

Cambridge International AS & A Level

COMPUTER SCIENCE**9618/21**

Paper 2 Fundamental Problem-solving and Programming Skills

October/November 2025**MARK SCHEME**Maximum Mark: 75

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **19** printed pages.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptions for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.













Annotations guidance for centres


Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	Benefit of the doubt
	To indicate where a key word/phrase/code is missing
	Incorrect
	Follow through
	Indicate a point in an answer
Highlighted text	To draw attention to a particular aspect or to indicate where parts of an answer have been combined
	Ignore
	Not answered question
	No examples or not enough
	Not relevant or used to separate parts of an answer
Off-page comment	Allows comments to be entered at the bottom of the RM marking window and then displayed when the associated question item is navigated to.
	Repetition
	Indicates that work on a page has been seen including blank answer spaces and blank pages.
	Correct

Annotation	Meaning
	Too vague

Mark scheme abbreviations

/	separates alternative words / phrases within a marking point
//	separates alternative answers within a marking point
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be awarded
()	the word / phrase in brackets is not required, but sets the context

Question	Answer	Marks										
1(a)	<table><tr><th colspan="2">Expression</th></tr><tr><td colspan="2">MyString ← 'X' & MyString</td></tr><tr><td colspan="2">MyChar ← MID ("ABCD", 1 / 2 / 3 / 4 , 1)</td></tr><tr><td colspan="2">MyString ← NUM_TO_STR (DAY / MONTH / YEAR / DAYINDEX (MyDOB))</td></tr><tr><td colspan="2">MyInt ← INT (LENGTH (MyString) / 2)</td></tr></table> <p>One mark per row</p>	Expression		MyString ← 'X' & MyString		MyChar ← MID ("ABCD", 1 / 2 / 3 / 4 , 1)		MyString ← NUM_TO_STR (DAY / MONTH / YEAR / DAYINDEX (MyDOB))		MyInt ← INT (LENGTH (MyString) / 2)		4
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1(b)	<table><tr><th>Test description</th><th>Test method</th></tr><tr><td>carried out as soon as a program module has been coded</td><td>alpha</td></tr><tr><td>carried out as program modules are being combined</td><td>integration</td></tr><tr><td>completed by the developers without referring to the code</td><td>black-box</td></tr><tr><td>completed by the customer</td><td>acceptance / beta</td></tr></table> <p>One mark per row (2 to 4)</p>	Test description	Test method	carried out as soon as a program module has been coded	alpha	carried out as program modules are being combined	integration	completed by the developers without referring to the code	black-box	completed by the customer	acceptance / beta	3
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completed by the customer	acceptance / beta											
1(c)	<p>One mark per point:</p> <ul style="list-style-type: none">1 reference to a breakpoint2 reference to single stepping3 Correct explanation of both e.g. to stop program execution at specific point / line / statement / instruction and to execute one line / statement / instruction at a time to (locate an/the error) <p>One mark for each bulleted point</p>	3										

Question	Answer	Marks
2	<p>Example solution</p> <pre> graph TD Start([START]) --> Init[Set Index to 1 Set Count to 0] Init --> IsIndex{Is Index = 31 ?} IsIndex -- Yes --> OutputCount[/Output Count/] OutputCount --> End([END]) IsIndex -- No --> IsData{Is Data[Index] = "" ?} IsData -- Yes --> SetIndex[Set Index to Index + 1] SetIndex --> IsIndex IsData -- No --> SetCount[Set Count to Count + 1] SetCount --> OutputData[/Output Data[Index]/] OutputData --> IsData </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Initialisation of variables used as array index and count 2 Loop through exactly 30 elements in the array 3 Test for empty string in current array element // Test for non-empty string 4 Increment count if appropriate in a loop 5 Both required outputs under correct conditions with correct outputs 	5

Question	Answer	Marks
2	<p>Alternative solution</p> <p>Checking for empty string first</p> <pre>graph TD; START([START]) --> Init[Set Index to 1
Set Count to 0]; Init --> D1{Is Data[Index] = \"\"?}; D1 -- Yes --> IncIndex1[Set Index to Index + 1]; D1 -- No --> OutData[/Output Data[Index]/]; OutData --> IncCount[Set Count to Count + 1]; IncCount --> IncIndex2[/Set Index to Index + 1/]; IncIndex2 --> D2{Is Index > 30?}; D2 -- Yes --> OutTotal[/Output Total/]; OutTotal --> END([END]); D2 -- No --> D1; IncIndex1 --> D2;</pre>	

