Cambridge International AS & A Level

COMPUTER SCIENCE **9618/23**

Paper 2 Fundamental Problem-solving and Programming Skills **May/June 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 May/June 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **14** 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
BOD	Benefit of the doubt
^	To indicate where a key word/phrase/code is missing
✗	Incorrect
FT	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
I	Ignore
NAQ	Not answered question
NE	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.
REP	Repetition
SEEN	Indicates that work or a page has been seen including blank answer spaces and blank pages.
✓	Correct

Annotation	Meaning
TV	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
bold	word/phrase in bold indicates this is a key word/phrase in the candidates answer and this word/phrase or a word/phrase with a similar meaning must be present

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)(i)</td><td>**MP1** When a **task/module is repeated** / reused / called // performed in several places
MP2 A **specific task** can be identified /coded as a module / subroutine / procedure / function.
MP3 Reduces complexity of **program / code** // **Program / code** is simplified
MP4 Module / subroutine / procedure / function **already available**.
MP5 Testing / debugging / maintenance is easier

Max 2</td><td>**2**</td></tr>
<tr><td>1(a)(ii)</td><td>**MP1** Local variables are used within a module // are accessible only within the module (in which they are declared)
MP2 Global variables are accessible to all parts of the program /
MP3 Local variables use memory only while the module in is executing // Global variables use memory for the whole time the program is running

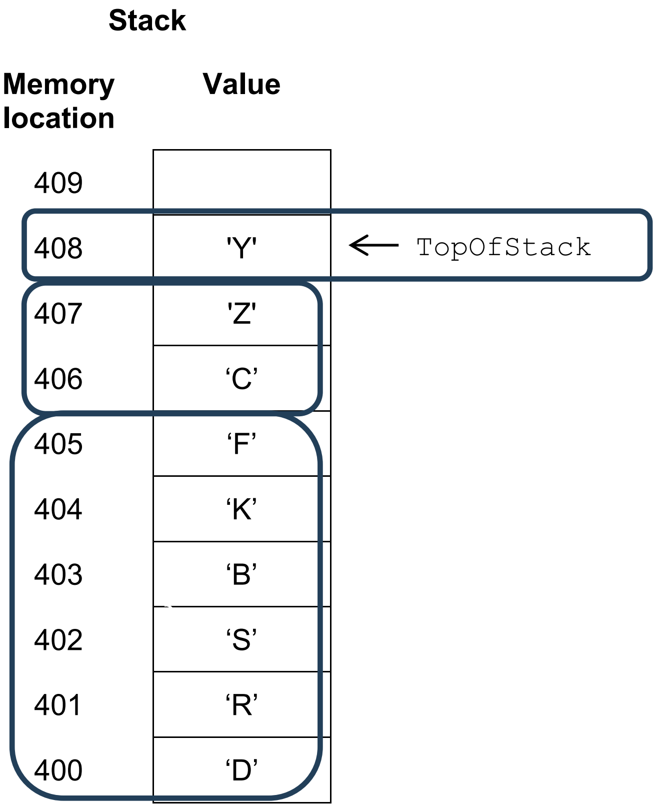
Max 1</td><td>**1**</td></tr>
<tr><td>1(a)(iii)</td><td>**MP1** The **same variable name** can be reused in other parts of the program
MP2 Using local variables makes modules **self-contained** // cannot accidentally change the same identifier outside of the module
MP3 Using local variables aids **modularisation**.
MP4 Memory allocated to local variables can be reused when module not in use

Max 2</td><td>**2**</td></tr>
<tr><td>1(b)</td><td>Mark as follows:
<table>
<tr><th>Expression</th><th>Evaluates to</th><th>Mark</th></tr>
<tr><td>CHR(68)</td><td>'D'</td><td>1</td></tr>
<tr><td>MONTH(04/02/2025)

// -2 + DAY(04/02/2025)
// -2023 + YEAR(04/02/2025)</td><td>2</td><td>1</td></tr>
<tr><td>NOT TRUE

