

Cambridge International Examinations Cambridge International Advanced Level

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	
	CIENCE		9608/42

COMPUTER SCIENCE

Paper 4 Further Problem-solving and Programming Skills

9608/42

October/November 2015

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.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. No marks will be awarded for using brand names of software packages or hardware.

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.

The maximum number of marks is 75.

This document consists of 15 printed pages and 1 blank page.



Throughout the paper you will be asked to write either **pseudocode** or **program code**.

Complete the statement to indicate which high-level programming language you will use.

Programming language

1 A large software house has been asked to supply a computerised solution for a business. The project manager has drawn up a list of activities and their likely duration.

Activity	Description	Weeks to complete
А	Write requirement specification	1
В	Produce program design	1
С	Write module code	7
D	Module testing	2
E	Integration testing 2	
F	Alpha testing 2	
G	Install software and carry out acceptance testing 2	
Н	Research and order hardware 1	
J	Install delivered hardware 3	
К	Write technical documentation 4	
L	Write user training guide 2	
М	Train users on installed hardware and software 1	
N	Sign off final system 1	

(a) From this data a GANTT chart is constructed.

Activity



(i)	Complete the GANTT chart by adding activities M and N.	[2]
(ii)	State the earliest completion date.	
	Week number	[1]

- (b) There are problems with the progress of the project:
 - Activity E showed that the code contained major errors. The senior programmer now estimates that:
 - further module coding will require another 2 weeks
 - further module testing will require another 2 weeks
 - further integration testing will require another 2 weeks
 - The hardware delivery is delayed by 16 weeks.

A revised GANTT chart is now required.

(i) Complete the chart in the grid below.



Activity

[9]

(ii) State the new estimated completion date.

2 A declarative programming language is used to represent the following facts and rules:

```
01 male(ahmed).
02 male(raul).
03 male(ali).
04 male(philippe).
05 female(aisha).
06 female(gina).
07 female(meena).
08 parent(ahmed, raul).
09 parent(aisha, raul).
10 parent(aisha, raul).
11 parent(aisha, philippe).
12 parent(aisha, philippe).
13 parent(aisha, gina).
14 mother(A, B) IF female(A) AND parent(A, B).
```

These clauses have the following meaning:

Clause	Explanation	
01	Ahmed is male	
05	Aisha is female	
08	Ahmed is a parent of Raul	
14	A is the mother of ${\tt B}$ if A is female and A is a parent of ${\tt B}$	

(a) More facts are to be included.

Ali and Meena are the parents of Ahmed.

Write the additional clauses to record this.

15	
16	[2]

(b) Using the variable C, the goal

```
parent(ahmed, C)
```

returns

C = raul, philippe, gina

Write the result returned by the goal

```
parent(P, gina)
```

(c)	Use the variable $\ensuremath{\mathbb{M}}$ to write the goal to find the mother of Gina.
	[1]
(d)	Write the rule to show that F is the father of C.
	father(F, C)
	IF
	[2]
(e)	Write the rule to show that x is a brother of y .
	brother(X, Y)
	IF

3 A college has two types of student: full-time and part-time.

All students have their name and date of birth recorded.

A full-time student has their address and telephone number recorded.

A part-time student attends one or more courses. A fee is charged for each course. The number of courses a part-time student attends is recorded, along with the total fee and whether or not the fee has been paid.

The college needs a program to process data about its students. The program will use an objectoriented programming language.

(a) Complete the class diagram showing the appropriate properties and methods.

Stude	ent
StudentName: STRIN	NG
ShowStudentName()	

FullTimeStudent	PartTimeStudent
Address: STRING	
Constructor()	
ShowAddress()	

(b)	Wri	te program code :
	(i)	for the class definition for the superclass Student.
		Programming language
		[2]
	(ii)	for the class definition for the subclass FullTimeStudent.
		Programming language
		[3]

- (iii) to create a new instance of FullTimeStudent with:
 - identifier: NewStudent
 - name: A. Nyone
 - date of birth: 12/11/1990
 - telephone number: 099111

- 4 A dictionary Abstract Data Type (ADT) has these associated operations:
 - Create dictionary (CreateDictionary)
 - Add key-value pair to dictionary (Add)
 - Delete key-value pair from dictionary (Delete)
 - Lookup value (Lookup)

The dictionary ADT is to be implemented as a two-dimensional array. This stores key-value pairs.

