to eleven relevant detailed points which relate to an extensive amount of the indicative content both in relation to Human Computer Interaction, in a variety of user environments, and Changeover. • addressed the question appropriately with minimal repetition and no irrelevant material • has presented a balanced discussion and justified their answer with examples • used appropriate technical terminology referring to the indicative content confidently and accurately.					
2	**4 - 8 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 as specified in the indicative content. Satisfactory knowledge is defined as a response that provides four to eight points as signalled in the indicative content both in relation to Human Computer Interaction and Changeover. • has presented a discussion with limited examples • 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 • 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 provides one to three points as signalled in the indicative content • used limited technical terminology referring to the indicative content.					
0	**0 marks** • Response not credit worthy or not attempted.					
Total	100					
			57	36	7	100