Question	Answer	Marks
3(a)(i)	<p>Pseudocode:</p> <pre> TYPE RentalRecord DECLARE RentalID : STRING DECLARE CarID : INTEGER DECLARE DisCode : CHAR DECLARE Start : DATE DECLARE Duration : INTEGER DECLARE Completed : BOOLEAN ENDTYPE </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> One mark for TYPE RentalRecord and ENDTYPE statements One mark for RentalID and CarID declared correctly One mark for DisCode and Start declared correctly One mark for Duration and Completed declared correctly 	4
3(a)(ii)	<p><u>DECLARE Rental : ARRAY[1:500] OF RentalRecord</u></p> <p>One mark per underlined phrase</p>	2
3(b)	<p>One mark per point:</p> <ol style="list-style-type: none"> Different data types held (for each rental) under a single identifier Allows for iteration through <u>rentals/records</u> // Can access rentals/records in a loop // Can (directly) access a specific <u>rental/record</u> <u>using an</u> (array) <u>index</u> Simplifies the code/program / less code needed / reduces code duplication // Makes code/program easier to understand // Makes testing / debugging easier // Program maintenance easier 	3

Question	Answer	Marks
4(a)	<p>Example solution - conditional:</p> <pre> PROCEDURE Store() DECLARE ThisNum, LastNum : REAL DECLARE Index : INTEGER // index to global array INPUT ThisNum LastNum ← ThisNum Number[1] ← ThisNum INPUT ThisNum Index ← 2 WHILE Index < 21 AND ThisNum > LastNum Number[Index] ← ThisNum LastNum ← ThisNum Index ← Index + 1 IF Index < 21 THEN INPUT ThisNum ENDIF ENDWHILE OUTPUT Index - 1, " values were stored in the array" ENDPROCEDURE </pre> <p>Alternative loop:</p> <pre> // Loop without using LastNum WHILE Index < 21 AND ThisNum > Number[Index - 1] Number[Index] ← ThisNum Index ← Index + 1 IF Index < 21 THEN //skip input if array full INPUT ThisNum ENDIF ENDWHILE </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Declare local variables <code>Index</code> as integer, <code>ThisNum</code> and <code>LastNum</code> as real 2 Input value and assign to first element 3 Attempt at conditional loop including both tests 4 Completely correct conditional loop including both tests 5 Assign input value to current element if greater than previous element and input next value in a loop 6 Final output giving attempted count of elements stored plus message after a loop 	6

Question	Answer	Marks
4(a)	<p>Alternative FOR loop example solution:</p> <pre> PROCEDURE Store() DECLARE ThisNum, LastNum : REAL DECLARE Index : INTEGER // index to global array DECLARE Count : INTEGER INPUT ThisNum LastNum ← ThisNum Number[1] ← ThisNum Count ← 1 INPUT ThisNum FOR Index ← 2 TO 20 IF ThisNum > LastNum THEN Number[Index] ← ThisNum LastNum ← ThisNum Count ← Count + 1 IF Index < 20 THEN INPUT ThisNum ENDIF ELSE BREAK ENDIF NEXT Index OUTPUT Count, " values were stored in the array" ENDPROCEDURE </pre> <p>Alternative loop:</p> <pre> Count ← 1 INPUT ThisNum FOR Index ← 2 TO 20 IF ThisNum > Number[Index - 1] THEN Number[Index] ← ThisNum Count ← Count + 1 IF Index < 20 THEN INPUT ThisNum ENDIF ELSE BREAK ENDIF NEXT Index </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Declare local variables <code>Index</code> as integer, <code>ThisNum</code> and <code>LastNum</code> as real 2 Input value and assign to first element 3 Count-controlled loop 4 Count-controlled loop with BREAK if current value greater than previous value 5 ... Assign input value to current element following correct comparison in a loop 6 Final output giving count of elements stored plus message following a reasonable attempt after loop 	

