

Computing

Advanced Subsidiary GCE

Unit **F452**: Programming Techniques and Logical Methods

Mark Scheme for June 2013

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Question			Answer	Marks	Guidance
1	(a)	(i)	<ul style="list-style-type: none"> • Problem to be solved is split into smaller sub problems • Which are split further • ...until each sub-problem is small enough to solve. 	2	
		(ii)	<ul style="list-style-type: none"> • Easier to implement (a series of small problems) • Easier to test/debug (small components) • Code is more structured/easier to upgrade sections • Development can be shared easily • Modules can be reused • Programmers can work on area of expertise. • Modules can be written in different languages 	2	
	(b)		<p>Award marks for:</p> <ul style="list-style-type: none"> • A main program, appropriately named, at the top of the design • <u>Separate</u> manager and employee sections • Managing employees under manager's section • Adding, removing and editing employees under managing employees • Calculating wages and printing pay slips under manager's section (directly or via another module) • Log in, clock in and clock out under employees' section (directly or via other modules) 	6	

Question		Answer	Marks	Guidance												
(c)	(i)	<table border="1"> <thead> <tr> <th>Item of data</th> <th>Data type</th> <th>Maximum size in bytes.</th> </tr> </thead> <tbody> <tr> <td>Name</td> <td>String</td> <td>15–30</td> </tr> <tr> <td>Nat. Ins</td> <td>String</td> <td>9</td> </tr> <tr> <td>Hourly wage</td> <td>Real</td> <td>4 or 8</td> </tr> </tbody> </table> <p>1 mark per box</p>	Item of data	Data type	Maximum size in bytes.	Name	String	15–30	Nat. Ins	String	9	Hourly wage	Real	4 or 8	6	<p>Size of name MUST be at least 15.</p> <p>For wage accept currency or any other recognisable real number data type. For string accept text, alphanumeric but not character.</p> <p>Allow a reasonable length greater than 9 for national insurance number</p> <p>For the two strings allow for 2 or 4 bytes per character in case candidate is using Unicode.</p>
	Item of data	Data type	Maximum size in bytes.													
Name	String	15–30														
Nat. Ins	String	9														
Hourly wage	Real	4 or 8														
	(ii)	<p>Award marks for:</p> <ul style="list-style-type: none"> • Adding up sizes from c(i) – allow FT • Multiplying by 12 • Adding 10% for overheads. 	3	<p>Allow working with shows these steps in different order correctly e.g: $1.1 * (12 * \text{size1} + 12 * \text{size2} + 12 * \text{size3})$</p> <p>Allow any reasonable arbitrary overhead instead of 10% (but not rounding up)</p>												
(d)	(i)	<ul style="list-style-type: none"> • Records appear in the order in which they are received/chronologically • New records are appended (to the end of the file) • To access a record, you have to search through all preceding records. 	2													
	(ii)	<ul style="list-style-type: none"> • A new file is created • Records are copied from the old file to the new file • Except the record to be deleted • The new file is renamed as the old file. 	4	<p>Accept an in-place algorithm</p> <ul style="list-style-type: none"> • Search through the items in turn • till item to be deleted found • Repeatedly copy next item in place of current item • ... until end of file (and close file) <p>If using this algorithm, candidates should be doing something reasonable with the records that appear after the item to be deleted to get the fourth bullet point.</p>												

Question	Answer	Marks	Guidance
(e)	<p>High level response (6–8 marks) The candidate gives a detailed description of indexed sequential files and a thorough comparison of serial and indexed sequential files, benefits and limitations in detail. The information will be presented in a structured and coherent form. There will be few if any errors in spelling, grammar and punctuation. Technical terms will be used appropriately and correctly.</p> <p>Medium level response (3–5 marks) Candidate describes the main features of indexed sequential files and identifies some benefits and/limitations of serial/and indexed sequential files. The information will be presented in a structured format. There may be occasional errors in spelling, grammar and punctuation. Technical terms will be mainly correct.</p> <p>Low level response (0–2 mark) Candidate may state some features of indexed sequential files or may state some benefits and limitations of serial and/or sequential files; response may be inaccurate or lacking in with detail with little or no comparison.. Information will be poorly expressed and there will be a limited, if any, use of technical terms. Errors of grammar, punctuation and spelling may be intrusive.</p>	8	

