

CANDIDATE
NAME

CENTRE
NUMBER

--	--	--	--	--

CANDIDATE
NUMBER

--	--	--	--



COMPUTING

9691/22

Paper 2

October/November 2015

2 hours

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.

This document consists of **12** printed pages.

(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]

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

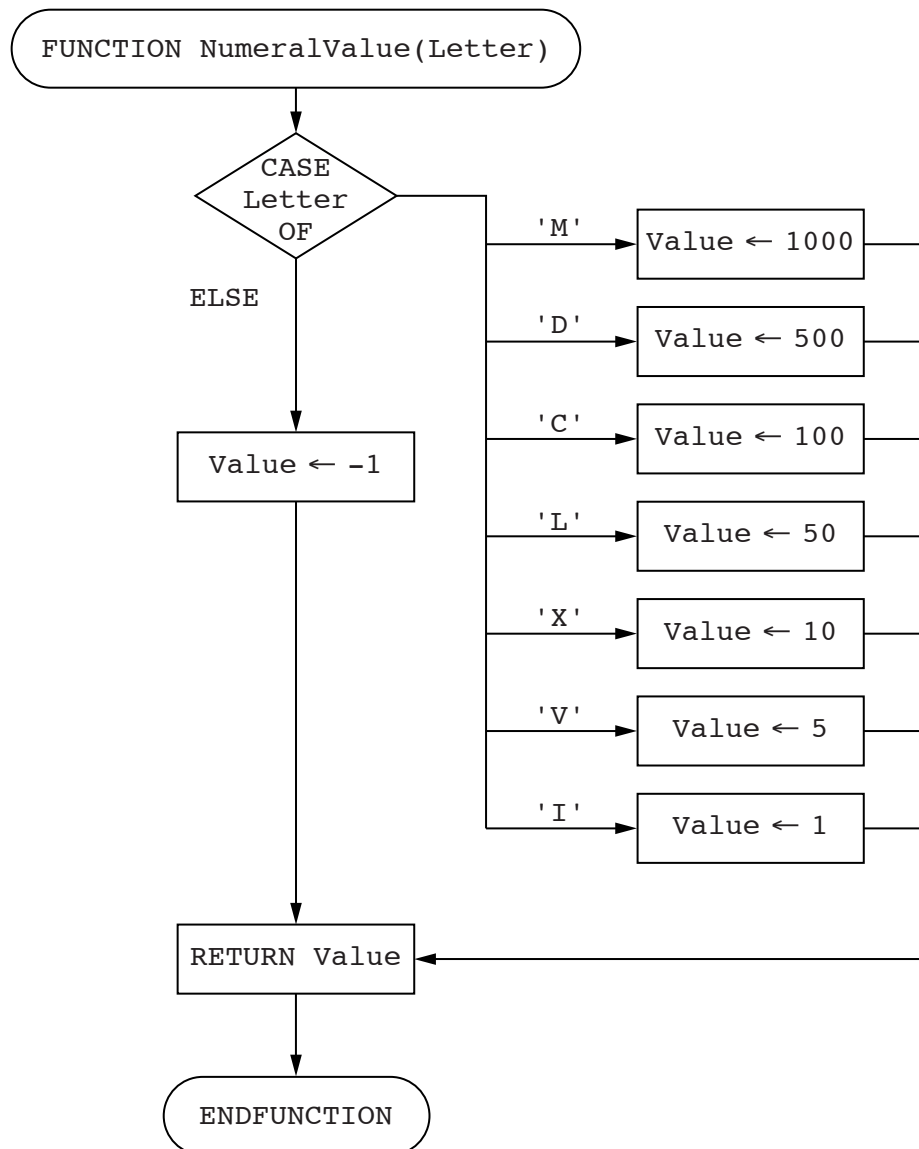
Roman numbers are formed by combining letters together and adding their value. The letters used and their values are:

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.



- (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]

- (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	Interpretation	Denary
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:

```

INPUT RomanNumber
ThisLetter ← MID(RomanNumber, 1, 1)
ThisNumber ← NumeralValue(ThisLetter)

Denary ← 0

FOR i ← 2 TO LENGTH(RomanNumber)
    NextLetter ← MID(RomanNumber, i, 1)
    NextNumber ← NumeralValue(NextLetter)
    IF ThisNumber < NextNumber
        THEN
            ThisNumber ← - ThisNumber
        ENDIF
    Denary ← Denary + ThisNumber
    ThisNumber ← NextNumber
ENDFOR

Denary ← Denary + ThisNumber

```

(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 has written the final program code. There are syntax and logic errors in his program.

(i) Describe when and how 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) Explain how each of the following are used:

(i) Break point

.....

.....

.....

..... [2]

(ii) Stepping

.....

.....

.....

..... [2]

(iii) Variable check/watch

.....

.....

.....

..... [2]

(b) Name the type of testing that is performed with such debugging tools.

..... [1]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.