Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

4243528463

COMPUTER SCIENCE **9608/13**

Paper 1 Theory Fundamentals **October/November 2016**

1 hour 30 minutes

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 **13** printed pages and **3** blank pages.

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1 **(a)** Five descriptions and seven relational database terms are shown below.

Draw a line to link each description to its correct database term.

Description	Database term
Any object, person or thing about which it is possible to store data	Secondary key
Dataset organised in rows and columns; the columns form the structure and the rows form the content	Candidate key
Any attribute or combination of attributes that can act as a unique key	Entity
Attribute(s) in a table that link to the primary key in another table to form a relationship	Foreign key
Attribute or combination of attributes that is used to uniquely identify a record	Primary key
	Table
	Tuple

[5]

(b) Explain what is meant by referential integrity.

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.....[3]

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2 **(a)** State **two** differences between Static RAM (SRAM) and Dynamic RAM (DRAM).

1 .....

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2 .....

.....[2]

(b) **(i)** Explain why a computer needs an operating system.

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.....[2]

(ii) Give **two** key management tasks carried out by an operating system.

1 .....

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2 .....

.....[2]

(c) New program code is to be written in a high-level language. The use of Dynamic Link Library (DLL) files is considered in the design.

Describe what is meant by a DLL file.

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.....[2]

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3 **(a)** **(i)** Convert the denary number 46 to an 8-bit binary integer.

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.....[1]

(ii) Convert the denary integer –46 to an 8-bit two's complement form.

.....

.....[1]

(iii) Convert the denary number 46 into hexadecimal.

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.....[1]

(b) Binary Coded Decimal (BCD) is another way of representing numbers.

(i) Describe how denary integers larger than 9 can be converted into BCD.
Give an example in your answer.

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.....[2]

(ii) Describe how an 8-bit BCD representation can be converted into a denary integer.
Give an example in your answer.

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.....[2]

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4 Describe the basic internal operation of the following devices:

(i) Keyboard

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.....[2]

(ii) Optical disc

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.....[2]

(iii) Optical mouse

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.....[2]

(iv) Scanner

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.....[2]

5 A motor is controlled by a logic circuit. The circuit has inputs (0 or 1) from three sensors R, T and W. The motor is switched off when the output from the logic circuit is 1.

The following table shows the three sensors and the conditions being monitored.

Sensor	Description	Binary value	Condition
R	rotation	0	rotation < 4000 rpm
		1	rotation >= 4000 rpm
T	temperature	0	temperature >= 90 °C
		1	temperature < 90 °C
W	water flow rate	0	water flow rate >= 50 litre/min
		1	water flow rate < 50 litre/min

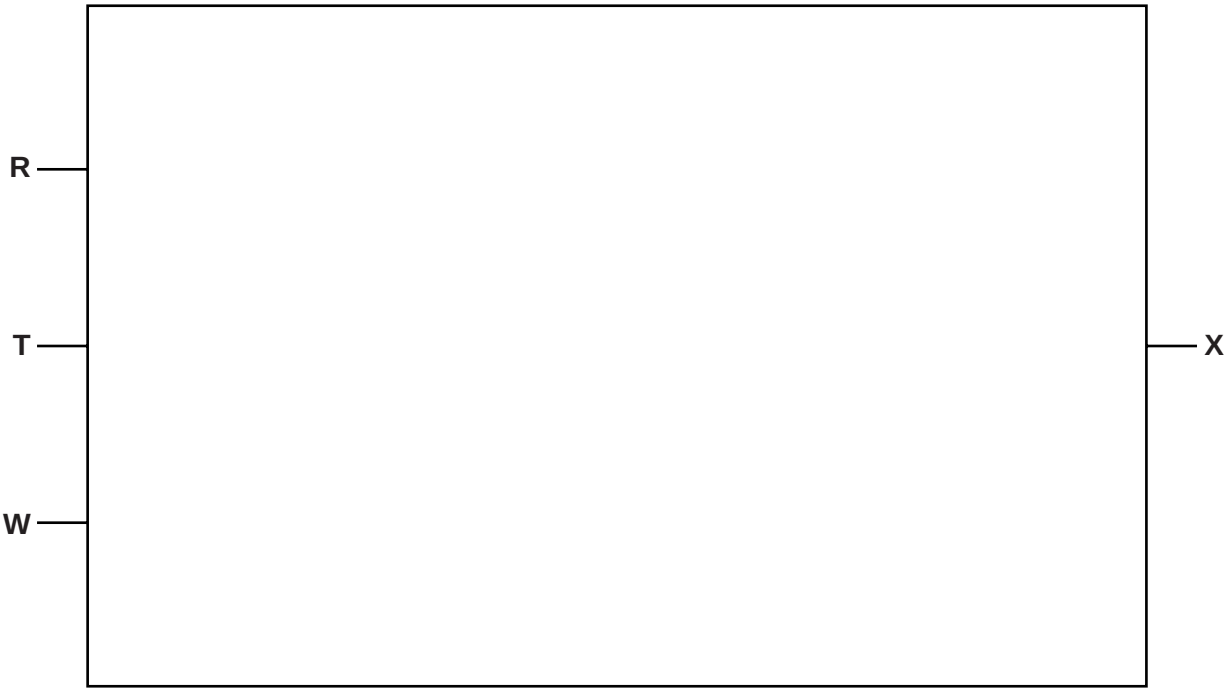
The output, X, is 1 if:

temperature >= 90 °C and rotation >= 4000 rpm

or

temperature < 90 °C and water flow rate >= 50 litre/min

(i) Draw a corresponding logic circuit.



[5]

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(ii) Give a logic statement corresponding to the logic circuit in part **(i)**.

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.....[2]

(iii) Complete the truth table for this system.

INPUT			Workspace	OUTPUT
R	T	W		X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

6 A user watches a video available on a website. The website uses on-demand bit streaming.

Describe how it is possible to watch the video without it continually pausing.

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.....[4]

7 A small company produces scientific magazines. The owner buys some new desktop computers. The computers are used to store thousands of colour images (diagrams and photographs). All the computers have Internet access.

(a) Name **three** utility programs the company would use on all their computers. Describe what each program does.

1 .....

Description .....

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2 .....

Description .....

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3 .....

Description .....

.....[6]

(b) The images contained in the magazines are produced using either bitmap or vector graphics software.

Give **four** differences between bitmap and vector graphics.

1 .....

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2 .....

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3 .....

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4 .....

.....[4]

(c) Employees using the new computers receive training. At the end of the training, each employee completes a series of questions.

Three answers given by an employee are shown below.

Explain why each answer is incorrect.

(i) *"Encryption prevents hackers breaking into the company's computers."*

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.....[2]

(ii) *"Data validation is used to make sure that data keyed in are the same as the original data supplied."*

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.....[2]

(iii) *"The use of passwords will always prevent unauthorised access to the data stored on the computers."*

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8 The table shows assembly language instructions for a processor which has one general purpose register, the Accumulator (ACC) and an Index Register (IX).

Instruction		Explanation
Op code	**Operand**	
LDD	<address>	Direct addressing. Load the contents of the given address to ACC.
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC.
STO	<address>	Store contents of ACC at the given address.
ADD	<address>	Add the contents of the given address to ACC.
CMP	<address>	Compare contents of ACC with contents of <address>
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True.
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	Jump to the given address.
OUT		Output to the screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

The diagram shows the contents of the main memory:

Main memory

800	0110 0100
801	0111 1100
802	1001 0111
803	0111 0011
804	1001 0000
805	0011 1111
806	0000 1110
807	1110 1000
808	1000 1110
809	1100 0010
:	
2000	1011 0101

(a) (i) Show the contents of the Accumulator after execution of the instruction:

```
LDD  802
```

Accumulator: | | | | | | | | |

[1]

(ii) Show the contents of the Accumulator after execution of the instruction:

```
LDX 800
```

Index Register:	0	0	0	0	1	0	0	1
Accumulator:								

Explain how you arrived at your answer.

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.....[3]

(b) (i) Complete the trace table below for the following assembly language program. This program contains denary values.

100	`LDD 800`
101	`ADD 801`
102	`STO 802`
103	`LDD 803`
104	`CMP 802`
105	`JPE 107`
106	`JPN 110`
107	`STO 802`
108	`OUT`
109	`JMP 112`
110	`LDD 801`
111	`OUT`
112	`END`
⋮	
800	`40`
801	`50`
802	`0`
803	`90`

Selected values from the ASCII character set:

ASCII code	40	50	80	90	100
Character	(	2	P	Z	d

Trace table:

ACC	**Memory address**				**OUTPUT**
	800	**801**	**802**	**803**	
	40	50	0	90	

[4]

(ii) There is a redundant instruction in the code in **part (b)(i)**.

State the address of this instruction.

.....[1]

(c) The program used the ASCII coding system for character codes. An alternative coding system is Unicode.

(i) Give **two** disadvantages of using ASCII code.

1 .....

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2 .....

.....[2]

(ii) Describe how Unicode is designed to overcome the disadvantages of ASCII.

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.....[2]

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