

## **Cambridge International Examinations**

International AS & A Level	Cambridge International Advanced	Subsidiary and Advanced Le	vel
CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	
COMPUTING			9691/23
Paper 2		Oct	ober/November 2015
	swer on the Question Paper. naterials are required.		2 hours

## **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.





1 (a) A college provides courses for the local community. The Computing teacher, Ravi, wants to develop a program to keep details of the courses. 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)
course code	CourseCode		015110217	
title	Title		Programming for Beginners	
tutor (3-letter initials)	Tutor		PGL	
day of week (1 – Monday 7 – Sunday)	Day		2	
lab based?	IsLabBased		TRUE	
session duration in hours	SessionHours		2.5	
fee (\$)	CourseFee		25.50	
date course starts	StartDate		02/11/2015	
date course ends	EndDate		03/12/2015	

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

Programming language

Code

.....[4]

[5]

(c)	Ravi decides to store course data in the array Course. The array will consist of 50 records	3.
	Initially, the array elements will not contain course data.	
	Use the high-level language from part (b) to:	
	<ul> <li>declare the array Course</li> <li>initialise its contents with appropriate dummy values for each field</li> </ul>	
	Programming language	
	Code	
		[6]

(d) Ravi has entered some course data. His program saved the array records to a serial file

	ne file.
	rogram is to be written to read the data from CourseData.DAT into consecutive location ne array Course.
(i)	Explain what the function $\mathtt{EOF}$ () does when used in a program.
	[2
Rav	ri wants to write another module in his program. The new module will:
•	read data from CourseData.DAT write these data into consecutive elements of the array Course
ii)	
	Write <b>pseudocode</b> to read the data from the file CourseData.DAT into the arra Course.
	Course.
	Course.
	Course.
	Course.
	Write pseudocode to read the data from the file CourseData.DAT into the array Course.
	Course.
	Course.
	Course.
	Course.

**(e)** Ravi wants to write a procedure to sort the records in the array Course. The records will be sorted into ascending order of course fee. The array contains records for each course provided. The remaining array elements contain dummy records.

One of his students has written a sorting algorithm:

```
PROCEDURE SortData

FOR x ← 1 TO 49

FOR y ← 1 TO 49

IF Course[y].CourseFee > Course[y + 1].CourseFee

THEN

TempRecord ← Course[y]

Course[y] ← Course[y + 1]

Course[y + 1] ← TempRecord

ENDIF

ENDFOR

ENDFOR

ENDPROCEDURE
```

An integer variable, NumberOfCourses, will contain the number of courses for which data are stored in the array.

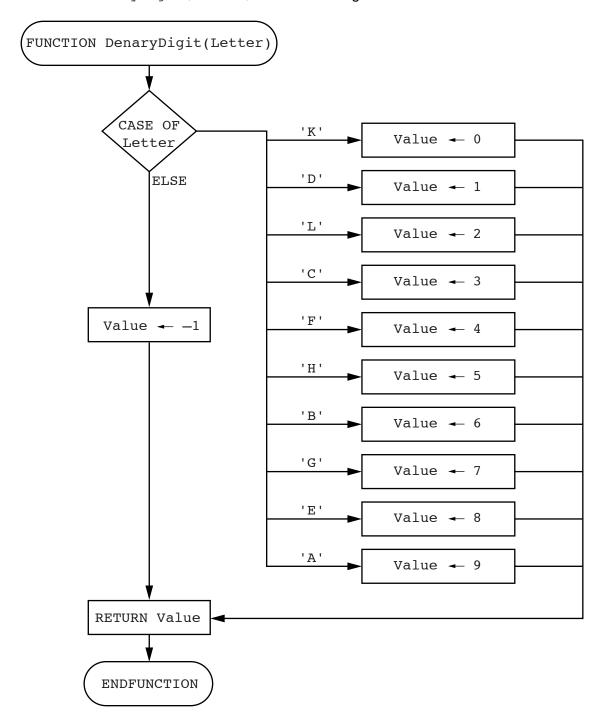
Improve the algorithm so that no unnecessary comparisons are made.

PROCEDURE SortData(NumberOfCourses)

2 Alia received a number coded as a sequence of letters. She wants to write a program to change this sequence of letters back to the original number. She knows that each digit of the original number was replaced by exactly one letter. The letters used are shown in the flowchart below.

She has drawn the flowchart as part of the design for her solution.

The function DenaryDigit (Letter) returns an integer.



(a)	(i)		gram code to impler nigh-level programmi		DenaryDigit	from	its flowd	chart
		Programming I	_anguage					
		Code						
								[5]
	(ii)	Alia needs to t	est this function befo	re using it in her p	rogram.			
		Complete the t	able of test data.					
		Letter	Expected result	ı	of data erline or invalid)			
		'1'						
		'X'						

[3]

'G'

- (b) Alia writes pseudocode to convert a coded number using
  - the function DenaryDigit() from part (a)
  - the string manipulation functions MID() and LENGTH()

Study the pseudocode:

```
01 PROCEDURE ConvertToDenary(CodedNumber : STRING)
02
03
      Denary \leftarrow 0
04
      FOR i ← 1 TO LENGTH(CodedNumber)
05
06
         ThisChar ← MID(CodedNumber, i, 1)
07
         ThisNumber ← DenaryDigit(ThisChar)
         Denary ← Denary + (ThisNumber * 10)
80
09
      ENDFOR
10
11
      OUTPUT Denary
12 ENDPROCEDURE
```

(i) Dry-run the procedure call ConvertToDenary ("LED") by completing the trace table.

CodedNumber	Denary	i	ThisChar	ThisNumber	OUTPUT
"LED"	0				

[5]

ii)	The denary value of the coded number LED is 281. There is an error in the pseudocode above.
	Give the line number of the statement that needs correcting.
	Write the corrected statement.
	[2]

(iii)	State the type of error Alia made in her pseudocode.
	[1]
(iv)	There are <b>two</b> other types of error that can occur when writing or executing program code.
	Name each type of error and describe when and how it is detected.
	Error type 1
	When
	How
	Error type 2
	When
	How
	[6]
(c) (i)	The pseudocode in <b>part (b)</b> has some features that make it easier to read and understand.
	State three such features.
	1
	2
	3
	[3]
(ii)	State <b>one</b> other feature Alia could have used to help the understanding of this code.
	[1]

(iii) Write program code to implement the pseudocode given in part (b).

Remember to declare variables before you use them.

The code is repeated here so that you do not need to turn back to **part (b)**:

```
PROCEDURE ConvertToDenary (CodedNumber : STRING)
    Denary \leftarrow 0
    FOR i ← 1 TO LENGTH(CodedNumber)
      ThisChar ← MID(CodedNumber, i, 1)
      ThisNumber ← DenaryDigit(ThisChar)
      Denary ← Denary + (ThisNumber * 10)
    ENDFOR
    OUTPUT Denary
  ENDPROCEDURE
Programming Language .....
```

(iv)	The parameter of ConvertToDenary might not be a valid coded number.
	An error message is to be output if the string provided as a parameter is not valid.
	Describe the changes required to the code design.

Ravi and Alia want to use debugging tools available in their program development environments.

3

(a)	Exp	plain how each of the following are used:	
	(i)	Breakpoint	
			[2]
	(ii)	Stepping	
	(iii)	Variable check/watch	[-]
	. ,		
			[2]
(b)	Nar	me the type of testing that is performed with such debugging tools.	
(~)		me the type of testing that is performed with such debugging tools.	[1]

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