GCE A LEVEL MARKING SCHEME

SUMMER 2019

A LEVEL (NEW)
COMPUTER SCIENCE - COMPONENT 1
A500U10-1

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.

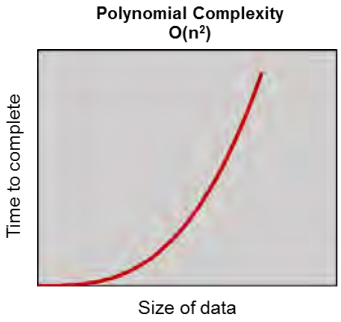
It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

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

GCE A LEVEL COMPUTER SCIENCE - COMPONENT 1

SUMMER 2019 MARK SCHEME

Question	Answer	Mark	AO1	AO2	AO3	TOTAL
1(a)	**One mark for each of the following up to a maximum of 4.**					4
	High level languages are closer to the semantics of spoken language.	1	1.1b			
	Each line of high level language translates in to multiple lines of machine code.	1	1.1b			
	Low level languages such as assembly language uses mnemonics.	1	1.1b			
	Each line of low level language is translated into one machine code instruction.	1	1.1b			
	Identifiers can be long and meaningful	1	1.1b			
	They allow use of more powerful commands that perform quite complex tasks	1	1.1b			
	Allows the creation of modules that can be re-used and accessed by other parts of the program.	1	1.1b			
1(b)	**One mark for stating a situation and one mark for the description**					2
	Device drivers - low level language must be used to directly access memory addresses to fully control hardware.	1	1.1b			
	Embedded software – software that runs on simple devices using simple microprocessors such as washing machines and microwaves will need direct access to the hardware	1	1.1b			
	Real-time software – simulators or fly-by-wire systems that require precise processing, timings or accuracy could potential benefit from using a low-level language.	1	1.1b			
	Assembly language can produce more compact code which can be important when placing on a chip.	1	1.1b			

Question	Answer	Mark	AO1	AO2	AO3	TOTAL
2(a)	1 mark for identifying i loop will execute n times. Accept n-1, n-2	1			3.1c	5
	1 mark for identifying j loop will execute n^2 times. Accept n^2-1 but not n^2-2	1			3.1c	
	1 mark for correct numbers of calculations $2n^2 + n$	1			3.1c	
	1 mark for determining that the order will be dominated by n^2	1			3.1c	
	1 mark for determining that the growth rate for time performance is $O(n^2)$	1			3.1c	
2(b)						3
	Time axis labelled correctly	1		2.1b		
	Size axis labelled correctly	1		2.1b		
	Correct gradient of line	1		2.1b		
2(c)	The algorithm only uses one data structure, a one-dimensional array. Therefore, total storage requirements = 1.	1			3.1c	2
	As only one data structure is being used, the growth rate for memory will be constant O(1). **Condone O(N)**	1			3.1c	

Question	Answer	Mark	AO1	AO2	AO3	TOTAL
3(a)	Correct answer can be established using different steps / laws / rules / identities / dual relations. One possible solution: $\overline{A.A} + A.B + \overline{A.B}$ $\overline{A} + \overline{A} + A.B + \overline{A} + \overline{B}$ $\overline{A} + A.B + \overline{B}$ $\overline{(A} + A).(\overline{A} + B) + \overline{B}$ $\overline{A} + B + \overline{B}$ $\overline{A} + 1$ 1 Correctly applying identities to arrive at correct answer 5 marks Correctly applying identities but arriving at wrong answer 1 mark for each correct step up to a maximum of 4			2.1a		5
3(b)	Correct answer can be established using different steps / laws / rules / identities / dual relations. One possible solution: $A.(B + B) + A.(\overline{A} + \overline{B})$ $A.(B + B) + A.\overline{A} + A.\overline{B}$ $A.(B) + 0 + A.\overline{B}$ $A.B + A.\overline{B}$ $A + A$ A Correctly applying identities to arrive at correct answer 4 marks Correctly applying identities but arriving at wrong answer 1 mark	5		2.1a 2.1a		5

