GCE AS MARKING SCHEME

SUMMER 2016

COMPUTER SCIENCE - NEW AS COMPONENT 1 B500U10-1

INTRODUCTION

This marking scheme was used by WJEC for the 2016 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.

AS COMPUTER SCIENCE

COMPONENT 1

SUMMER 2016 MARK SCHEME

Q	Answer	Marks	AO1	AO2	AO3	Tot
1a	<table><tr><td>**A OR B**</td><td>**A AND B**</td><td>**A XOR B**</td><td>**A OR (NOT B)**</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td></tr></table> Award 1 mark for each correct column: • A OR B • A AND B • A XOR B • A OR (NOT B)	 1 1 1 1	 1.1a 1.1a 1.1a	 2.1b		4
1b	Award 1 mark for each: • Use the AND logical operator • Mask: 10000000_2 • Correctly worked out example of masking: $\quad 10101111_2$ $\underline{\quad 10000000_2} \quad$ AND $\quad \mathbf{10000000_2}$	1 1 1		2.1a 2.1a 2.1a		3

Q	Answer	Marks	AO1	AO2	AO3	Tot
2	Award 1 mark per point. Any five of: Descriptor (advantage inherent in *) • Cache memory is typically integrated directly with the CPU*. • Cache memory can also be placed on a separate chip / located between the CPU and RAM (that has a separate bus to connect with the CPU). • Cache memory stores program instructions that are frequently re-referenced by software during operation*. • As a CPU processes data, it looks in the cache memory first to see if the instructions are there from a previous reading of data. • Cache memory is expensive compared to conventional RAM. • Cache memory is smaller than RAM. • Cache memory is categorised as "levels" that describe its closeness and accessibility to the CPU. • Least used data / instructions are overwritten when cache is full. Advantage • Cache memory is memory that a CPU can access more quickly than it can access regular RAM. • Cache memory ensures fast access to these instructions which increases the overall speed of the software program. • Computers with slower processors but larger caches tend to be faster than computers with faster processors but more limited cache space. Accepted not expected: • Level 1 (L1) cache is extremely fast but relatively small, and is usually embedded in the CPU. • Level 2 (L2) cache often has a higher capacity than L1 and may be located on the CPU or on a separate chip so that it is not slowed down by traffic on the main system bus. • Level 3 (L3) cache is typically specialized memory that works to improve the performance of L1 and L2. • Level 3 (L3) cache can be significantly slower than L1 or L2, but faster than RAM. • In multicore CPUs, each core may have its own dedicated L1 and L2 cache, but share a common L3 cache.	5	1.1b			5

Q	Answer	Marks	AO1	AO2	AO3	Tot
3	Award 1 mark per point. Any six of: SSDs are more durable: • Solid State Drives feature a non-mechanical design of NAND flash mounted on circuit boards • NAND flash is shock resistant • Traditional HDD consist of various moving parts making them susceptible to shock and damage. SSDs are faster: • SSDs have greater performance • SSDs have faster data access • Computers with SSDs have quicker boot up time • HDDs can only access the data faster the closer it is from the read write heads, while all parts of the SSD can be accessed equally. SSDs do not require defragmentation • Defragmentation may perform "trim" command which may slightly improve the speed of future write operations SSDs consume less power: • SSDs use significantly less power at peak load than hard drives • SSDs energy efficiency can deliver longer battery life in laptops. SSDs are lighter / smaller: • Flash-based SSDs weigh considerably less than hard drives. • Increased portability SSDs are cost-efficient (**NOT** cheaper): • SSDs offer cost savings in the long run for businesses with lower energy usage and greater productivity. SSDs run cooler: • SSDs require very little power to operate which translates into less heat output by the system. SSDs are quieter: • With no moving parts, SSDs run at near silent operation. Not longer life span	6	1.1b			6
4a	Handshaking is the process that establishes if a device is <u>ready</u> to communicate.	1	1.1b			1

