

Monday 21 January 2013 – Morning

A2 GCE COMPUTING

F453/01 Advanced Computing Theory

Candidates answer on the Question Paper.

OCR supplied materials:

None

Other materials required:

None

Duration: 2 hours



Candidate forename		Candidate surname	
-----------------------	--	----------------------	--

Centre number						Candidate number				
---------------	--	--	--	--	--	------------------	--	--	--	--

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **120**.
- 'Quality of Written Communication' will be assessed in this paper.
- This document consists of **20** pages. Any blank pages are indicated.

1 (a) After processing, data may be written automatically to a storage device and then printed.

(i) Give the name for this method.

..... [1]

(ii) Explain why this method is used.

.....
.....
.....
.....
.....
.....
..... [3]

(b) Describe the following features of an operating system used in a computer.

Utility programs

.....
.....
.....
..... [2]

Data security

.....
.....
.....
..... [2]

Memory management

.....
.....
.....
..... [2]

2 (a) Tick **one** box in each row to show at which stage(s) each of the following statements is true.

	Lexical analysis only	Syntax analysis only	Lexical & syntax analysis	
			Both	Neither
This is part of compilation				
May discover errors				
Removes redundant code such as comments				
Translates into source code				
The symbol table is used				
Optimises code				

[6]

(b) Tokens are used during compilation.

Describe tokens and state at what stage they are created.

.....

.....

.....

.....

.....

.....

.....

..... [3]

4 (a) A real binary number may be represented in normalised floating point binary notation using 3 bits for the mantissa followed by 3 bits for the exponent, both in two's complement binary.

(i) The binary number 010100 is in the format described.

Calculate its denary value, showing your working.

.....
.....
.....
.....
.....
..... [3]

(ii) Explain why it is **not** possible to represent the denary value +16 in the format described.

.....
.....
.....
.....
.....
.....
.....
.....
..... [4]

(b) Some numbers are represented using a total of 12 bits in normalised floating point binary notation. The mantissa and exponent are in two's complement binary.

Describe the effect on the values that can be represented with an 8-bit mantissa and 4-bit exponent compared with a 4-bit mantissa and 8-bit exponent. (Calculations are **not** required.)

.....
.....
.....
..... [2]

5 A data structure is last in first out (LIFO) and has a pointer called **top**.

(i) Give the name for this type of data structure.

..... [1]

(ii) Write an algorithm, in any suitable form, that allows **one** data item to be removed from this LIFO data structure.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
..... [4]

(iii) Give the name for the type of error that could occur when trying to add data to a LIFO data structure.

..... [1]

(iv) State **one** use of a LIFO data structure in a computer system.

.....
..... [1]

6 (a) Two types of high-level language are declarative and procedural.

(i) Describe the features of a declarative language.

.....
.....
.....
.....
.....
..... [3]

(ii) Describe the features of a procedural language.

.....
.....
.....
.....
.....
..... [3]

(b) (i) State why a procedural language may be used for stock control.

.....
..... [1]

(ii) State why a declarative language may be used for medical diagnosis.

.....
..... [1]

7 (a) (i) State the need for BNF (Backus-Naur form) in computing.

.....
..... [1]

(ii) You may assume that the terms <digit> and <letter> have been defined correctly to represent a digit from 0 to 9 inclusive and a letter from A to F inclusive. The sign + may also be used.

The terms value and sum have also been defined in BNF.

<value> ::= <digit> | <value> <digit>
<sum> ::= <digit> + <digit>

By applying these rules, explain whether each of the following expressions is a digit, a letter, a value, a sum or not defined.

1223

.....
.....

4 + 7

.....
.....

D + 2

.....
.....

EF

.....
.....

A + B

.....
.....

[5]

(iii) Write a BNF definition for hex where hex consists of at least one digit, or at least one letter, or a mixture of digits and letters.

For example, 2, B, 2B, B2, AB3D, 2A3BC4 are all valid examples of hex.

Your definition must use digit, letter and hex only.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) The definition for value is

$\langle \text{value} \rangle ::= \langle \text{digit} \rangle \mid \langle \text{value} \rangle \langle \text{digit} \rangle$

Draw a syntax diagram to show the definition of value.

You may assume the correct syntax diagram for digit already exists.

[2]

8 (a) Low-level and high-level languages may be used for different applications.

(i) Explain why a low-level language may be suitable for writing a program for the processor in a washing machine.

.....
.....
.....
..... [2]

(ii) Explain why a high-level language may be suitable for writing a program for processing customer accounts in a bank.

.....
.....
.....
..... [2]

(b) In a particular low-level language program, the instruction SUB 12 is used.

Explain the term mnemonic using this example.

.....
.....
.....
.....
.....
..... [3]

9 A database is used in a fitness club.

(a) When the database was being created, Structured Query Language (SQL) was used. An initial version of part of the SQL is shown below, with line numbers added. Some errors have been made.

```

Line 1      CREATE TABLE Member
Line 2          ( MemberId CHAR(5),
Line 3          Surname VARCHAR(18),
Line 4          Forename VARCHAR(8),
Line 5          PhoneNumber INTEGER,
Line 6          PRIMARY KEY )
    
```

(i) Write a correct version of line 6.