Question	Answer	Mark	AO1	AO2	AO3	TOTAL
4	**One mark for each of the following up to a maximum of 2.**		1.1b			6
	Alpha testing is conducted in-house by developers and occurs before the customer agrees to accept the final program.	1				
	Alpha builds are not shared with either the end user or with the customer.	1				
	Alpha builds are not final piece of software and often include limited functionality and many bugs.	1				
	One mark for each of the following up to a maximum of 2					
	Beta testing is conducted after alpha testing and later on in the software development life cycle.	1				
	Beta builds are shared with a limited number of end users to beta test the system with live data.	1				
	Beta builds contain all the main functionality but will still include some bugs.	1				
	Bugs reported by the beta testers are corrected by the development team.	1				
	One mark for each of the following up to a maximum of 2					
	Acceptance testing occurs is the final phase of testing during the software development life cycle.	1				
	Acceptance testing is undertaken by the actual end users of the system with real data.	1				
	The purpose of acceptance testing is to ensure the system has met the original requirements and specifications of the customer.	1				

Question	Answer	Mark	AO1	AO2	AO3	TOTAL
5(a)	**One mark for each of the following up to a maximum of 4**					4
	Algorithms/programs can be broken down in to smaller parts.	1	1.1b			
	These are named reusable pieces of code that can be called any number of times within an algorithm/program to perform a specific task.	1	1.1b			
	Procedures are used to avoid the duplication of code.	1	1.1b			
	Procedures are used to make an algorithm/program more efficient and secure.	1	1.1b			
	Each procedure can be individually tested / debugged	1	1.1b			
5(b)	Call by reference is where a value (address) is passed via a parameter into a subroutine and the original value is passed and used by that subroutine.	1	1.1b			4
	This is used if any changes made in the subroutine needs to be stored in the original value/variable outside the subroutine.	1	1.1b			
	Call by value is where a value is passed via a parameter into a subroutine and a copy of the value is created for the duration of the subroutine call.	1	1.1b			
	This ensures that the original value passed to the subroutine cannot be changed.	1	1.1b			
5(c)	The lifetime of the variable TArea is only during the call of the function trapeziumArea.	1		2.1b		2
	As soon as the trapeziumArea function call ends the variable lifetime ends.	1		2.1b		
5(d)	The variable a has local scope in the subprocedure MainProg.	1		2.1b		2
	The variable cannot be accessed outside of this subroutine for example by the function trapeziumArea.	1		2.1b		

<table>
<tr><th>Question</th><th>Answer</th><th>Mark</th><th>AO1</th><th>AO2</th><th>AO3</th><th>TOTAL</th></tr>
<tr><td>6</td><td>
<table>
<tr><th>A</th><th>B</th><th>C</th><th>$(B + C)$</th><th>$A.B$</th><th>$A.C$</th><th>$A.(B + C)$</th><th>$(A.B + A.C)$</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>
Award one mark for each correct column
Award one mark for correct combinations of A,B and C</td><td>5
1</td><td></td><td>2.1b
2.1b</td><td></td><td>6</td></tr>
<tr><td>7</td><td>X 01011011_2
Key 11001110_2
XOR 10010101_2

Retrieving the original:

10010101_2
Key 11001110_2
XOR 01011011_2
The encrypted data is produced by applying the XOR operator to the data (X) with the key (Y). The encrypted data can then only be read by someone who knows the same key (Y). Decryption is achieved by applying the XOR operator to the encrypted data using the same key (Y) to retrieve the original data.</td><td>1

1

1</td><td>
1.1b</td><td>2.1a

2.1a</td><td></td><td>3</td></tr>
<tr><td>8</td><td><letter> ::= A|B|C . . . Y|Z
<digit> ::= 0|1|2 . . . 8|9