// FALSE = TRUE</td><td>FALSE</td><td>1</td></tr>
<tr><td>STR_TO_NUM(MID("Court1.4Upper",6,3))</td><td>1.4</td><td>2</td></tr>
</table>
Mark Row 4 as follows:
STR_TO_NUM 1 mark
MID("Court1.4Upper",6,3) 1 mark</td><td>**5**</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(c)</td><td>
<table>
<tr><th>Variable</th><th>Data type</th></tr>
<tr><td>MemberCount</td><td>INTEGER</td></tr>
<tr><td>TotalTakings</td><td>REAL</td></tr>
<tr><td>BookingConfirmed</td><td>BOOLEAN</td></tr>
<tr><td>MemberDOB</td><td>DATE</td></tr>
</table>
Mark as follows:
1 mark per row</td><td>4</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td><b>MP1</b> 400
<b>MP2</b> 6</td><td>2</td></tr>
<tr><td>2(a)(ii)</td><td>

<b>Stack</b>
<table>
<tr><th>Memory location</th><th>Value</th><th></th></tr>
<tr><td>409</td><td></td><td></td></tr>
<tr><td>408</td><td>'Y'</td><td>← TopOfStack</td></tr>
<tr><td>407</td><td>'Z'</td><td></td></tr>
<tr><td>406</td><td>‘C’</td><td></td></tr>
<tr><td>405</td><td>‘F’</td><td></td></tr>
<tr><td>404</td><td>‘K’</td><td></td></tr>
<tr><td>403</td><td>‘B’</td><td></td></tr>
<tr><td>402</td><td>‘S’</td><td></td></tr>
<tr><td>401</td><td>‘R’</td><td></td></tr>
<tr><td>400</td><td>‘D’</td><td></td></tr>
</table>
<b>MP1</b> TopOfStack pointing to 'Y' <b>and</b> value 'Y' in location 408
<b>MP2</b> Values 'C' and 'Z' in 406 and 407
<b>MP3</b> Values 'D' to 'F' unchanged in 400 to 405 <b>and</b> 409 is empty</td><td>3</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)(i)</td><td>
<table>
<tr><th>Index</th><th>Data</th><th>Pointer</th><th></th></tr>
<tr><td>0</td><td>"Neptune"</td><td><b>2</b></td><td><b>MP3</b></td></tr>
<tr><td>1</td><td>"Jupiter"</td><td><b>4</b></td><td></td></tr>
<tr><td>2</td><td>"Saturn"</td><td><b>5</b></td><td></td></tr>
<tr><td>3</td><td>"Earth"</td><td><b>1</b></td><td><b>MP1</b></td></tr>
<tr><td>4</td><td>"Mercury"</td><td><b>0</b></td><td></td></tr>
<tr><td>5</td><td>"Uranus"</td><td><b>-1</b></td><td><b>MP2</b></td></tr>
</table>
<b>MP1</b> Earth pointer 1
<b>MP2</b> Uranus pointer -1
<b>MP3</b> Other four correct pointers
</td><td>3</td></tr>
<tr><td>2(b)(ii)</td><td><b>3</b></td><td>1</td></tr>
<tr><td>2(c)</td><td><b>MP1</b> First value added to queue is the first value removed // FIFO // LILO
<b>MP2</b> Two <b><u>pointers</u></b> needed to indicate the <b>start</b> and <b>end</b> of the queue
<b>MP3</b> May behave as a circular queue
<b>MP4</b> Manipulated using <code>enqueue()</code>/ <code>dequeue()</code> operations // by description

<b>Max 2</b></td><td>2</td></tr>
</table>

Question	Answer	Marks

3	Example solution:
	
	`FUNCTION RollDice(NoOfTimes : INTEGER) RETURNS REAL`
	`   DECLARE RollValue : INTEGER`
	`   DECLARE Average : REAL`
	`   DECLARE Count : INTEGER`
	`   DECLARE Sum : INTEGER`
	
	`   Sum ← 0`
	
	`   FOR Count ← 1 TO NoOfTimes`
	`     RollValue ← INT(RAND(6)) + 1`
	`     OUTPUT RollValue`
	`     Sum ← Sum + RollValue`
	`   NEXT Count`
	
	`   Average ← Sum / NoOfTimes`
	`   RETURN Average`
	`ENDFUNCTION`
	
	MP1 Declare all variables used **and** initialise `Sum` to `0`
	MP2 Loop for 'number of times' parameter
	
