GCE A LEVEL MARKING SCHEME

SUMMER 2018

A LEVEL (NEW)
COMUTER SCIENCE - UNIT 3
1500U30-1

INTRODUCTION

This marking scheme was used by WJEC for the 2018 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.

WJEC GCE A Level Computer Science - Unit 3

Mark Scheme Summer 2018

Qu	Answer	Mark	AO1	AO2	AO3	Total
1a	 Award 1 mark root node Award 1 mark correct structure	 1 1		 2a 2b		2
1b	G D B A C F E L I J O M One mark for each of the following up to a maximum of two Clone a tree Count the number of leaves Convert expression tree to prefix notation	1 1	 1b	2a		2
1c	A B C D E F G I J L M O Sort/search a binary tree Accept traversing alphabetically	1 1	 1b	2a		2
1d	A C B E F D J I M O L G One mark for each of the following up to a maximum of two Deleting / Undo a binary tree Stack-based programming Convert postfix notation to expression tree	1 1	 1b	2a		2

Qu	Answer	Mark	AO1	AO2	AO3	Total
2a	Functionality – the system must produce correct results for a given set of inputs.	1	1b			2
	Performance – the system must produce results within an acceptable timeframe.	1	1b			
2b	A natural user interface uses relies on intuitive actions related to natural, everyday human behavior.	1	1a			6
	One mark for each of the following examples up to a maximum of two marks Examples include: • Touch screens, where uses touch or tap graphic icons. • Gesture recognition systems which track and translate user movements into instructions. • Speech recognition systems that identify spoken words and phrases and convert them into instructions.	1 1	1b 1b			
	An immersive interface places one or more of the user's sense into a computer generated virtual environment.		1a			
	One mark for each of the following examples up to a maximum of two marks	1	1b 1b			
	Examples include: • Virtual reality headsets or HMDs (head mounted displays) which receive video from a computer, possibly with head tracking (up and down movement). • Binaural or 3D earphones to filter out natural sound and replace with a chosen selected audio. • Force feedback and touch controls provide sensation of using hands within a virtual environment.	1 1				
3						3

A	B	$\overline{A+B}$	$\overline{A}$	$\overline{B}$	$\overline{A}.\overline{B}$
0	0	1	1	1	1
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	0

Qu	Answer	Mark	AO1	AO2	AO3	Total
	1 mark for correct column $\overline{A+B}$	1		2a		
	1 mark for correct column $\overline{A}$ and column $\overline{B}$ 1 mark for correct	1		2a		
	column $\overline{A}.\overline{B}$	1		2a		

Qu	Answer	Mark	AO1	AO2	AO3	Total
4a	Award one mark for each of the following: $$\overline{A.B} + A$$ Using De Morgan's Law $\overline{A.B} = \overline{A} + \overline{B}$ $$\overline{A} + \overline{B} + A$$ Using Boolean identity $\overline{A} + A = 1$ $$\overline{B} + 1$$ Using Boolean identity $\overline{B} + 1 = 1$	1 1 1		2a 2a 2a		3
4b	Award one mark for each of the following: A.B.($\overline{B}$ +C) + B.C + B A.B. $\overline{B}$ + A.B.C + B.C + B A.0 +A.B.C + B(C + 1) (B. $\overline{B}$ = 0) A.B.C + B (C + 1 = 1) B(A.C + 1) B (A.C + 1 = 1)	 1 1 1 1 1		 2a 2a 2a 2a 2a		5
5a	Award two marks for each of the following, one for feature, one for description, up to a maximum of 4: Auto completion or code completion Suggests or completes the function being typed including variables and arguments OR Bracket matching Useful when coding in a language that uses blocks of code contained within brackets, for detecting missing brackets. OR Syntax checks Recognises and highlights errors in syntax during code input. Maximum 4 marks. 2 marks for naming tools, 2 marks for expansions. OR Formatting e.g. indentation or colour coding of variables	 1 1 1 1 1 1 1	1b			4
5b	• Converting the source code written by the programmer into machine code / executable code.	1	1b			
5c	• Errors in code syntax / syntax errors will prevent translation. • e.g. spelling mistakes in command works / incorrect punctuation. • Logical errors / semantic errors / runtime errors. • e.g. 2 + 2 = 4 included as 2 * 2 = 8, any error in logic. • divide by 0, infinite loops, referencing missing files. Maximum 4 marks. 2 marks for naming errors, 2 marks for correct examples.	1 1 1 1	1b			4

Qu	Answer	Mark	AO1	AO2	AO3	Total
6a						2

decNumber	decNumber MOD 2	bin	answer
137	1	1	1
68	0	0	01
34	0	0	001
17	1	1	1001
8	0	0	01001
4	0	0	001001
2	0	0	0001001
1	1	1	10001001