Question	Answer	Marks
4(b)(i)	One mark per point: 1 The amount of values stored (in a text file) is not fixed / not limited (other than by secondary storage available) // The amount values stored is not limited to the size of the array 2 The data is stored permanently / non-volatile // Data can be restored / reused without re-entering values	2
4(b)(ii)	Each (real) value would have to be converted to a string	1

Question	Answer	Marks
5(a)(i)	It is a value that is invalid as an (array) index // not in the range of valid (index) values	1
5(a)(ii)	To test whether the current element / value at index matches the given / search string / data / parameter	1
5(a)(iii)	The value of <code>FoundAt</code> is only updated to the (current) index if it currently stores the initial value / -1 // <code>FoundAt</code> is not updated when it currently stores any other value than -1	1
5(b)(i)	The loop continues after the (first instance) of the search value / string / matching element has been found Comparisons/tests continue to be made even if the search value / string / matching element has been found	1
5(b)(ii)	One mark per point Construct: A conditional loop Justification: The loop / search can be terminated as soon as the (first occurrence of) SearchString / required value / required string / matching element is found	2

Question	Answer	Marks
6(a)	Number: Any number where the first two digits sum to 5 / 15 and the last three digits are 623 Explanation: The remainder is the same / 3 // The sum of the (first four) digits is the same / 13	2

Question	Answer	Marks
6(b)	<p>Example solution – conversion of Number to a string</p> <pre> FUNCTION Generate (Number : INTEGER) RETURNS INTEGER DECLARE Total, Index, CheckDigit : INTEGER DECLARE NumString : STRING Total ← 0 NumString ← NUM_TO_STR (Number) FOR Index ← 1 TO LENGTH (NumString) Total ← Total + STR_TO_NUM (MID (NumString, Index, 1)) NEXT Index CheckDigit ← Total MOD 10 Number ← Number * 10 + CheckDigit // NumString ← NumString & NUM_TO_STR (CheckDigit) RETURN Number // STR_TO_NUM (NumString) ENDFUNCTION </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> Function heading, parameters return type and ending Initialise Total Convert Number to a string and loop for length of converted Number attempt to form sum of digits in a loop completely correct sum of digits in a loop Calculate CheckDigit Add CheckDigit to original number multiplied by 10 and return number // Convert CheckDigit to a character and appended to NumString and then convert to a number and return 	7

Question	Answer	Marks
6(b)	<p>Example Solution – no conversion to string</p> <pre> FUNCTION Generate (Number : INTEGER) RETURNS INTEGER DECLARE Total, CheckDigit, Remainder, Num: INTEGER Num ← Number Total ← 0 WHILE Num > 0 Remainder ← Num MOD 10 Num ← Num DIV 10 Total ← Total + Remainder ENDWHILE CheckDigit ← Total MOD 10 Number ← Number * 10 + CheckDigit RETURN Number ENDFUNCTION </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Function heading, parameters return type and ending 2 Initialise Total 3 Loop while Num > 0 4 attempt to use MOD and DIV to sum successive digits in Number 5 completely correct sum of digits 6 Calculate CheckDigit 7 Add CheckDigit to original number and return number 	

Question	Answer	Marks
7(a)	<div><pre>graph TD; START((START)) --> S1((S1)); S1 -- "A1 X1" --> S2((S2)); S1 -- "A2 X2" --> S3((S3)); S2 -- "A3 X3" --> S3; S2 -- "A4 X4" --> S5((S5)); S3 -- "A2 X4" --> S4((S4)); S3 -- "A1" --> S3; S4 -- "A3" --> S2; S4 -- "A4 X4" --> S5; S4 -- "A1 X1" --> S4;</pre></div> <p>One mark for each:</p> <ol style="list-style-type: none">1 Label A1 X1 added on line from S1 to state labelled S22 States S3, S4 and S5 labelled3 Line from S2 to S5 with event label A4 X44 Lines from S3 with correct event labels including 'loop' label5 Lines from S4 with correct event labels including 'loop'	5