	MP3 Use `RAND`() function with Integer parameter **in a loop**
	MP4 Use `INT`() function **in a loop**
	MP5 Generate a random integer between 1 and 6 **in a loop**
	
	MP6 Output each value generated **in a loop**
	MP7 Calculate `Sum` **and** if `Average` used check declared as `REAL` **and** return `Average` **and** check function header returns `REAL`
		7

Question	Answer	Marks
4(a)	**MP1** **Open** the file (`Sales.txt`) in **read mode and** subsequently close **MP2** **Read <u>a line</u>** (from the text file) **MP3** Convert the line read (string) to a number **MP4** If the number is greater than 500 **and** then output week number **MP5** Increment week number (must have been Initialised **…**) **MP6** Repeat from step 2 for 52 times // Repeat from step 2 until end of file **Max 5**	**5**

Question	Answer	Marks
4(b)	**MP1** Going through the program **a line / statement at a time** **//** doing a **dry run** // **single-stepping (**at run-time with an IDE) // Peer testing/review is carried out **MP2** Creating a **trace table** **MP3** Draw up **test data** // draw up list **of inputs with expected output** **//** boundary, normal, abnormal data is used **MP4** Errors will be indicated when a **variable** / **output** gives an **unexpected value** **MP5** Faults in the logic of the program can be detected // Errors may be indicated by an unexpected path through the program **Max 3**	**3**

Question	Answer	Marks

5	Example solution:
	
	`FUNCTION Parity(BitString : STRING) RETURNS STRING`
	`   DECLARE Index, Count: INTEGER`
	`   Count ← 0`
	
	`   FOR Index ← 1 TO LENGTH(BitString)`
	`     IF MID(BitString, Index, 1) = '1' THEN`
	`       Count ←Count + 1`
	`     ENDIF`
	`   NEXT Index`
	
	`   IF Count MOD 2 = 1 THEN`
	`      BitString ← BitString & '1'`
	`   ELSE`
	`      BitString ← BitString & '0'`
	`   ENDIF`
	
	`   RETURN BitString`
	`ENDFUNCTION`
	
	MP1 Function heading **and** ending **and** parameter (`STRING`) **and** return type `STRING`
	MP2 Loop for length of `BitString`
	MP3 Extract current character **in a loop**
	MP4 Compare current character to `'1'` or `'0'` **in a loop**
	MP5 Increment count **and** was Initialised earlier **in a loop**
	
	MP6 Check if even/odd number of 1s
	MP7 Append `'1'` or `'0'` as appropriate
	MP8 Return amended `BitString`
		8

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)</td><td><b>MP1</b> A function returns a (single) <b>value and</b> a procedure does not
<b>MP2</b> A procedure can pass parameters by ByRef

<b>Max 1</b></td><td><b>1</b></td></tr>
<tr><td>6(b)</td><td>Sub_Part1A:

<code>PROCEDURE Sub_Part1A(R: INTEGER)</code> 1 Mark

Sub_Part2A:

<code>FUNCTION Sub_Part2A(T : REAL) RETURNS BOOLEAN</code>
2 Marks

Sub_Part3A:

<code>PROCEDURE Sub_Part3A(V: INTEGER, W: BOOLEAN, BYREF U : STRING)</code>
2 Marks</td><td><b>5</b></td></tr>
<tr><td>6(c)</td><td>
<table>
<tr><th>Symbol</th><th>Explanation</th></tr>
<tr><td>◇</td><td>The module <b>Main</b> calls either <b>Sub_A or Sub_B</b> (which one is called is determined at run time)</td></tr>
<tr><td>↷</td><td>The module <b>Sub_A</b> will repeatedly call <b>Sub_Part1A</b> followed by <b>Sub_Part2A</b> then <b>by Sub_Part3A</b></td></tr>
</table>
<b>MP1</b> Shape1: reference to <b>selection</b>
<b>MP2</b> Shape2: reference to <b>repetition // iteration</b>

<b>MP3</b> <b>Descption (×2)</b> including correct use of <b>all module names</b> in <b>both</b> parts</td><td><b>3</b></td></tr>
</table>

