GCE A LEVEL MARKING SCHEME

SUMMER 2018

A LEVEL
COMPUTER SCIENCE - COMPONENT 2
A500U20-1

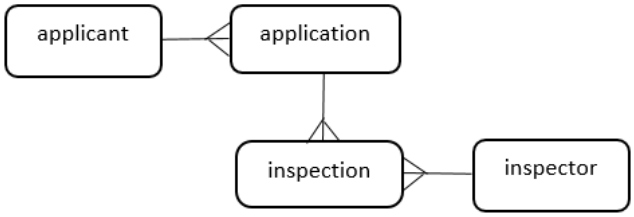
INTRODUCTION

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.

		Mark	AO1	AO2	AO3	Total
1 (a)	SELECT ArrivalDate, ShipName FROM VOYAGE **1 mark for:** SELECT ArrivalDate, ShipName **1 mark for:** FROM VOYAGE	2			3b	
1(b)	SELECT ContainerID, Contents FROM CONTAINER WHERE VoyageID=(SELECT VoyageID FROM VOYAGE WHERE ArrivingFrom = 'Shanghai') **1 mark for:** SELECT ContainerID, Contents **1 mark for:** FROM CONTAINER WHERE VoyageID=(..) **1 mark for:** SELECT VoyageID FROM VOYAGE WHERE ArrivingFrom = 'Shanghai' **Accepted not expected** SELECT ContainerID, Contents FROM (VOYAGE JOIN CONTAINER ON ContainerID) WHERE ArrivingFrom = 'Shanghai' **1 mark for:** SELECT ContainerID, Contents **1 mark for:** FROM (VOYAGE JOIN CONTAINER ON ContainerID). **Award the mark for joining the two tables in a query,** even if syntax is not exactly correct. **1 mark for:** WHERE ArrivingFrom = 'Shanghai'	3			3b	
1(c)	1 mark for each point up to a maximum of three. CREATE TABLE DISPATCH (ContainerID Integer PRIMARY KEY not NULL, Dispatched Boolean, Date DateTime, Transport String(12)) **1 mark for:** CREATE TABLE DISPATCH **1 mark for:** Primary Key **1 mark for:** fields. **1 mark for:** data types. Accept Date as a string field. Transport: accept any suitable length for the string, or no length specified	3			3b	

		Mark	AO1	AO2	AO3	Total
2(a)	**1 mark** for the concept that the bytes are subjected to left shifts during each time interval. **1 mark:** Least significant bits (at the right of the bytes) are replaced by zero bits.	2		2b		4
2(b)	**1 mark** for the concept that the bytes are subjected to right shifts during each time interval. **1 mark:** Least significant bits leaving the right of the byte are copied after shifting to the most significant bit positions at the left of the bytes.	2		2b		
3(a)	**1 mark** for each reason. The database is not in third normal form as: • ApplicantName is dependent on ApplicantID, which is not the key field of APPLICATION / ApplicantName is duplicated • InspectorName is dependent on InspectorID, which is not the key field of INSPECTION / InspectorName is duplicated	2		2a		10
3(b) (i)	 **1 mark** for each of the three 1 : n relationships. **1 mark** for 4 suitable table names	4		2b		
3(b) (ii)	Tables should be similar to: APPLICANT (ApplicantID **[P]**, ApplicantName, ApplicantPhone…) APPLICATION (ApplicationID **[P]**, PropertyLocation, WorkDescription, ApplicantID **[F]** …) INSPECTION (InspectionID **[P]**, Date, ApplicationID **[F]**, InspectorID **[F]**, Comments…) INSPECTOR (InspectorID **[P]**, InspectorName…) **2 Mark** for 4 primary keys clearly identified (1 mark for each 2 correct) **1 mark** for each of 3 foreign keys clearly identified	5		2b		

		Mark	AO1	AO2	AO3	Total
4	**Indicative Content** **Gas Billing** Batch processing. Bills are issued regularly in response to meter readings. **Traffic Lights** Real time control processing. Traffic lights have timed intervals, and may also react to the arrivals of traffic. **Theatre Booking** Real time transaction processing. To avoid double bookings, the ticketing database is updated immediately payment is made.	 1 1 1 1 1 1	6	2a		6
5(a)	**1 mark** for concept that IMAP is used to upload/download e-mail between the user's computer and an internet server. **1 mark** for SMTP transfers e-mail between internet servers.	1 1	1a 1a			11
5(b)	**1 mark** for FTP applications use TCP **1 mark** Concept that TCP has error checking facilities, which ensure that correct packets of data are received to construct the file. **1 mark** If packets are found to be corrupted, replacement copies can be requested.	1 1 1		2b 2b 2a		
5(c)	**1 mark** for video applications use UDP **1 mark** Concept that UDP does not have error checking facilities. **1 mark** For video streaming, it is better to accept occasional corruption of the picture or sound, rather than pausing the presentation while replacement data packets are downloaded.	1 1 1		2b 2b 2a		
5(d)	**1 mark** for the concept that IP provides an address which identifies a computer device on a network. **1 mark** Concept that DHCP can (dynamically) allocate an IP address when a device connects to a network. **1 mark** This IP address will apply for a single session then may be reallocated.	1 1 1	1b 1b 1b			