.....
 [1]

(ii) Identify **one** other line where there is an error, giving a reason for your answer.

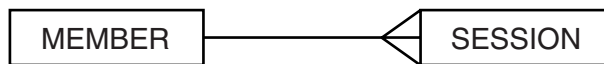
Write this line correctly.

.....

 [2]

(b) The club has activity sessions for groups of members. A member can book sessions in advance. For example, Meena may book Tuesday 10am Pilates and Wednesday 3pm Yoga.

(i) Explain why the entity-relationship (E-R) diagram shown is **not** appropriate to show the relationship between MEMBER and SESSION.



.....

 [2]

(ii) Draw an improved version of the diagram in third normal form (3NF).

[3]

(c) The club database is used by staff and by members. Some tasks may use views of data.

(i) Explain the purpose of a view of data.

.....
.....
.....
..... [2]

(ii) Explain why views of data would be used for each of the following tasks.

An instructor wants to check which members have booked an activity session.

.....
.....
.....
..... [2]

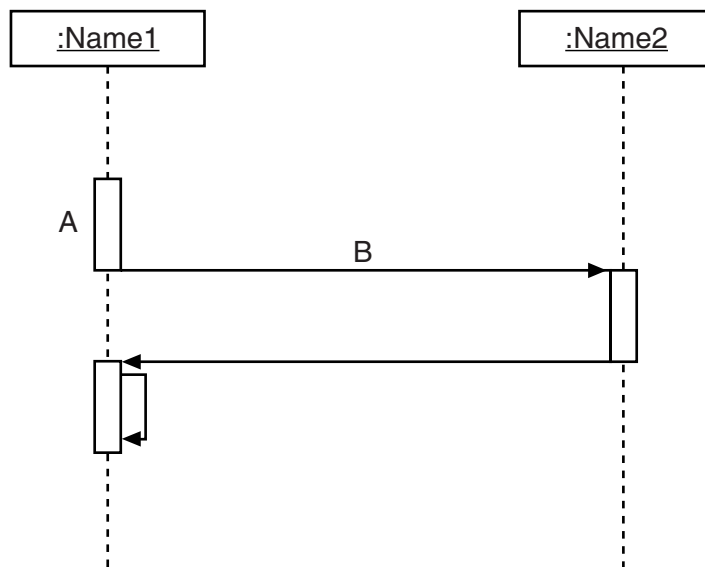
A member wants to check that their membership details have been stored correctly.

.....
.....
.....
..... [2]

10 (a) Explain the purpose of the Unified Modelling Language (UML).

.....
.....
.....
.....
.....
..... [3]

(b) A UML sequence diagram is shown.



Describe the meaning of the symbols

the rectangle labelled :Name1

.....
.....
.....
..... [2]

the vertical dotted lines

.....
.....
.....
..... [2]

the rectangle at A

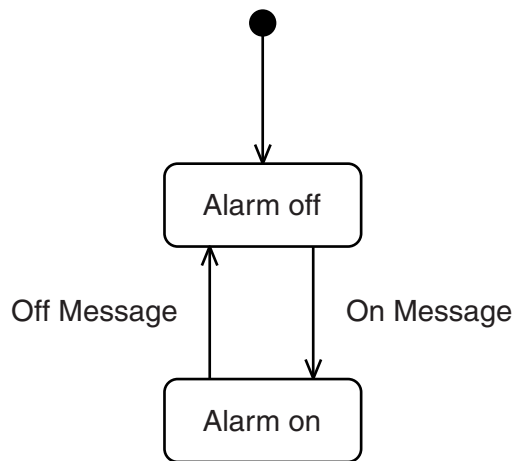
.....
.....
.....
..... [2]

the horizontal arrow at B

.....
.....
.....
..... [2]

UML diagrams are used to represent a burglar alarm in a house.

(c)



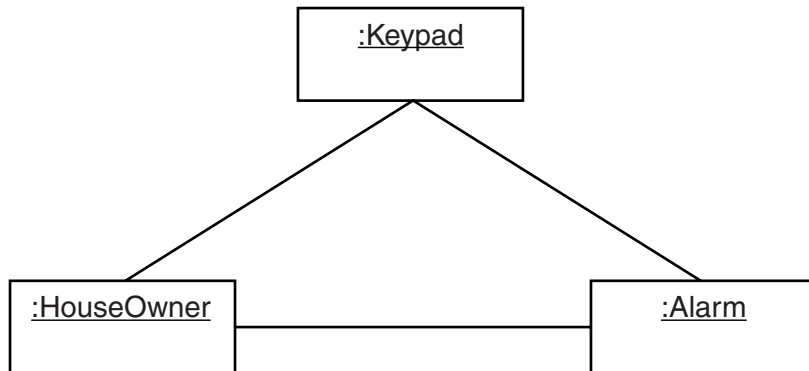
Give the name of the type of UML diagram shown.

..... [1]

- (d) The house owner uses a keypad to set the alarm. The alarm is switched on, and then it beeps once to confirm this to the house owner.

Part of the communication diagram has been drawn for you.

Complete the diagram.



[6]

17
BLANK PAGE

Question 11 begins on page 18
PLEASE DO NOT WRITE ON THIS PAGE

.....

.....

.....

..... [8]

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR 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.