Question	Answer	Marks

7(a)(i)	Example solution:
	`PROCEDURE UpdateVisit(BYREF LastVisitDate : DATE,__`
	`                        BYREF LoyaltyPoints : INTEGER)`
	`   IF MONTH(TODAY()) = MONTH(LastVisitDate) THEN`
	`      LoyaltyPoints ← LoyaltyPoints + 4`
	`   ELSE`
	`      LoyaltyPoints ← LoyaltyPoints + 1`
	`   ENDIF`
	`   LastVisitDate ← TODAY()`
	`ENDPROCEDURE`
	MP1 Procedure heading **and** ending **and** two parameters of correct type
	MP2 … both passed `BYREF`
	MP3 Use of `TODAY()` function to obtain current date
	MP4 Use `MONTH` function (×2) **and** one parameter is the header parameter **and** 2nd parameter is `TODAY()` / assigned variable
	MP5 If visit is same month, increase `LoyaltyPoints` by 4 otherwise increase by 1
	MP6 `LastVisitDate` set to `TODAY()` / 'current date' variable (assigned or unassigned)
	Max 5
		5

7(a)(ii)	`DAYINDEX(LastVisitDate) = DAYINDEX(TODAY())`	**1**

Question	Answer	Marks
7(b)(i)	Example solution:	8

```
FUNCTION (MondayCheck(CustomerID : STRING) RETURNS INTEGER
   DECLARE LoyaltyPoints : INTEGER
   DECLARE LoyaltyPointsString : STRING
   DECLARE Line : STRING

   Line ← FindCustomer(CustomerID)
   LoyaltyPointsString ← MID(Line, 8, LENGTH(Line) – 16))
   LoyaltyPoints ← STR_TO_NUM(LoyaltyPointsString)

IF DAYINDEX(TODAY()) = 2 THEN
      LoyaltyPoints ← LoyaltyPoints + 10
   ENDIF

   RETURN LoyaltyPoints
ENDFUNCTION
```

MP1 Value is returned from `FindCustomer(CustomerID)` and stored

MP2 Function `MID` used
MP3 Attempt to extract `LoyaltyPoints` from the string returned by `FindCustomer()`
MP4 Correct extraction of `LoyaltyPoints` from the string returned by `FindCustomer()`

MP5 Conversion of `LoyaltyPoints` extracted to an integer

MP6 Check - is today's date a Monday using **`TODAY()`**
MP7 … increase `LoyaltyPoints` by 10
MP8 Return `LoyaltyPoints`

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(b)(i)</td><td>

Alternative example solution:

Uses a loop to calculate the number of digits in the `LoyaltyPoints` string

```
FUNCTION MondayCheck(CustomerID : STRING) RETURNS INTEGER

   DECLARE LoyaltyPoints : INTEGER
   DECLARE LoyaltyPointsString : STRING
   DECLARE Index : INTEGER
   DECLARE Line : STRING

   Line ← FindCustomer(CustomerID)
   Index ← 9

   WHILE MID(Line, Index, 1) <> ','
     Index ← Index + 1
   ENDWHILE
   // calculate the number of digits in LoyaltyPoints string
   LoyaltyPointsString ← MID(Line, 8, Index - 8)
   LoyaltyPoints ← STR_TO_NUM(LoyaltyPointsString)

   IF DAYINDEX(TODAY()) = 2 THEN
     LoyaltyPoints ← LoyaltyPoints + 10
   ENDIF

   RETURN LoyaltyPoints

ENDFUNCTION
```

</td><td></td></tr>
<tr><td>7(b)(ii)</td><td>

Example solution:

```
DayInt ← STR_TO_NUM(LEFT(LastVisitDateString, 2))
MonthInt ← STR_TO_NUM(MID(LastVisitDateString, 3, 2))
YearInt ← STR_TO_NUM(RIGHT(LastVisitDateString, 4))

LastVisitDate ← SETDATE(DayInt, MonthInt, YearInt)
```

Mark as follows:

MP1 Use of one substring function
MP2 `DayInt`, `MonthInt` and `YearInt` all correctly extracted

MP3 Use of `STR_TO_NUM` x 3

MP4 `SETDATE()` function used to convert to a date type **and** assigned to `LastVisitDate`

</td><td>4</td></tr>
</table>