

Cambridge International Examinations

Cambridge International Advanced Subsidiary and Advanced Level

COMPUTING Paper 2	Octobe	9691/22 r/November 2015
CENTRE NUMBER	CANDIDATE NUMBER	
CANDIDATE NAME		

Candidates answer on the Question Paper.

No additional materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer all questions.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.



2 hours

1 (a) Sheena wants to develop a program to keep details of the books she has read.

One way of storing this data will be to use records. Each record will contain the fields shown in the table below.

Complete the table.

Field	Identifier	Data type	Example of input data	Field size (in bytes)
Title	Title		How to solve it	
Author	Author		G Polya	
International Standard Book Number	ISBN		9780691119663	
Number of pages	NumberOfPages		253	
Price (\$)	BookPrice		12.50	
Date started to read book	DateStarted		28032012	
Date finished reading book	DateFinished		17052012	
Paperback?	IsPaperback		TRUE	
Rating (range 0 to 5)	Rating		4	

(b) Use a high-level programming language to define a book record with identifier BookRecordType and the fields listed in part (a).

Programming language

Code

.....[4]

[5]

(c)	Sheena declares an array of records to store the book data:
	DECLARE Book ARRAY[1 : 100] OF BookRecordType
	At the beginning, the array elements will not contain book data.
	Explain how the array should be initialised.
	[2]
(d)	The records are to be saved to a serial file.
	Calculate the size, in kilobytes, of the file after details of 10 books have been saved.
	Show your working.
	[4]

(e)	Sheena has entered some more book data.					
	Write pseudocode to save the array records to the serial file BookData.DAT					
	Only those array elements containing book data should be saved to the file.					
	[5]					
(f)	Sheena wants to read previously saved data from the file.					
	Here is part of the pseudocode she wrote:					
	WHILE NOT EOF(BookData.DAT)					
	:					
	:					
	ENDWHILE					
	Explain what the function \mathtt{EOF} () does when used in a program.					
	[2]					

(g) Sheena wants to know the title of her favourite book. She plans to write code to search the

arra	ay Book.
(i)	Write pseudocode to output the title of the book with the highest rating. For now, assume that only one book in the $Book$ array has the highest rating.
	[6]
(ii)	There may be more than one book with the highest rating. Sheena wants to output all the titles that have this rating. The pseudocode will need to be changed.
	Describe the changes you would need to make. Do not write more pseudocode.
	[2]

2 At the end of movies, when credits are listed, the year of production is often shown in Roman numerals.

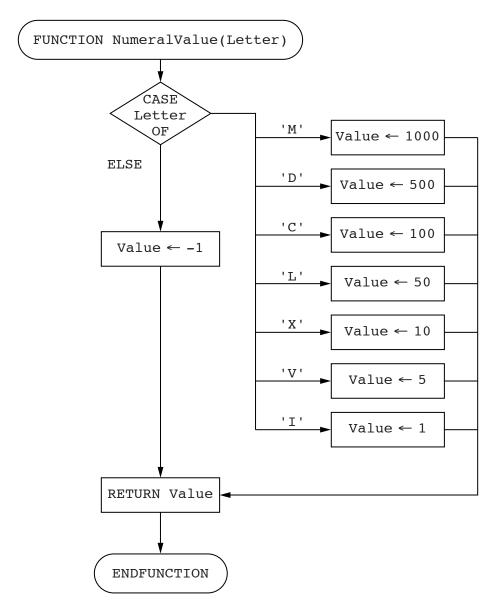
Roman numbers are formed by combining letters together and adding their value. The letters used and their values are:

M: 1000 D: 500 C: 100 L: 50 X: 10 V: 5 I: 1

For example, MMXV is 1000 + 1000 + 10 + 5 = 2015.

Ali wants to write a program to convert a year written in Roman numerals to denary.

He has drawn the flowchart as part of the design for his solution.



(a)	(i)		code to convert the ramming language.	flowchart into the function Numeral	Value, using a
		Programming I	Language		
		Code			
					[ວ]
	(ii)	Ali needs to te	st this function before	e using it in his program.	
		Complete the t	able of test data.		
					1
		Letter	Expected result	Type of data (normal, borderline or invalid)	
		'D'			
		1 1/1			
		'I'			

' Y '

- **(b)** Ali writes pseudocode to convert a Roman number using:
 - the function NumeralValue() from part (a)
 - the string manipulation functions MID and LENGTH

Study the pseudocode:

```
RomanNumber ← "MDCLI"

Denary ← 0

FOR i ← 1 TO LENGTH(RomanNumber)

ThisLetter ← MID(RomanNumber, i, 1)

ThisNumber ← NumeralValue(ThisLetter)

Denary ← Denary + ThisNumber

ENDFOR

OUTPUT Denary
```

Dry-run the pseudocode by completing the trace table.

RomanNumber	Denary	i	ThisLetter	ThisNumber	OUTPUT
"MDCLI"	0				

[5]

(c)	(i)	The pseudocode has some features that make it easier to read and understand.
		Identify two such features.
		1
		2
		[2]
	/::\	White presume and to implement the proceeds given in part (b)
	(ii)	Write program code to implement the pseudocode given in part (b) .
		Programming Language
		Code
		[8]

(d) The order of letters in Roman numbers is significant. Letters are placed from left to right, in order of value, starting with the largest.

However, a sequence of four identical letters (such as IIII) is shortened as follows. If a letter to the left is of lower value than the letter to its right, the left letter's value becomes negative.

Examples are shown in the following table:

Roman number	Shortened Roman number	rtened Roman number Interpretation	
IIII	IV	-1 + 5	4
VIIII	IX	-1 + 10	9
XXXX	XL	-10 + 50	40
LXXXX	XC	-10 + 100	90
CCCC	CD	-100 + 500	400
DCCCC	CM	-100 + 1000	900

Ali has to amend his pseudocode to include the conversion of these shortened Roman numbers.

Ali has chosen some test data.

Complete the table.

RomanNumber	Expected result	Reason for choice
"MDCLXVI"	1666	Each letter used once in descending order
"CCC"	300	Multiple letters (but not 4 identical letters)
"IIII"		
"IV"		
"XIV"		
"XY"		

[4]

(e) Study the pseudocode below:

(i) Dry-run the pseudocode using "IV" as input.

RomanNumber	ThisLetter	ThisNumber	i	NextLetter	NextNumber	Denary
"IV"	'I'	1				0

[2]

(ii) Dry-run the pseudocode using "XY" as input.

RomanNumber	ThisLetter	ThisNumber	i	NextLetter	NextNumber	Denary
"XY"	'X'	10				0

[2]

	(iii)	Comment on the result of the dry-run in part (e)(ii).
		Describe what changes are required to the pseudocode.
		[3]
(f)	Ali I	nas written the final program code. There are syntax and logic errors in his program.
()	(i)	Describe when and how syntax errors are detected.
	(1)	Describe when and now syntax errors are detected.
		When
		How
		[2]

	(ii)	Describe when and how logic errors are detected.	
		When	
		How	
		[2]
3	Sheena	wants to use debugging tools available in her program development environment.	
	(a) Exp	plain how each of the following are used:	
	(i)	Break point	
		[2]
	(ii)	Stepping	
		[2]
	(iii)	Variable check/watch	
		[2]
	(b) Nar	me the type of testing that is performed with such debugging tools.	
		[1]

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