The pseudocode statement

DECLARE Dictionary : Array[1:2000, 1:2] OF STRING

reserves space for 2000 key-value pairs in array Dictionary.

The CreateDictionary operation initialises all elements of Dictionary to the empty string.

(a) The hashing function Hash is to extract the first letter of the key and return the position of this letter in the alphabet. For example Hash("Action") will return the integer value 1. (Note: The ASCII code for the letter A is 65.)

Complete the pseudocode:

FUNCTION Hash ()	RETURNS
DECLARE Number : INTEGER	
Number←	
ENDFUNCTION	

(b) The algorithm for adding a new key-value pair to the dictionary is written, using pseudocode, as a procedure.

```
PROCEDURE Add(NewKey : STRING, NewValue : STRING)
Index ← Hash(NewKey)
Dictionary[Index, 1] ← NewKey // store the key
Dictionary[Index, 2] ← NewValue // store the value
ENDPROCEDURE
```

An English-German dictionary of Computing terms is to be set up.

(i) Dry-run the following procedure calls by writing the keys and values in the correct elements of Dictionary.

```
Add("File", "Datei")
Add("Disk", "Platte")
Add("Error", "Fehler")
Add("Computer", "Rechner")
```



Dictionary

(ii) Another procedure call is made: Add ("Drive", "Laufwerk")

Explain the problem that occurs when this key-value pair is saved.

10

(iii) Describe a method to handle the problem identified in part (b)(ii).

(iv) Write **pseudocode** to implement the method you described in **part (b) (iii)**. Choose line numbers to indicate where your pseudocode should be inserted in the given pseudocode.

10	PROCEDURE Add(NewKey : STRING, NewValue : STRING)	
20	Index ← Hash(NewKey)	
30	Dictionary[Index, 1] \leftarrow NewKey // store the key	
40	Dictionary[Index, 2] ← NewValue // store the val	ue
50	ENDPROCEDURE	
		[4]

Question 5 begins on page 12.

5 The table shows assembly language instructions for a processor which has one general purpose register – the Accumulator (ACC).

Instruction		Funlanation
Op Code	Operand	Explanation
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address></address>	Direct addressing. Load the contents of the given address to ACC
STO	<address></address>	Store the contents of ACC at the given address
ADD	<address></address>	Add the contents of the given address to the ACC
INC	<register></register>	Add 1 to the contents of the register
CMP	<address></address>	Compare the contents of ACC with the contents of <address></address>
JPN	<address></address>	Following a compare instruction, jump to <address> if the compare was False</address>
END		Return control to the operating system

(a) (i) Dry-run this assembly language program using the trace table.

500	LDD	512
501	ADD	509
502	STO	512
503	LDD	511
504	INC	ACC
505	STO	511
506	CMP	510
507	JPN	500
508	END	
509	7	
510	3	
511	0	
512	0	

	Memory address				
Accumulator	509	510	511	512	
	7	3	0	0	

Trace table

[5]

(ii) Explain the role address 511 has in this assembly language program.

(b) Using opcodes from the given table, write instructions to set the value at address 509 to 12.

Write the program code to declare the record structure StockItem. Programming language _____[4] (b) Before records can be read from file StockFile, the file needs to be opened. (i) Complete the pseudocode. 01 TRY 02 OPENFILE 03 EXCEPT 04 05 ENDTRY [2] Explain the reason for including lines 01, 03, 04, 05. (ii)[2]

A company keeps details of its stock items in a file of records, StockFile.

(a) The record fields are the ProductCode, the Price and the NumberInStock.

(c) A stock report program uses a variable of type StockItem declared as follows:

DECLARE ThisStockItem : Stockitem

The program reads each record in the file StockFile in turn.

The program outputs the fields ProductCode and NumberInStock for each record.

Write **pseudocode** for this.

[4]

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