

Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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OXFORD CAMBRIDGE AND RSA EXAMINATIONS
ADVANCED GCE
F453
COMPUTING

Advanced Computing Theory

MONDAY 14 JUNE 2010: Afternoon

DURATION: 2 hours

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Question Paper

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

None

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **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).**

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.**

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(iv) Describe the problem of disk thrashing.

[3]

(b) An operating system also uses scheduling.

Describe ONE method of scheduling.

[2]

2 Various types of translator may be used when writing and preparing a new computer program.

(a) Explain the main purpose of a translator.

[2]

(b) Some compilers produce intermediate code instead of executable code.

(i) Explain why intermediate code may be more useful than executable code.

[2]

(ii) State what additional software is needed to run the intermediate code.

[1]

(iii) State ONE DISADVANTAGE of using intermediate code.

[1]

(c) When a compiler is used to produce executable code, code generation includes optimisation.

Describe what optimisation does.

[2]

- 3 (a) One feature of Von Neumann architecture is the use of the fetch-execute cycle.

State TWO other features of Von Neumann architecture.

[2]

- (b) The program counter is one register used by the processor.

Give the names of THREE other registers used by the processor.
(Do not use abbreviations)

[3]

(d) In some computer systems, a co-processor may be used.

Explain the term co-processor.

[3]

4 A real binary number may be represented in normalised floating point binary notation using 6 bits for the mantissa and 2 bits for the exponent, both in two's complement binary.

(a) Convert the following binary number to denary.

Show your working.

0	1	0	1	1	0	0	1
---	---	---	---	---	---	---	---

[3]

(b) Write, in binary, the largest positive number that can be represented in this format.

[2]

(c) For this part of the question, 4 BITS are used for the mantissa and 4 BITS for the exponent.

(i) Two numbers, A and B, have been written in binary. Only one of the numbers has been normalised.

number A

1	0	0	1	0	1	1	0
---	---	---	---	---	---	---	---

number B

0	0	1	1	1	0	1	0
---	---	---	---	---	---	---	---

State which of the numbers has been normalised giving a reason for your answer.

_____ [1]

(ii) Give TWO reasons why binary numbers should be normalised.

_____ [2]

- (iii) Convert the denary number +3.5 to binary, giving your answer as a normalised floating point number using 4 bits for the mantissa and 4 bits for the exponent.**

Show your working.

[3]

5 (a) An array is an example of a static data structure.

(i) State the meaning of the term static in this context.

_____ [1]

(ii) State ONE advantage of using a static data structure compared with a dynamic data structure.

_____ [1]

(b) (i) Show the result of merging the following data files.

File A: Anna, Cleo, Helen, Pritti
File B: Billy, Ian, Omar, Rob, Tom

_____ [2]

- 6 (a) The table below shows some statements about types of programming language.

Tick the boxes to show the type of programming language for which each statement is correct.

	Low-level	Object-oriented	Procedural
Data is only accessible through methods			
Each instruction usually represents one machine code instruction			
Inheritance may be used			
Local variables may be used			
Mnemonics are used			

[5]

(i) Give the correct name for this type of programming language.

_____ [1]

(ii) Give ONE example of a fact.

_____ [1]

(iii) Give ONE example of a rule.

_____ [1]

(iv) Give ONE example of a goal.

_____ [1]

(v) Give ONE example of instantiation.

_____ [1]

(vi) Explain the term backtracking and give ONE example of backtracking.

[3]

7 (a) Explain how functions and procedures may be used to develop a program in a structured way.

[2]

(b) A particular high level language uses local variables, global variables and parameters.

Discuss and compare the use of local variables, global variables and parameters.

(The quality of written communication will be assessed in your answer to this question.)

8 (a) State the need for BNF (Backus-Naur form).

_____ [1]

(b) In a large company, each employee is given a staff code. Using BNF, the definition of a staff code is

$\langle \text{DIGIT} \rangle ::= 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9$
 $\langle \text{LETTER} \rangle ::= A \mid B \mid C \mid D \mid E$
 $\langle \text{STAFF_CODE} \rangle ::= \langle \text{LETTER} \rangle \langle \text{DIGIT} \rangle \mid$
 $\langle \text{STAFF_CODE} \rangle \langle \text{DIGIT} \rangle$

State how the rules have been broken by each of the following invalid staff codes.