Q	Answer	Marks	AO1	AO2	AO3	Tot
4b	Award 1 mark per point. **Example**: File transfer protocol (FTP) (1) **Description**: allows the transfer of large files over a network (1). This is important as the FTP protocol has in-built error checking and re-transmission request as necessary (1). **Example**: Hypertext transfer protocol (HTTP) (1) **Description**: allows the transfer of multimedia webpages over the internet (1). This is important as the HTTP protocol allows multiple different web browsers to display and format web pages as the original author intended (1). **Example**: Simple mail transfer protocol (SMTP) (1) **Description**: allows emails to be sent over a network (1). This is important as the SMTP provides a standard way of transferring emails between two different servers (1). **Example**: Internet Message Access Protocol (IMAP) (1) **Description**: allows emails to be <u>transferred</u> between computer systems (via the internet) (1). This is important as the IMAP provides a standard way of transferring emails between two different servers / messages are stored on the server instead of mobile devices, which saves storage space (1). **Example**: Dynamic host control protocol (1) (DHCP) **Description**: assigns IP addresses to devices on a network (1). This is important as the DHCP protocol ensures that unique/dynamic IP addresses are allocated / allows addresses no longer in use to be automatically returned to the pool of available IP addresses for reallocation (1). **Example**: Universal datagram protocol (UDP) (1) **Description**: sends datagrams across a network with very few error recovery services. (1). This is important as, for example, video and audio streaming protocols are designed to handle occasional lost packets and need to receive new packets rather than the retransmission of previous ones (1). **Example**: Transmission Control Protocol/Internet Protocol (TCP/IP) (1) **Description**: allows any networked computers to communicate with each other (1) This is important as TCP/IP specifies how signals are routed and transported around a network (and reduces the need for gateways to convert signals into different protocols). (1)	3	1.1b			3

Q	Answer	Marks	AO1	AO2	AO3	Tot
5ai	Award 1 mark per point. Storage requirements = 8 bits (1 byte) **Example:** 131_{10} = 10000011_2	1 1		2.1b 2.1b		2
5aii	-127_{10} to 127_{10}	1		2.1b		1
5bi	Award 1 mark per point. Any one of: • Ensures that computers use the same character representation and can transfer meaningful data • Each character is mapped to binary number • Binary numbers represent specific characters	1	1.1b			1
5bii	Award 1 mark per point. **Character:** B = 8 bits (1 byte) **String:** BOB = 24 bits (3 bytes) Accept 7 bit ASCII example if consistent for both character and string Accept Unicode or any other **standard** character set	1 1	1.1b 1.1b			2
6	Award 1 mark per point. Up to 3 marks for each method of investigation. Award 1 mark for method Award 1 mark for benefit Award 1 mark for drawback **Study the existing system documentation** Benefits • Team can see how current system 'should' be operating • Inexpensive method of gathering lots of information fairly quickly • Can identify storage requirements Drawbacks • Staff may not be following procedures in documentation and may be using system in their own way • Documentation may be out of date and not updated to reflect system changes **Carry out a questionnaire of staff** Benefits • Relatively cheap to produce for a large number of people • Can be distributed worldwide • Could be completed on-line so results can be available very quickly • Gather a large number of responses in a short time Drawbacks • Have to be designed by experts or information could be unusable • Limited responses • People are 'too busy' and may not complete • People may not give correct answers	6	1.1b			6

		Interview staff / focus groups					

Interview staff / focus groups
Benefits
- Can gather large amount of detailed information
- Can make judgements on validity of information from personal contact or body language
- Can ask 'follow up' or 'open ended' questions to gather more detailed information in selected areas

Drawbacks
- Time consuming and expensive to carry out
- Has to be carried out by trained interviewer or closed questions written by experts
- Difficult to analyse large amount of information
- Difficult to analyse wide variety of information

Observe the current system in practice
Benefits
- Can actually see what is really happening and do not have to rely on what people tell you what they think is happening

Drawbacks
- Very time consuming and therefore expensive to carry out
- Staff may feel like they are being watched and therefore behave differently so do not actually see what goes on every day
- Cost of sending analysts around the world.

