GCE AS MARKING SCHEME

SUMMER 2017

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

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 AS COMPUTER SCIENCE

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Q	Answer	Marks	AO1	AO2	AO3	Total
1a	Any one of: • The Internet is a world-wide communications infrastructure • A network of networks Has to imply more than one network	1	1.1a			1
1bi	User Datagram Protocol (UDP)	1		2.1a		1
1bii	Hypertext Transfer Protocol (HTTP)	1		2.1a		1
1biii	Dynamic Host Configuration Protocol (DHCP)	1		2.1a		1
1biv	Any one of: • Post Office Protocol (POP/POP3) • Internet Message Access Protocol (IMAP) Not SMTP	1		2.1a		1
2	Any of the following up to a maximum of four: Fetch: • The address of the next instruction is copied from RAM into the register (PC to the MAR) • The instruction (at that address) is copied to the MDR • The PC is incremented (so that it holds the address of the next instruction) Decode: • The MDR is copied into the Current Instruction Register (CIR) • The instruction / data (opcode / operand) is decoded Execute • The instruction is carried out. • Each stage is designed to happen concurrently to maximise resources use (clock ticks and memory) **For 4 marks, at least one from each, otherwise max 3 marks**	4	1.1b			4

Q	Answer	Marks	AO1	AO2	AO3	Total
3	Any of the following up to a maximum of four: • Multiple processors are used (to process a single task). • Many calculations are carried out simultaneously / at the same time • Large problems can be divided into smaller ones,(which are then solved concurrently). • Parallel computer programs are more complex to design and to write than sequential ones • Concurrency introduces several new classes of potential software bugs • Race conditions are the most common class of potential software bug • Communication and synchronisation between the different subtasks creates an overhead. Accept a suitable example of this. Accepted, not expected: • The maximum possible speed-up of a single program as a result of parallelisation is known as Amdahl's law: o $T(n) = T(1)(B + \frac{1}{n}(1 - B))$ o $Where$: ▪ $T(n) =$ $time\ taken\ on\ n\ threads$ ▪ $n = number\ of\ threads$ ▪ $B =$ $fraction\ of\ algorithm\ that\ is\ sequential$ • The speedup of a program using multiple processors in parallel computing is limited by the time needed for the sequential fraction of the program	4	1.1b			4
4a	Convert 106_{10} into binary: 01101010_2 Convert 57_{10} into binary: 00111001_2 Binary addition: 01101010_2 00111001_2 **10100011_2** *11110000* Convert 10100011_2 into hexadecimal: $A3_{16}$	1 1 1(answer) 1(carry) 1		2.1a 2.1a 2.1a 2.1a 2.1a		5

Q	Answer	Marks	AO1	AO2	AO3	Total
4bi	• For +8 the leftmost bit to indicate the sign. ("0" indicates a positive integer, and for -8 "1" indicates a negative integer) • the rest of the bits are used for the magnitude of the number 8. +8 = 00001000 −8 = 10001000 Accept answers where the leftmost bit is 1 to represent a positive integer. Accept answers using a minimum of 5 bits	1 1 1		2.1a 2.1a 2.1a		3
4bii	• From RHS, rewrite the binary number 8 up to and including the first one and change other 1 digits to 0 and 0 digits to 1 00001000 = 11111000 *Or* • Flip the bits (of 8 binary) and add one 00001000 -> 11110111 ->11111000 Accept a minimum of 4 bits	1 1		2.1a 2.1a		2
4ci	10.011 Exponent = 0010 0.1001100 Accepted – not normalised	1 1 1		2.1a 2.1a 2.1a		3
4cii	Mantissa = 0.9375 or 15/16, Exponent = 5 Answer =(0.9375 x 2^5)= 30_{10}	1 1 1		2.1a 2.1a 2.1a		3
4ciii	Any two from each of the following up to a maximum of four Advantages of integers (any two of): • Numbers are stored accurately • Less complex processing • Exact representation of zero Advantages of floating-point (any two of): • Very large/small numbers can be stored • Larger range of numbers can be represented • Fractions/decimal places can be represented	 2 2	 1.1b 1.1b			4

Q	Answer	Marks	AO1	AO2	AO3	Total
5a	A process or set of rules to be followed to solve a given problem.	1	1.1a			3
	Any two of: • flowcharts • pseudo-code • structured English Condone • annotated code • formal language e.g. Z	2	1.1a			