Qu	Answer	Mark	AO1	AO2	AO3	Total
	Award 1 mark for order of answer	1			3c	
	Award one mark for correct answer (10001001) -	1			3c	
6b	Converts decimal numbers to binary numbers	1		2b		1
6c	bin as integer, despite being either 1 or 0, because values are to be used to form a binary number.	1		2b		3
	answer as string to represent **the bit pattern** of the denary numbers expressed as a binary number.	1		2b		
	Each time the loop is executed the result of the MOD calculation is placed at the **beginning** of the output string.	1		2b		
7a	• Sets out the professional standards required by the Institute as a condition of membership.	1		2a		2
	• a code of conduct includes standards for professional competence and integrity.	1		2a		
7b	One mark for each of the following up to a maximum of two	1		2b		2
	• Only undertake to do work or provide a service that is within your competence. • **NOT** claim any level of competence as an ICT Technician that you do not possess.	1		2b		
	• Develop your professional knowledge, skills and competence on a continuing basis, maintaining awareness of technological developments, procedures, and standards that are relevant to school ICT systems • Ensure that you have the knowledge and understanding of Legislation and that you comply with such Legislation, in carrying out your professional responsibilities within the school. 1 mark each point to a maximum of 2	1		2b		

Qu	Answer	Mark	AO1	AO2	AO3	Total
7c	• Respect and value alternative viewpoints and, seek, accept and offer honest criticisms of work by teachers and management	1		2b		2
	• Avoid injuring others, their property, reputation, or employment by false or malicious or negligent action or inaction.	1		2b		
	• Reject and will not make any offer of bribery or unethical inducement in relation to exams or coursework	1		2b		
	• Confidentiality, respect confidentiality of pupils, exams, and staff	1		2b		
	1 mark each point to a maximum of 2					

Qu	Answer	Mark	AO1	AO2	AO3	Total
8a	• Hash table stores data in an associative array and uses a hash technique to generate an index where details of stock items are to be inserted into the table.	1		2b		3
	• The index is a numeric value calculated from the stock item's key value.	1				
	• The hash table provides direct access to the stock item via its index and therefore performance is not affected by the number of items stored.	1				
8b	One mark for each of the following as indicated up to a maximum of four.					4
	Definition of characters: <lowercase letter> ::= a|b|c . . . . . .|z <uppercase letter>::=A|B|C . . . . .|Z <digit>::= 0|1|2|3|4|5|6|7|8|9	1				
	Definition of string / number: <string> ::= <lower case letter>|<string><lower case letter> <number>::= <digit>|<number><digit>	1				
	Definition of letters / digits <two letters> ::= <uppercase letter><uppercase letter> <two digits> ::= <digit><digit>	1				
	Definition of address: <house name> ::= <uppercase letter>|<uppercase letter><string> <street name> ::= <uppercase letter>|<uppercase letter><string>	1				
	<postcode> ::= <two letters><two digits><two letters>|<two letters><two digits><digit><two letters>	1				
	<street> ::=<number><street name>|<house name><street name>	1				
	<town> ::= <uppercase letter><string>	1				
	<postal address> ::=<street><town><postcode>	1				

9a	• Iteration is repeating a set of instructions • a set number of times or until a logical condition is satisfied	1 1	1b 1b			2
9b	• Recursion is a method where a function calls itself • with different input values until the base case is reached	1 1	1b 1b			2
9c	Iterative solutions tend to be: • Easier to program • Easier to understand / maintain. • Functions that just iterate make no demands on stack space, and may be more efficient where memory is limited. • Each time a recursive function is called, certain values are placed onto the stack - this takes time and uses memory and if not terminated could use all stack space causing the program to crash.	1 1 1 1	1b 1b 1b 1b			4
10a	One mark for each of the following up to a maximum of two • Validation aims to make sure that data is sensible, reasonable, complete and within acceptable boundaries. • It is the process of checking the data against a set of validation rules set up in a program. • Validation only proves that the data entered has a reasonable value and cannot prove that the data entered is what the user intended	1 1 1	1b 1b 1b			2

10b	Indicative content					11

```
        Declare checkDate
        LeapYear is boolean
        Year is integer
        Month is integer
        Day is integer
        flag is integer
        input Date
        Year = val(mid(Date, 7, 4))
        Month = val(mid(Date, 4, 2))
        Day = val(mid(Date, 1, 2))
        flag = 0
        if Year Mod 4 = 0 then
            LeapYear = True
        end If
        if Month < 13 then
                if Month = 1 Or Month = 3 Or Month = 5
                Or Month = 7 Or Month = 8 Or Month = 10
                Or Month = 12 then
                  if Day <= 31 then
                            flag = 0
                  else
                      flag = 1
                  end if
              else
                  if Month = 4 Or Month = 6 Or Month =
        9 Or Month = 11 then
                        if Day <= 30 Then
                                flag = 0
                        else
                            flag = 1
                        end if
                  end if
            end if
        else
            flag = 1
        end if
if LeapYear = True then
        if Month = 2 then
            if Day <= 29 then
                    flag = 0
            else
                flag = 1
            end if
        else
            if Month = 2 then
                if Date <= 28 then
                        flag = 0
                else
                    flag = 1
                end if
            end if
        end if
    end if
if flag = 0 then
     Print "date is correct"
else
     Print "date is incorrect"
end if
```