Question	Answer	Marks
7(b)	<div><pre>graph TD Setup[Setup] -- H1 --> Restart[Restart] Setup -- C1 --> Restart Setup -- B1 --> Modify[Modify] Setup -- T1 --> Final[Final] Modify -- R2 --> Update[Update] Update --> Modify Confirm[Confirm] --> Final</pre><p>One mark per point: 1 All boxes correctly labelled 2 Iteration arrow 3 Parameter to Restart 4 Return value from Modify and parameter to Final 5 BYREF parameter to Update</p></div>	5

Question	Answer	Marks
8(a)	<p>Example solution:</p> <pre> PROCEDURE OKToBorrow(ThisStudentID : STRING) DECLARE Index, Count : INTEGER CONSTANT Max = 5 Count ← 0 Index ← 1 / 0 WHILE Index <= 5000 / Index <= 4999 AND Count < Max IF Loan[Index].StudentID = ThisStudentID AND Loan[Index].OnLoan = TRUE THEN Count ← Count + 1 ENDIF Index ← Index + 1 ENDWHILE IF Count < Max THEN OUTPUT "Student may borrow another book" ELSE OUTPUT "Student may not borrow another book" ENDIF ENDPROCEDURE </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Procedure heading, parameter and ending 2 Loop through all elements in Loan array 3 ... terminating if Max reached 4 Test for correct StudentID field in a loop 5 ... and that OnLoan = TRUE in a loop ... if so, then increment Count in a loop 6 Output an appropriate message in both cases after the loop 	7

Question	Answer	Marks
8(b)	<p>Example solution:</p> <pre> FUNCTION ReturnBook(ThisStudentID, ThisBookID : STRING) RETURNS BOOLEAN DECLARE Index : INTEGER Index ← 1 WHILE Index < 5001 IF Loan[Index].StudentID = ThisStudentID AND __ Loan[Index].BookID = ThisBookID THEN IF Loan[Index].OnLoan = TRUE THEN // Not returned Loan[Index].OnLoan ← FALSE // Mark as returned now RETURN TRUE //Found and not already returned ELSE RETURN FALSE // Found and already returned ENDIF ENDIF Index ← Index + 1 ENDWHILE RETURN False // loan not found ENDFUNCTION </pre> <p>Mark as follows:</p> <ol style="list-style-type: none"> 1 Loop through all elements in Loan array 2 ...and book loan not found 3 Attempt to reference an individual data item in a loop 4 Correct test for StudentID and correct BookID in a loop 5 ... If book not returned yet, then set OnLoan field to FALSE 6 RETURN TRUE if book loan Found and not already returned 7 RETURN FALSE if book loan Found and loan already returned 8 RETURN FALSE if book loan not found <p>Alterative example solution – not immediate return</p> <pre> FUNCTION ReturnBook(ThisStudentID, ThisBookID : STRING) RETURNS BOOLEAN DECLARE Index : INTEGER DECLARE Found, OK : BOOLEAN Index ← 1 Found ← FALSE OK ← TRUE </pre>	8

Question	Answer	Marks
8(b)	<pre> WHILE Index < 5001 AND NOT Found IF Loan[Index].StudentID = ThisStudentID AND ___ Loan[Index].BookID = ThisBookID THEN Found ← TRUE IF Loan[Index].OnLoan = FALSE THEN // Already returned OK ← FALSE ELSE Loan[Index].OnLoan ← FALSE // Mark as returned now ENDIF ENDIF Index ← Index + 1 ENDWHILE RETURN Found AND OK ENDFUNCTION </pre>	
8(c)	<p>Award marks for reference to following design features:</p> <p>Change to existing Record:</p> <ol style="list-style-type: none"> 1 Store date due back as a new data item / in the loan record 2 Store date of loan and the loan length category as new data items / in the loan record <p>Max 1</p> <p>New Record</p> <ol style="list-style-type: none"> 3 New Records with Category (and Loan length field) <p>Change to Program:</p> <ol style="list-style-type: none"> 4 (Use the loan length category of a book to) calculate the date due date 5 Compare due date with today's date (to check if overdue / to calculate fine) 6 Map loan length category to length of loan / date due back <p>Max 1</p> <p>Max 2 marks</p>	2