5b	**Indicative content**
	
	`Num is integer`
	
	`input Num`
	
	`if Num <= 100 then`
	
	`    if Num MOD 2 = 0 then`
	`          Output "Number is Even"`
	`    else`
	`          Output "Number is Odd"`
	`    end if`
	
	`else`
	
	`    Output "Data entered is greater than 100"`
	
	`end if`
	
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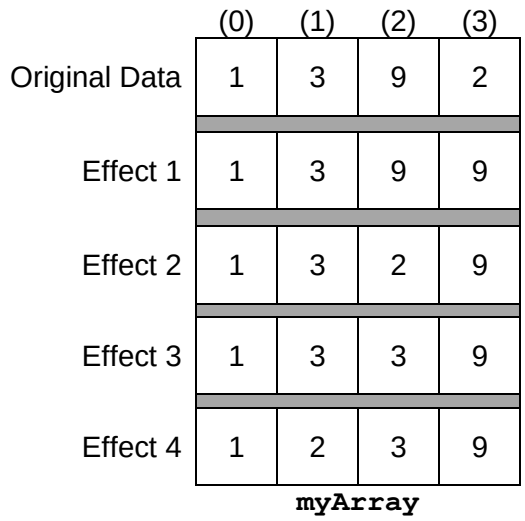
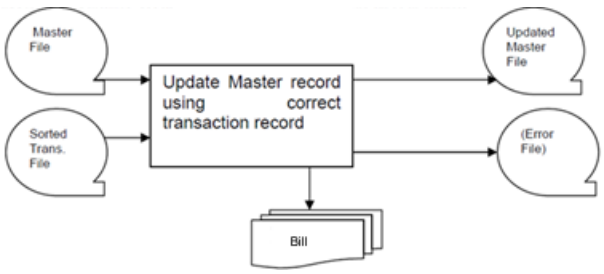
	• Initialise / Declare variable	1			3.1b	
	• Input `Num`	1			3.1b	
	• Check for Num <=100	1			3.1b	
	• Output error message	1			3.1b	
	• Correct use of `MOD`	1			3.1b	
	• Output message if data is odd/even	1			3.1b	
	• Algorithm works correctly	1			3.1b	
6	$A.(B+C)+B.\left(A+\overline{B}\right)+C.\left(\overline{A}+C\right)$					6
	$A.B+A.C+B.A+B.\overline{B}+C.\overline{A}+C.C$	1		2.1b		
	$A.B+A.C+B.\overline{B}+C.\overline{A}+C.C$	1		2.1b		
	$A.B+A.C+B.\overline{B}+C.\overline{A}+C$	1		2.1b		
	$A.B+A.C+C.\overline{A}+C$	1		2.1b		
	$A.B+C+C$	1		2.1b		
	$A.B+C$	1		2.1b		

Q	Answer	Marks	AO1	AO2	AO3	Total
7a		1 1 1		2.1a 2.1a 2.1a		4
7b	• Insertion sort • Sorts data in ascending order / lowest to highest	1 1		2.1a 2.1a		2
7c	`AND`	1		2.1a		1
7d	`if (currentItem < myArray[j]) then` • Execute code if a certain condition is met.	1 1		2.1a 2.1a		2

7e	`for i = 1 to n - 1`
	`next i`
	or
	`Do`
	`While (j >=0 AND inserted = false)`
	• Repeatedly executes the code until a certain condition is met.
		1
		1
				2.1a
				2.1a
						2

Q	Answer	Marks	AO1	AO2	AO3	Total
8	Any of the following up to a maximum of six: Mark-up language (any six of): • Mark-up languages add commands, or mark-up, to a text document to offer meaning to the text. • The commands give instructions to the program reading the file on how to interpret / format / and display the text. • One of the most common mark-up languages is HTML. • The commands in HTML are called tags, are surrounded by chevrons. • Commands are opened, for example , so that any text that follows will have that format applied to it. • Commands are then ended using a forward slash inside the tag, for example . • XML (eXtensible Mark-up Language) is another mark-up language that is commonly used in web applications. • XML is used for structuring and marking-up data for storage rather than information for display. • The developer is free to create their own tags and specify their own meaning to them. • Mark-up languages are commonly combined with other languages, such as JavaScript with HTML.	6	1.1b			6
9	• Data compression reduces the file size • When compressed files are decompressed they do not give back the original data, i.e. data is lost • Because lossy compression cannot be decompressed to yield the exact original data, it is not a good method of compression for critical data, such as textual data • It is most useful for digitally sampled analogue data, such as sound, video, graphics or images • Some examples of lossy data compression algorithms are JPEG, MPEG, and MP3. • Algorithms for lossy compression vary, but many use a threshold level truncation. / suitable lossy data compression example	4	1.1b			4