	``
end subroutine
```
Award one mark for:<br>• Declare/initialise<br>• Setting a flag<br>• String handling year<br>• String handling month<br>• String handling day<br>• Calculation of leap year<br>• Month comparisons for 31 days<br>• Month comparisons for 30 days<br>• Month comparisons for 29 days<br>• Month comparisons for 28 days<br>• Output correct message | 1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1 | | | 3b | |
| 11a | One mark for each of the following up to a maximum of four.<br>• OOP is a programming paradigm based on objects,<br>• objects are made up of properties and methods<br>• which are data structures.<br>• operations or functions which are applied to the data structures<br>• and code in the form of procedures<br>• known as methods | 1<br>1<br>1<br>1<br><br>1<br>1 | 1b<br>1b<br>1b<br>1b<br><br>1b<br>1b | | | 4 |
| 11b | • A class is a programming template for creating objects<br>• An object is built from a class, an instance is a variable that holds the memory address of the object<br>• It is possible to have many objects from the same class and many instances of each of these objects. | 1<br>1<br><br>1 | 1b<br>1b<br><br>1b | | | 3 |
| 11c | One mark for each of the following up to a maximum of three.<br><br>• A method is a program routine<br>• within an object<br>• designed to carry out a particular task on data within that object (private)<br>• or provided by another part of the program (public)<br>• Methods can be inherited from parent classes | <br><br>1<br>1<br>1<br><br>1<br>1 | <br><br>1b<br>1b<br>1b<br><br>1b<br>1b | | | 3 |

| 12 | **Indicative content** | 10 | 1b | | | 10 |
|---|---|---|---|---|---|---|
| | Standardisation allows changes and enhancements to be incorporated in a controlled manner. Programming languages are subject to continuous development resulting in multiple versions that are often not fully compatible with each other. Standardisation aims to avoid these incompatibilities and provide advantages in design and programming such as; | | | | | |
| | **Portability of programs.** There is a high possibility that applications written for a particular hardware platform may be used on different platforms if the applications were developed in a standardised language because compilers/interpreters for standardised languages exist for diverse hardware platforms. | | | | | |
| | **Portability of programmers.** A programming language is an interface between the programmer and the computing system or a hardware platform. If the different platforms support a standard programming interface, then the skills of the programmer is portable across these platforms. | | | | | |
| | **Easier to maintain the software.** Most software requires continuous maintenance and enhancements after the original release. Most of the time, different programmers work on such maintenance tasks. A standardised language ensures that there will be sufficient skilled programmers available to carry out maintenance tasks. | | | | | |
| | **Acceptability.** Most business organisations would not consider using a programming language that is not standardised. A non-standardised language is a big risk for business-critical software development. | | | | | |
| | **Faster development**. Standardisation promotes standard ways of working and therefore speeds up team working in development. | | | | | |
| | **Standard library.** In addition to the particular programming language, a common set of library functions for that language may be standardised, to support "generic programming". This provides a language abstraction a level above the language itself, promoting re-use and faster programming. Libraries have been written by experts and thoroughly tested. | | | | | |
| | **Standard algorithms**, reference to binary search, quick sorts etc. and benefits arising in design time and accuracy. | | | | | |

| Band | AO1b - Max 10 marks | | | | | |
|------|---------------------|---|---|---|---|---|
| 3 | **AO1b– 8 - 10 marks**<br>The candidate has:<br>• written an extended response that has a sustained line of reasoning which is coherent, relevant, and logically structured<br>• 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 of the implications of program standardisation, which relate to an extensive amount of the indicative content.<br>• addressed the question appropriately with minimal repetition and no irrelevant material<br>• has presented a balanced discussion and justified their answer with examples<br>• 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 | **4 - 7 marks**<br>The candidate has:<br>• written a response that has an adequate line of reasoning with elements of coherence, relevance, and logical structure<br>• 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 of the implications of program standardisation, which relate to the indicative content.<br>• presented a discussion with limited examples<br>• 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- 3 marks**<br>The candidate has:<br>• written a response that that lacks sufficient reasoning and structure<br>• produced a discussion which is not well developed<br>• 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 and used limited technical terminology. | | | | | |
| 0 | No response of any worth | | | | | |