The benefits or drawbacks of any of the methods could be extended with more detail and gain extra marks.

7	The Computer Misuse Act deters:						3
	• accessing computer material without permission	1	1.1b				
	• altering computer data without permission,	1					
	Award 1 mark for any suitable example		1.1b				
	e.g. writing a virus to destroy someone else's data, or actually changing the money in an account.	1					
			1.1b				

8a	Award 1 mark per correct response. Convert $3E_{16}$ into binary: 00111110_2	1		2.1a		5
	Convert 27_{16} into binary: 00100111_2	1		2.1a		

	Binary addition:
	
	  00111110_2
	  00100111_2
	  01100101_2
	  01111100
	
	Convert 01100101_2 into denary: 101_{10}
		$1_{(answer)}$
		$1_{(carry)}$
		
		1
				2.1a
				2.1a
				
				2.1a		

8b	Award 1 mark per correct response. **Two's complement:** • From RHS, rewrite it up to and including the first one by change other 1 digits to 0 and 0 digits to 1 $00011011 \rightarrow xxxxxxx1 \rightarrow 11100101$ *Or* • Flip the bits and add one **Sign and magnitude:** • Use the leftmost bit to indicate the sign. "0" indicates a positive integer, and "1" indicates a negative integer • the rest of the bits are used for the magnitude of the number. $00011011 \rightarrow 10011011$ Accept answers where the leftmost bit is 1 to represent a positive integer.	1 1 1 1 1		2.1a 2.1a 2.1a 2.1a 2.1a		5
8ci	Award 1 mark per correct response. 1000.11 Mantissa = 0.1000110 Exponent = 0100	1 1 1		2.1a 2.1a 2.1a		3
8cii	Award 1 mark per correct response. Mantissa = 0.6875 or 11/16, Exponent = 3 Answer = $0.6875 \times 2^3 = 5.5_{10}$	1 1 1		2.1a 2.1a 2.1a		3

9	**Indicative content**
	
	``
	1 Declare myArray[0 to 6]
	2 SearchValue is integer
	3 Found is Boolean
	4 set Found = False
	5
	6 input SearchValue
	7
	8 For i = 0 to 6
	9 if SearchValue = myArray(i)then
	10 set Found = True
	11 Output "SearchValue found at
	              position ", i
	12 end if
	13 Next i
	14
	15 if Found = False
	16 Output "SearchValue not
	   found"
	17 end if
	``
	
	Award 1 mark per correct response.
	
	Marking
	• Declare array and initialise variables
	• Input SearchValue
	• Loop structure and increment
	• Calculate position if found
	• Output position if found
	• Correct terminating condition for loop
	• Output message if not found.
				1
				1
				1
				1
				1
				1
				1
						3.1b
						3.1b
						3.1b
						3.1b
						3.1b
						3.1b
						3.1b
								7

10	Award 1 mark per correct response. A.(A + C) + A.(C + B) + C.(C + B) A.A + A.C + A.C + A.B + C.C + C.B A + A.C + A.C + A.B + C + C.B A + A.C + A.B + C + C.B A + A.B + C +C.B A + C + C.B A + C Or A.(A + C) + A.(C + B) + C.(C + B) A.A + A.C + A.C + A.B + C.C + C.B A.(1 + C) + A.(C + B) + C.(1 + B) A + A.(C + B) + C A + A.C + A.B + C A + A.B + C A.(1 + B) + C A + C Other methods equally accepted.		1 1 1 1 1 1		2.1b 2.1b 2.1b 2.1b 2.1b 2.1b			6