<digits> ::= <digit><digit><digit><digit><digit><digit>
<year>::= 1900|1901|1902 . . . 2199|2200
<type>::=S|V|C
<letters>::=<letter><letter>|<letter><letters>
<id>::=<letters><digits>
<cardcode>::= <id> - <year><type>

Answer not correct if BNF notation used incorrectly.
Must include hyphen (-) for full marks.</td><td>1

1
1
1
1</td><td></td><td>2.1b

2.1b
2.1b
2.1b
2.1b</td><td></td><td>5</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Mark</th><th>AO1</th><th>AO2</th><th>AO3</th><th>TOTAL</th></tr>
<tr><td>9</td><td>Indicative content
<pre><code>Declare myArray[0 … 999] of integer
i is integer
k is integer
currentItem is integer

for i = 0 to len(myArray) – 1

        currentItem = myArray[i]

        j = i

        while (j > 0 and myArray[j – 1] > currentItem)

                myArray[j] = myArray[j – 1]

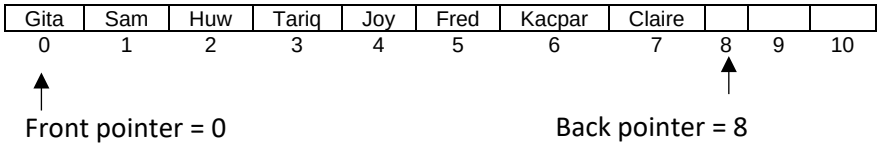
                j = j - 1

        endwhile

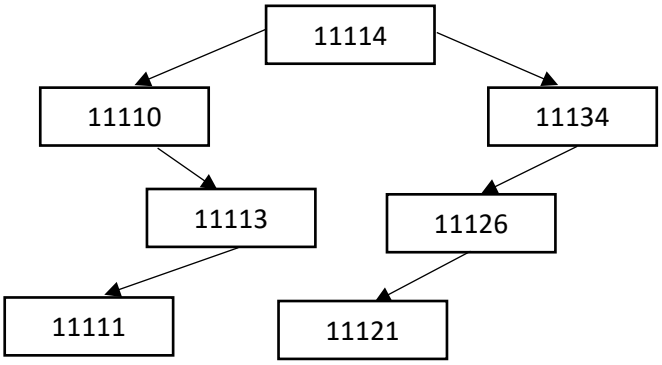
        myArray[j] = currentItem

next i</code></pre></td><td></td><td></td><td></td><td></td><td>7</td></tr>
<tr><td></td><td>Declare and initialise variables</td><td>1</td><td></td><td></td><td>3.1b</td><td></td></tr>
<tr><td></td><td>Use of inner and outer loop with terminating condition</td><td>1</td><td></td><td></td><td>3.1b</td><td></td></tr>
<tr><td></td><td>Correct condition in inner loop</td><td>1</td><td></td><td></td><td>3.1b</td><td></td></tr>
<tr><td></td><td>Initialise j to value of i</td><td>1</td><td></td><td></td><td>3.1b</td><td></td></tr>
<tr><td></td><td>Swap myArray[j] with next element</td><td>1</td><td></td><td></td><td>3.1b</td><td></td></tr>
<tr><td></td><td>Decrement j</td><td>1</td><td></td><td></td><td>3.1b</td><td></td></tr>
<tr><td></td><td>Set myArray[j] to currentItem</td><td>1</td><td></td><td></td><td>3.1b</td><td></td></tr>
<tr><td>10(a)</td><td>Validation is the process of checking if the data entered is sensible in the context in which it is being used. Validation reduces the possibility of entering invalid data into a system.</td><td>1</td><td>1.1b</td><td></td><td></td><td>2</td></tr>
<tr><td></td><td>An example of a validation is a range check on dates.
Accept any suitable example.</td><td>1</td><td>1.1a</td><td></td><td></td><td></td></tr>
<tr><td>10(b)</td><td>Verification is a means of checking to see if the data being entered is consistent. Verification reduces the chance of incorrect data being entered into a system.</td><td>1</td><td>1.1b</td><td></td><td></td><td>2</td></tr>
<tr><td></td><td>An example of a verification is duplicate entries of data.
Accept any suitable example.</td><td>1</td><td>1.1a</td><td></td><td></td><td></td></tr>
</table>