		Mark	AO1	AO2	AO3	Total
6(a)	**1 mark** for the concept that weather forecasts must be produced quickly, otherwise there will be insufficient advance warning of weather events. 5 hours is too long a delay between obtaining weather station data and issuing a forecast.	1		2b		4
6(b)	Using Amdahl's Law: $T_p = T_s (L + P/N)$ **1 mark** where T_p is parallel processing time, T_s is time using a single processor system, L is fraction of the processing which must be linear, P is fraction which can be run in parallel, and N is the number of processors. Therefore: $T_p = 5 (0.2 + 0.8/12)$ **1 mark** T_p = 1.33 hours = 1 hour 20 minutes **1 mark** **Alternative solution not using a formula:** **1 mark** for: Total time to run on one processor: 5 hours Linear program time is 20%: 1 hour **1 mark** for: Remaining 4 hours of processing can be shared between 12 processors, so each will carry out 20 minutes of processing. **1 mark** for: The processors run in parallel, so the total time for the run of the model is: 1 hour 20 minutes	3		2b		

		Mark	AO1	AO2	AO3	Total
7	**Indicative Content** register R is the loop counter register S holds Num1 register T holds Num2 register U holds NewNum LOD R, 8 initialise loop counter LOD S, 0 initialise Num1 LOD T, 1 initialise Num2 LOOP: MOV S , U Set NewNum = Num1 ADD U, T Add Num2 to NewNum MOV T, S Num1 = Num2 MOV U,T Num2 = NewNum DEC R Decrement loop counter JGZ R, LOOP jump if counter not yet zero OUT T Output final result **1 mark** for initialising loop counter **1 mark** for initialising Num1 and Num2 **1 mark** for: label marking the start of the loop **1 mark** for: producing a loop with a jump command **1 mark** for: loop repeats exactly 8 times **1 mark** for setting NewNum = Num1 + Num2 **1 mark** for updating Num1 and Num2 **1 mark** for output of Num2 value	8			3b	8
8(a) (i)	**1 mark** for fixed point binary representation: 138.375 = 1000 1010 . 011 **1 mark** for floating point representation: $0.1000\ 1010\ 011 \times 2^{8}$ giving: 0100 0101 0011 0000 | 0000 1000	2		2b		5
8(a) (ii)	$0.101\ 1000 \times 2^{7}$ = 1011 000.0 = 88 1 mark for 2^{7} / exponent = 7 1 mark for 0.5 + + 0.125 + 0.0625 = 0.6875 1 mark for 88	3		2b		

		Mark	AO1	AO2	AO3	Total
8(b) (i)	+17 = 0001 0001 **1 mark** Converting to two's complement -17 = 1110 1111 **1 mark**	2		2b		5
8(b) (ii)	One mark for each of the following up to a maximum of two 32 = 0010 0000 **1 mark** Adding -17 and 32 gives: 0000 1111 **1 mark** Converting to base-10 via the two's complement: 15 **1 mark**	2		2b		
9(a)	One mark for each of the following up to a maximum of 2 Possible interrupts involved in this system: • Clock sends interrupt at the end of the time slice • Disk controller sends interrupt when file transfer completed • Printer sends interrupts to spooling system • Processor sends interrupt if a software error occurs • Terminals send interrupts if key pressed/mouse clicked	2	1b			5
9(b)	**1 mark** for the concept that the operating system periodically checks the progress of jobs suspended in the spooling system, / availability of I/O devices **1 mark:** allows jobs to re-join the runnable queue when input/output is completed.	2	1a			
9(c)	Concept that there is a difference in device speed between the spooling system disk and the mainframe processor, printer, or user terminals	1	1a			