(i) A2C

_____ [1]

(ii) G45

_____ [1]

(c) After changes in the company, it is decided to allocate new codes. Write a definition for NEW_CODE which has one or more digits followed by zero or more letters. For example, 1234 and 3AB are valid but A25 is not valid.

(You may assume that DIGIT and LETTER are still defined as in part (b).)

[3]

9 (a) An assembly language uses mnemonics.

Explain the term mnemonics.

[2]

(b) Describe relative addressing.

[3]

(c) Describe indexed addressing.

[3]

(d) Give the correct names for TWO other modes of addressing.

[2]

(e) One feature of assembly language is flow-control. Explain the term flow-control.

[2]

10 A shop sells classical music CDs. The shop uses a relational database to store information about its products. Data stored about each CD includes the name of the composer, the title, the name of the artiste or orchestra, the price and the number in stock.

(a) State why the name of the composer is NOT suitable as a primary key.

_____ [1]

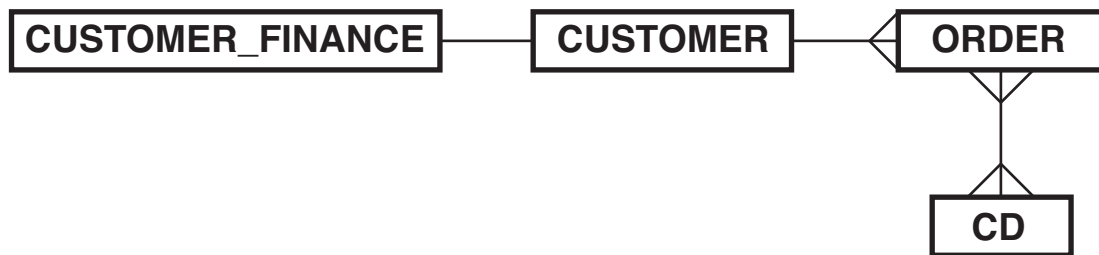
(b) Explain the use of a secondary key from the information given.

_____ [2]

Customers are able to register their details and buy CDs from the shop's website.

The entity-relationship (E-R) diagram below shows

CUSTOMER_FINANCE	includes customer's bank details
CUSTOMER	includes name and address
ORDER	details of an order made by a customer, including the date
CD	data about a CD, as described at the start of the question



(c) (i) State the type of relationship between **CUSTOMER_FINANCE** and **CUSTOMER** on the E-R diagram above.

_____ [1]

(ii) Give ONE reason why **CUSTOMER_FINANCE** and **CUSTOMER** are stored separately.

_____ [1]

(iii) Explain ONE reason why CUSTOMER and ORDER are stored separately.

[2]

(iv) State ONE problem with the relationship between ORDER and CD on the diagram.

[1]

(v) Draw an improved version of the E-R diagram which corrects this problem.

[3]

(d) Some of the Structured Query Language (SQL) used for this database is

```
SELECT CustomerId, AmountOwed,  
CreditLimit  
FROM CUSTOMER_FINANCE  
WHERE AmountOwed > 80  
ORDER BY CreditLimit
```

Describe the purpose of this code.

[3]

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11 (a) Explain why the Unified Modelling Language (UML) is used.

[2]

Figures 1, 2 and 3 on the opposite page show parts of some UML diagrams for a security system.

(b) Give the correct name for each type of UML diagram.

Figure 1 _____

Figure 2 _____

Figure 3 _____

[3]

(c) State the feature of object-oriented languages which is shown by the arrow in Figure 1.