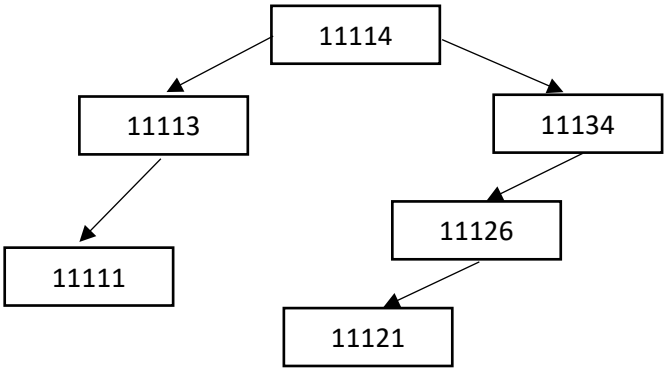
Question	Answer	Mark	AO1	AO2	AO3	TOTAL
11	**One mark for definition, one mark for example.** Translation errors **–** usually identified by a compiler where the instructions given cannot be translated to machine code due errors. Syntax error e.g. IF without ENDIF or punctuation error or spelling error if correct words given Linking error e.g. calling a standard function where the correct library has not been linked to the program Semantic Error e.g. Variable declared illegally **One mark for definition, one mark for example.** Runtime errors – Even though a program will compile and execute it could unexpectedly crash or produce incorrect results. Logical error e.g. division by 0 or use of incorrect logical/comparative operator File handling e.g. When an attempt is made to write to a file that does not exist.	2 2		1.1a 1.1a		4

Question	Answer	Mark	AO1	AO2	AO3	TOTAL
12(a)	A queue data structure operates on the first in first out principle (FIFO) or the last in last out (LILO) principle. Data items are added at the end of the queue and removed from the front. Accept references to pointers	1 1	1.1a 1.1a			2
12(b)(i)	queueArray []  1 mark for identifying a front pointer 1 mark for identifying a back pointer 1 mark for representation of one dimensional array	 1 1 1	 	 2.1a 2.1a 2.1a	 	3

12(b)(ii)	**Indicative content**
	
	`if frontPointer <> backPointer then`
	`  queueArray[frontPointer] = Null`
	`  frontPointer = frontPointer + 1`
	
	`else`
	`  output “Queue is empty”`
	`end if`
	
	1 mark for adjusting the front pointer and removing the data item
	1 mark for correct condition and output message
		
		1
		1
			
					3.1b
					3.1b
						2

<table>
<tr><th>Question</th><th>Answer</th><th>Mark</th><th>AO1</th><th>AO2</th><th>AO3</th><th>TOTAL</th></tr>
<tr><td>13(a)</td><td> 

1 mark for correct root
1 mark for ALL left pointers correct
1 mark for ALL right pointers correct</td><td>
1
1
1</td><td></td><td>
2.1a
2.1a
2.1a</td><td></td><td>3</td></tr>
<tr><td>13(b)</td><td>
<table>
<tr><th></th><th>Left Pointer</th><th>Data</th><th>Right Pointer</th></tr>
<tr><td>0</td><td>4</td><td>11114</td><td>1</td></tr>
<tr><td>1</td><td>2</td><td>11134</td><td>-1</td></tr>
<tr><td>2</td><td>3</td><td>11126</td><td>-1</td></tr>
<tr><td>3</td><td>-1</td><td>11121</td><td>-1</td></tr>
<tr><td>4</td><td>-1</td><td>11110</td><td>5</td></tr>
<tr><td>5</td><td>6</td><td>11113</td><td>-1</td></tr>
<tr><td>6</td><td>-1</td><td>11111</td><td>-1</td></tr>
<tr><td>7</td><td></td><td></td><td></td></tr>
<tr><td>8</td><td></td><td></td><td></td></tr>
</table>
1 mark for data in the correct order
1 mark for ALL left pointers correct
1 mark for ALL right pointers correct</td><td>
1
1
1</td><td></td><td>
2.1a
2.1a
2.1a</td><td></td><td>3</td></tr>
</table>