Question	Answer	Marks	Guidance
(e) cont	<p>Points may made include:</p> <p>Indexed Sequential Files</p> <ul style="list-style-type: none"> • Records are sorted according to a primary key • A separate index is kept • Index allows groups of records to be accessed directly • New data needs to be inserted in correct position and index updated. <p>Comparison</p> <ul style="list-style-type: none"> • Serial files are simple and on the whole easier to implement. • Adding new records is easy • Searching is easy but slow • Ideally suited to a small number of records such as the restaurant • ...especially if you tend to use all the records at a time (eg to process wages) • An indexed sequential file is more difficult to manage... • ...eg when adding new records, it needs to be inserted in the correct position • ...and the index has to maintained and kept in sync with the data • But accessing individual files is much faster • More suited to large files 		

Question			Answer	Marks	Guidance
2	(a)	(i)	<ul style="list-style-type: none"> 5 followed by 4 (when pattern is cycled so does not follow rule 2) 	1	
		(ii)	<ul style="list-style-type: none"> Total is 16 which is not divisible by 3 (so does not follow rule 1). 	1	
	(b)		<p>Algorithm</p> <ul style="list-style-type: none"> Inputs 3 values Checks if total divisible by 3 (using specific operators correctly, not text) .. and outputs "INVALID SITESWAP" if it is not Checks if $\text{Num1} = \text{Num2} + 1$ OR $\text{Num2} = \text{Num3} + 1$ or $\text{Num3} = \text{Num1} + 1$ / other correct method to check rule 2 ...and outputs "INVALID SITESWAP" if any of those is true. <p>Programming style</p> <ul style="list-style-type: none"> Comments to explain algorithm Correct indentation Meaningful identifiers throughout <p>(max 5 for algorithm + 2 for style)</p>	7	<p>For the first bullet, the algorithm must clearly be dealing with three distinct values. If a single input statement is used, the algorithm should show that the input is split into three values.</p> <p>If bullet 2(rule 1) or bullet 4(rule 2) is not correct allow up to 1 FT mark for the outputs (bullets 3 and 5).</p> <p>To award marks for style the algorithm must be substantial enough to show consistent correct use.</p>

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3	(a)	eg <ul style="list-style-type: none"> • files used the program... • ... e.g. library routines/data files/executables • ...need to be in the correct folders • Program needs an icon/shortcut... • ...so that it can be accessed easily/identified... • Changes made need to be recorded • ...so that the program can be uninstalled • ... e.g. in the registry • Configure initial settings... • ... to suit user preferences 	4	Accept other valid answers, but do not accept answers which are not part of the installation routine eg user pays for the application or accepts the end user licence. Do not accept answers describing why the application is downloaded, only why the application needs to be installed.	
	(b)	(i)	<ul style="list-style-type: none"> • Testing done within the software company • Carried out as the program is developed • Aim is to find bugs • May use emulators rather than actual phones / other example of alpha testing in this case 	3	
		(ii)	<ul style="list-style-type: none"> • The application is complete • The company demonstrates it to the <u>organisers of the flower show / organisers of the flower show</u> get to see it working • The aim is to show that all the requirements have been met. 	3	

Question	Answer	Marks	Guidance
(c)	<p>Award one mark for each valid test case as per list below, and another mark if the test data given matches the description</p> <p>Possible test cases include</p> <ul style="list-style-type: none"> - On a path (at least one whole number) - At the edge of the field (either of the numbers is 0 or 10) - In the middle of a flower bed (both numbers fractional) - Out of the field (either number is < 0 or > 10) - Exactly at a crossroad(both whole numbers) 	6	<p>Mark needs to be awarded for reason before you can award a mark for the test data.</p> <p>Do not accept normal/valid, invalid or borderline/extreme, but in these cases you may award FT marks for the test data.</p> <p>The test data must be coordinates – do not accept tests for textual input etc as these would not come from the sensor.</p>
(d)	<p>Award marks if, using the candidates' IF statement,</p> <ul style="list-style-type: none"> • If Direction > 90 AND Direction is < 270 the south field is used • If (Direction > 0 AND) Direction < 90 the north field is used • If Direction > 270 (AND Direction <360) the north field is used • If direction = 0, the north field is used • IF statement is correctly formatted and indented. 	5	<p>Marks can be awarded for dealing with additional cases (crossroads and edge) if done correctly.</p> <p>IF the ANDing is incorrect (e.g. If direction > 270 and < 360) then still mark the logic but you cannot award the mark for the IF statement being correctly formatted</p> <p>Assume direction is between 0 to 360. So: If "Direction < 90 OR Direction > 270" gets 3 marks (bullets 2, 3 and 4)</p> <p>Must have END IF to be correctly formatted as question asks candidates to use the format in the example</p>