11	Award 1 mark per correct response. Explanation of the concept can contain any four of: • Free licence / General Public licence • Relaxed / non-existent copyright restrictions • Built using community co-operation • Code is available for all to view, debug, rewrite, etc. • Free from commercial pressures • Frequent integration with other software packages • Several versions • High modularisation	4	1.1b			4
12	Award 1 mark per correct response. Any three of: • Symbol table generated • Tokens are produced. • Tokens are checked to see if they match the spelling and grammar expected, using standard language definitions • Parsing each token to determine if it uses the correct syntax for the programming language • If syntax errors are found, error messages are produced./ if no errors are found the compilation process continues	1 1 1	1.1b 1.1b 1.1b			3
13a	Award 1 mark per correct response. • Bubble sort • Sorts data in descending order / highest to lowest	1 1		2.1a 2.1a		2
13b	Award 1 mark per correct response. myArray table: (0)=10, (1)=6, (2)=5, (3)=2, (4)=1	1		2.1a		1
13ci	Award 1 mark for each: • two values are the same • the algorithm would never finish - it would swap the two identical values on every pass • and 'swapped' would never become 'FALSE'/Remain 'TRUE' The algorithm is unstable (accepted not expected)	1 1 1		2.1b 2.1b 2.1b		3
13cii	Award 1 mark per correct response. Line 10 changed to: `if myArray[i] < myArray[i + 1] then`	1		2.1b		1

14a	Award 1 mark per correct response. Any four of: • Procedural languages are used in traditional programming based on algorithms or a logical step-by-step process for solving a problem • (An imperative) A language in which program statements can be grouped into self-contained blocks called procedures and functions • They obey (ordered) instructions • They carry out actions / calculations etc. • A procedural programming language provides the programmer a way to define precisely each step when performing a task • Allows tight control over the underlying operation of the hardware • Used in (large complicated) programs where the same procedures are run out at varying stages of the program execution.	4	1.1b			4
14b	Award 1 mark per correct response. Any four of: • Uses objects and classes - include both data and associated processing • Encapsulation – technical implementation is hidden within the object • Inheritance – is the means by which properties and methods from a class are copied to another class • Polymorphism – a form of overloading which allows us to create general object structures which can be used with a wider range of data types • Enables production of buttons / icons etc. - useful in a visual environment • A class defines the methods properties (data) for a group of similar objects • Once an object is created, knowledge of its implementation is not necessary for its use. • Objects control how other objects interacts with themselves, preventing other kinds of errors, e.g. a programmer cannot set the width of a window to -500 • In some languages, the programmer places objects on forms. These are event-driven languages • An event, e.g. click a command button, initiates a sequence of code to be executed • Objects created using object oriented languages can easily be reused in other programs	4	1.1b			4

15	**Indicative content**	12	1.1b			12
	• Example: Batch processing					

Indicative content

- Example: Batch processing
  - Example: payroll / utility billing
  - Time sheets are collected for e.g. a monthly operation etc.
  - Process is carried out with no user interaction
  - Batch processing may avoid using computer resources at times when demand is high /off-peak
  - Errors are stored in a file for later use and not dealt with as they occur

Input methods:
- Scanning of OCR sheets, batch file

Output method
- Printing of payslips/electronic payslip sent

- Example: Real-time processing
  - Example: nuclear power station to control reactor temperature by continuously monitoring the temperature which is input to the system.
  - These Inputs are processed very quickly
  - Processing needs to be quick enough to deliver output in time
  - Output adjusted accordingly
  - This means that accidents can be avoided.

Input methods:
- Sensor (e.g. temperature sensor)

Output method
- Adjust temperature/sprinkler/alarm/actuator

- Example: Real-time transaction processing
  - Example: theatre selling tickets
  - A seat is booked and the record is updated very quickly
  - Record is locked during update
  - Availability very quickly decreases by one
  - This avoids double booking a seat.

Input methods:
- Terminal input (e.g. keyboard)

Output method
- Automated email

Band	AO1.1b Max 12 marks				
3	**9 - 12 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 twelve relevant detailed points on modes of operation, and input and output methods 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	**5 - 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 of modes of operation as specified in the indicative content. Satisfactory knowledge is defined as a response that provides five to eight points on modes of operation and input and output methods as signalled in the indicative content. • has presented a discussion with limited examples • used appropriate technical terminology referring to the indicative content.				
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 a response that provides one to four points on modes of operation and input and output methods 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