Question	Answer	Mark	AO1	AO2	AO3	TOTAL
13(c)	 1 mark for replacing 11110 with 11113.	1		2.1a		1

Question	Answer	Mark	AO1	AO2	AO3	TOTAL
14	**Indicative content** General Data Protection Regulation 2018 • A set of rules to protect the privacy of all European Union citizens. • GDPR is to simplify the data, privacy and consent legislation across the EU in the digital age. • All private data must be collected lawfully and with consent. • All data collected and stored must be protect from misuse and exploitation. • The types of data considered personal under the existing legislation include name, address, and photos. • GDPR extends the definition of personal data so that something like an IP address can be personal data. • It also includes sensitive personal data such as genetic data, and biometric data which could be processed to uniquely identify an individual. • Under the GDPR it is a legal requirement that data breaches such has hacking are reported to the relevant authorities within 72 hours and the consumer has a right to know when a breach occurs. • Businesses also need to make it easier for consumers to access their data and be very clear on how their data is being processed and used. • GDPR also acknowledges the right to be forgotten where by a business should delete data help on a consumer if they have no grounds to retain it. • Parental consent is required for the processing of data of under 16-year olds. • Data processors can be directly liable for the security of personal data.		1.1b			13

Question	Answer	Mark	AO1	AO2	AO3	TOTAL
	Data Protection Act 1998 • Personal data shall be processed fairly and lawfully. • Personal data shall be obtained only for one or more specified and lawful purposes, and shall not be further processed in any manner incompatible with that purpose or those purposes. • Personal data shall be adequate, relevant and not excessive in relation to the purpose or purposes for which they are processed. • Personal data shall be accurate and, where necessary, kept up to date. • Personal data processed for any purpose or purposes shall not be kept for longer than is necessary for that purpose or those purposes. • Personal data shall be processed in accordance with the rights of data subjects under this DPA. • Appropriate technical and organisational measures shall be taken against unauthorised or unlawful processing of personal data and against accidental loss or destruction of, or damage to, personal data. • Personal data shall not be transferred to a country or territory outside the EU unless that country or territory ensures an adequate level of protection for the rights and freedoms of data subjects in relation to the processing of personal data. The Regulation of Investigatory Powers Act 2000 and the Investigatory Powers Act 2016 • Internet and communications companies such as internet service providers and mobile telecommunications providers retain customer browsing history for up to one year. This data can be accessed by a range of public bodies including British security services and the police, upon issue of a warrant. • Allows the GCHQ, MI6 and MI5 to collect bulk personal datasets including NHS Health Records. When information is bulk collected, it will not only contain information on persons of interest but will also contain information on innocent members of the public. • Allows the GCHQ, MI6 and MI5 to carry out equipment interference also known as 'hacking' personal digital devices upon issue of a warrant. These devices include personal computers and mobile phones. If there is encryption on the devices the service provider will have to comply in bypassing the device security to access any personal data. Human Rights Act 1998 Article 8 • Right to a private and family life. **Any examples of suitable measures**					

Band	Q13 AO1b - Max 13 marks					
3	**10 – 13 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 responses that provide relevant detailed points on how current legislation impacts on private data and what measures can be taken to protect this data, 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	**5 - 9 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 responses that provide relevant points on how current legislation impacts on private data and what measures can be taken to protect this data, 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	**1- 4 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 responses that provide limited relevant points on how current legislation impacts on private data and what measures can be taken to protect this data, which relate to a limited amount the indicative content. • used limited technical terminology.					
0	Response not credit worthy or not attempted.					