Question			Answer	Marks	Guidance
4	(a)	(i)	<ul style="list-style-type: none"> • A condition is used to determine • Whether or not sections of code will be executed • Line 06 only executed if condition in line 05 is true. 	3	
		(ii)	<ul style="list-style-type: none"> • Code is executed repeatedly • For a given number of times / until a condition is met • Lines 34 and 35 will be executed 4 times 	3	
	(b)	(i)	<pre>IF Letter = "W" OR Letter = "X" OR Letter = "Y" OR Letter = "Z" THEN Digit = "9" END IF</pre> <p>Marks for:</p> <ul style="list-style-type: none"> • Correct IF statement • Digit = "9". 	2	Digit must be a string i.e. with quotation marks, but allow single or double quotes

Question		Answer	Marks	Guidance
	(b) (ii)	<ul style="list-style-type: none"> Select/switch <u>on the value of Letter</u> For <u>each</u> set (eg "A", "B", "C") ... the corresponding digit is given. Formatted correctly including quotation marks. 	4	<p>Allow ranges e.g. CASE Is between "A" – "C".</p> <p>For bullet 2 allow indication of the pattern continuing (e.g. .../etc)</p> <p>Accept descriptions in text for max 2 (bullets 2 and 3)</p>
	(iii)	<ul style="list-style-type: none"> All the alternatives depend on the value of one variable So this makes the code clearer/easier to read/easier to write Allows multiple branches/avoids nested IFs Avoids numerous repeats of similar conditions 	2	Not shorter
	(c) (i)	<ul style="list-style-type: none"> An identifier / memory location (representing a value needed by the program) The value may change <u>while the program is running.</u> 	2	
	(ii)	<ul style="list-style-type: none"> Local variable: Digit Global variable: MyWord, I, Letter. 	2	Identifier name only.
	(iii)	<ul style="list-style-type: none"> That part of a program where the variable is available e.g. whether it is local or global A global variable is available throughout the program A local variable only applies to a subsection/subroutine etc If global and local variables use the same identifier, then the local takes precedence. 	4	Mentioning local and global variables automatically gets the 2 nd bullet point

Question		Answer	Marks	Guidance
	(d) (i)	<ul style="list-style-type: none"> • A subroutine/a named section of code • It is called as part of an expression (in the main program) • Which returns a single value when called • The value replaces the function call (in the main program). 	3	
	(ii)	<ul style="list-style-type: none"> • RETURN tells to program to exit the function • ...and supplies the value <u>which will be used by the main program</u> • OUTPUT tells the program to display a value • ...on the user interface/screen. 	4	Just "Returns the value" is too vague

(e)	<p>Example:</p> <pre> INPUT Str Answer = "" FOR i = 1 to Length(Str) Letter = MID(Str,I,1) IF Letter in range A..Z THEN Answer = Answer & LetterToDigit() ELSE Answer = Answer & Letter END IF NEXT i OUTPUT Answer </pre> <p>Award marks for:</p> <ul style="list-style-type: none"> • Input a string. <p>either</p> <ul style="list-style-type: none"> • Attempt to loop through each character • ...start, end of loop correct for a string of any size. <p>within each loop/recursive case</p> <ul style="list-style-type: none"> • Checks that character is in range "A"-"Z" • ... assigns the global variable Letter to the current character • ... LetterToDigit function is used • ...the result is output/appended to a string which is output later <ul style="list-style-type: none"> • If not in the range "A"-"Z", the character is output/appended to a string which is output later. 	8	
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