Q	Answer	Marks	AO1	AO2	AO3	Total
10a	• A file is collection of **related** records • A record is a collection of **related** fields *or* • A file is a collection of **related data** handled as a single unit. • A file has a filename which a user can use to access data at a later date.	1 1	1.1a 1.1a			2
10b	Any four of: • Fixed length field / record has same number of bytes in each field / record (and same number of fields) / Variable length record has different number of bytes in each record (or different number of fields). • Fixed length field / record is easier to program as it can be calculated to know how much storage space will be required / Variable length field / record makes it difficult to calculate how much storage space will be required • Fixed length field / records are quicker to process (read/write) by computer as start and end locations are known / Variable length field / records are slower to process (read/write) by computer as start and end locations have to be calculated at read/write time • Fixed length field / record wastes storage space as fields have blank space / Variable length field / record saves storage space as no blank space • Fixed length field / record will truncate long fields / Variable length record avoids truncation as each field can extend to accommodate any number of characters **Examples** • Variable length fields e.g. – Name, Address, email address • Fixed length fields e.g. – Gender, DOB If same example given, example **MUST** be justified.	4 1 1	1.1b 1.1b 1.1b			6

Q	Answer	Marks	AO1	AO2	AO3	Total
11a	• Records stored in key sequence order • 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 position	1 1	1.1b 1.1b			2
11b	One mark for each of the following up to a maximum of six. • Physical location for new record is calculated from the key field • A hashing algorithm is used for this calculation to find the location • If data collision / something there, the record is stored instead in an overflow area • Data in the overflow area is normally stored and searched in a linear manner • The overflow becomes too large • File may need reorganising (and new hashing algorithm) • Existing records are accessed in the same way.	6	1.1b			6
11c	One mark for each of the following up to a maximum of four. • Two input files: old master file and **sorted** transaction file • Update process i.e. **comparison** record by record with **corresponding** master record - update master record where appropriate • New (updated) master file output • Bill output  Award zero if no arrows	1 1 1 1		2.1b 2.1b 2.1b 2.1b		4

Q	Answer	Marks	AO1	AO2	AO3	Total
12	**Indicative content** **Resources** • Communicates with and sends data output to a printer / monitor / other valid output device • Communicates with and receives data input to a keyboard / mouse / other valid input device • In spooling, data is stored on hard disk / in memory / stored in a queue / in a buffer • Manages backing store by ensuring that data is stored and can be retrieved correctly from any disk drive • O/S creates and maintains a filing system such as FAT or NTFS • Organise files in a hierarchical directory structure • O/S offers compression which can be used to save disk space • The O/S manages memory (RAM) by ensuring all programs and data including itself is stored in correct memory locations/do not try to occupy the same memory location	10	1.1b			10
	• The O/S manages memory (RAM) by ensuring all programs and data have enough memory allocated • The O/S can utilise virtual memory when not enough memory (RAM) is available to run a program • Ensures different processes can utilise the CPU and do not interfere with each other or crash • On a multi-tasking O/S, the O/S ensures that all tasks appear to run simultaneously **Interface** • Provides user interface with meaningful icons / avoid text input / drop-down menus • Can provide a command line interface • Allows customisation of interface e.g. change desktop colours / layout • Allows access to system settings such as hardware • Allows copying / deleting / moving / sorting / searching of files or folders • Allows creation of shortcuts • Controls security using passwords or access permissions • Allows user to have more than one window open / Allows user to switch between tasks (programs/windows) • Provides user with error/warning/help messages					

Band	AO1.1b Max 10 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 indicative content. Clear knowledge is defined as a response that provides four to six relevant detailed points on operating systems from each of resources and interface 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 • 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 as specified in the indicative content. Satisfactory knowledge is defined as a response that provides two to four points on operating systems from resources or interface as signalled in the indicative content. • 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 two points on operating systems from resources or interface 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