[1]

Figure 1

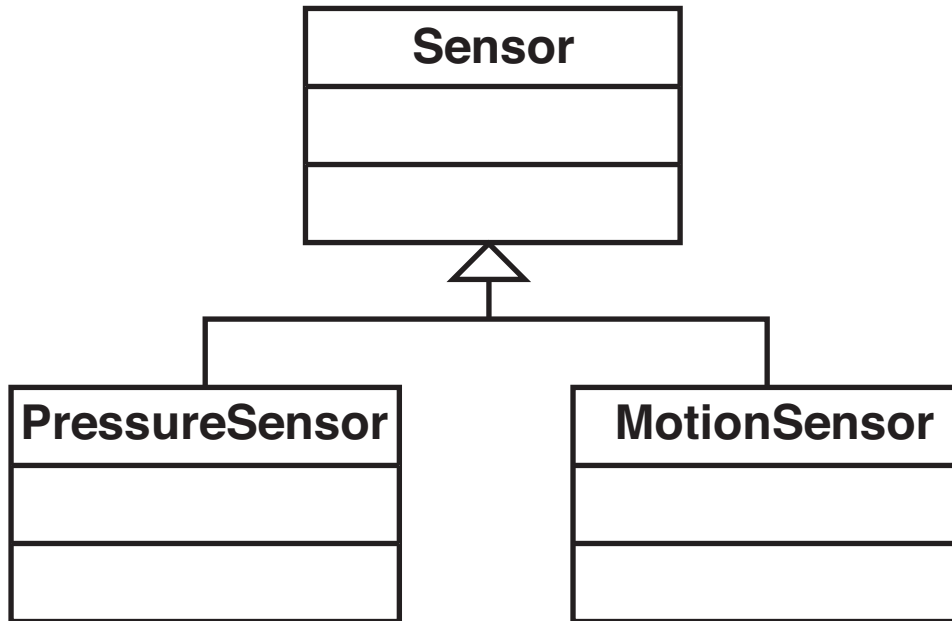
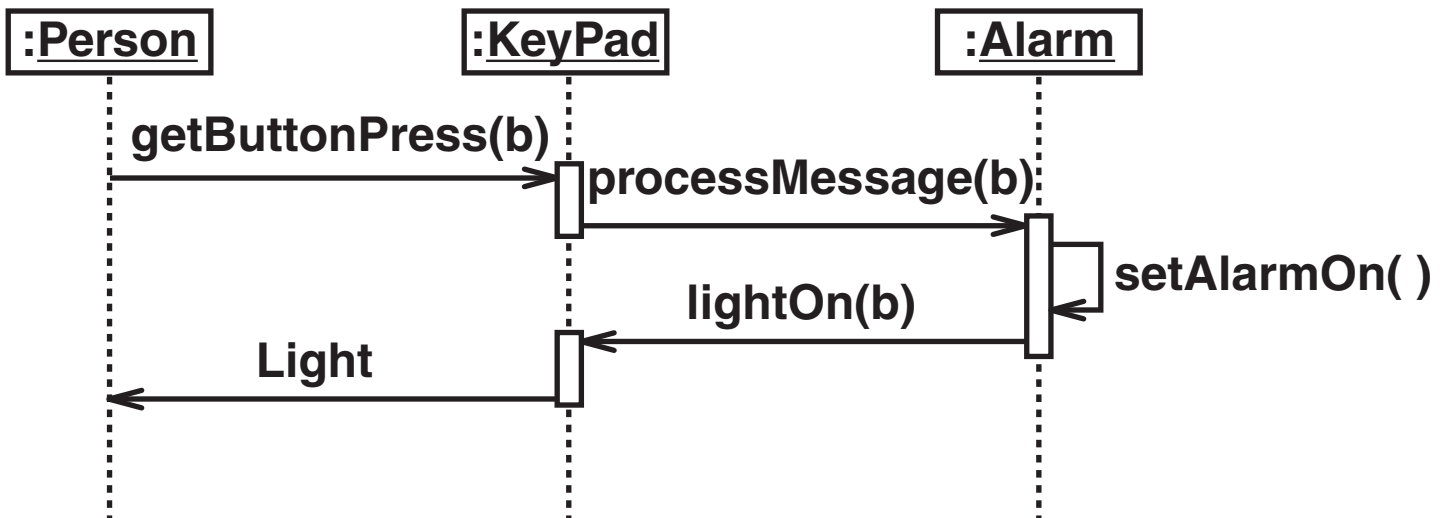


Figure 2



Figure 3



(d) Taking your information from Figures 1, 2 and 3, give ONE example of each of the following.

(i) an object

_____ [1]

(ii) a class

_____ [1]

(iii) a message

_____ [1]

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