		Mark	AO1	AO2	AO3	Total
10(a)	(a) Random access file: **1 mark** for each point, up to a maximum of 6 marks: • Explanation of strategy to save records, using hashing to convert a key field value into a memory location/address. • Explanation of strategy to handle collisions. • Explanation of strategy to access records. • If the main file is large and there are few collisions, most records will be found immediately. • Separate overflow area where records are stored in the next available memory location • Overflow area can be serial file or linked list • Searching the separate overflow area is done linearly and may be slow if the area is large • Progressive overflow within the main file may be used, so records are found very close to their home locations even if overflow has occurred. • Could be a problem with the random access file if the overflow area becomes too large – main file may need to be restructured with a different hash function. • Could be faster than obtaining records from the sequential indexed file, where several index blocks must be searched and the required record found amongst other records in a data block.	6	1a			10
10 (b)	Indexed sequential file: **1 mark** for each point, up to a maximum of 4 marks: • Explanation of strategy to save records in data blocks on disk, with records sorted into sequential order within each data block. • Explanation of locating records through use of index block pointers. • Explanation of multiple levels of index. • Fast searching using indexes will find the data block containing the required record. • Could be faster than searching the overflow area of the random access file. • Easy to add any amount of further records by adding extra data blocks, then setting index pointers.	4	1a			

		Mark	AO1	AO2	AO3	Total
11(a)	Indicative Content **1 mark for each of the points shown in bold**. Some justification required to gain the mark. **Solid State Drives are more durable**: • Solid State Drives feature a non-mechanical design of NAND flash mounted on circuit boards • NAND flash is shock resistant • Traditional Hard Disk Drives consist of various moving parts making them susceptible to shock and damage. **SSDs are faster:** • SSDs have faster data access • Computers with SSDs have quicker boot up time • HDDs data access speed depends on distance of data from the read write heads, while all parts of the SSD can be accessed equally. **SSD Performance is unaffected by fragmentation**: • HDDs may need to be periodically defragmented. **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:** • Flash-based SSDs weigh considerably less than hard drives. **SSDs run cooler:** • SSDs require very little power to operate which translates into less heat output by the system.. **Hard Disk Drives are cheaper than SSDs**, which generally gives a more cost effective storage capacity. However, **SSDs are cost-efficient** (NOT cheaper): • SSDs may offer cost savings in the long run for businesses with lower energy usage and greater productivity.	6	1b			14

		Mark	AO1	AO2	AO3	Total
11(b)	**One mark for each of the following up to a maximum of 6** • RAM holds programs and / or associated data when an application is running. • RAM holds the operating system. • RAM composed of cheap semiconductor devices. • Cache holds intermediate data whilst processing is carried out. • Cache located between the RAM and the processor. • Cache faster to access than RAM main memory. • Cache made from logic devices, so is more expensive than main memory. • Large RAM main memory allows more data and larger sections of program to be held in electronic memory. This reduces the number of slow disk operations./ Virtual memory • A large cache size reduces the need for slower access to RAM main memory.	6	1b			
11(c)	**1 mark** for describing USB: Universal Serial Bus is a (fast) interface for connecting peripherals to computers using serial data transmission / wired connection. **1 mark** for any one of: • USB cables transmit data and also provide a power supply for peripheral devices. • Many devices can be linked to the serial bus, chained together through hubs. • Devices on a serial bus can be allocated different levels of priority: continuous operation (e.g. web cam) or only by generating an interrupt (e.g. keyboard). **1 mark** for describing Bluetooth: Bluetooth is a wireless interface for connecting peripherals to computers. **1 mark** for any one of: • avoids need for cables, which might be more convenient on small desk, or for using headphones. • devices would need their own power supply (e.g. battery in a keyboard). • Devices generally require pairing	4	1b			

		Mark	AO1	AO2	AO3	Total
12(a)	**1 mark for each of the following up to a maximum of two**: • Knowledge base. • Inference engine • User Interface • Should be able to explain its decision • Should be able to give a level of confidence • May have a learning capability Condone: a system that provides an expert opinion based on human knowledge	2	1b			8
12(b)	**One mark for each of the points below up to a maximum of 6 – two marks maximum for advantages In the context of a suitable example chosen**: (e.g. medical diagnosis, careers advice, diagnosing car faults, determining an insurance premium or deciding whether to provide a bank loan/mortgage) • explaining the input stage of the system (e.g. providing a sequences of questions on-screen) • explaining the processing stage (e.g. the program asks different questions, depending on responses received, until sufficient information obtained to make a decision.) • then processes facts according to a set of rules. • explaining the output stage (e.g. a diagnosis and treatment advice is presented on screen.) • the program comments on how the conclusion was reached, explaining its reasoning. This allows the user to evaluate the validity of the decision. • the program indicates the certainty of the result produced (e.g. there is a 70% change of outcome A, but 30% chance of outcome B). This alerts the user to possible alternative solutions. • advantages of the expert system to the user (e.g. faster and more consistent loan application decisions, more accurate medical diagnosis with less chance of important symptoms being overlooked.)	6	1b			