Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

5168899534

COMPUTER SCIENCE **9608/12**

Paper 1 Theory Fundamentals **May/June 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 **15** printed pages and **1** blank page.

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1 Three examples of language translators and four definitions are shown below.

Draw lines to link each language translator to the correct one or more definitions.

Language translator	Definition
Compiler	The software reads the source code and reports all errors. The software produces an executable file.
Assembler	The software reads each statement and checks it before running it. The software halts when it encounters a syntax error.
Interpreter	The software translates a high-level language program into machine code for the processor to execute.
	The software translates low-level statements into machine code for the processor to execute.

[3]

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2 **(a)** Convert the following denary integer into 8-bit binary.

55

[1]

(b) Convert the following Binary Coded Decimal (BCD) number into denary.

10000011

.....[1]

(c) Convert the following denary integer into 8-bit two's complement.

-102

[2]

(d) Convert the following hexadecimal number into denary.

4E

.....[1]

3 **(a)** Describe how special purpose registers are used in the fetch stage of the fetch-execute cycle.

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.....

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.....[4]

(b) Use the statements A, B, C and D to complete the description of how the fetch-execute cycle handles an interrupt.

A	the address of the Interrupt Service Routine (ISR) is loaded to the Program Counter (PC).
B	the processor checks if there is an interrupt.
C	when the ISR completes, the processor restores the register contents.
D	the register contents are saved.

At the end of the cycle for the current instruction ..... .

If the interrupt flag is set, ... , ... and ..... .

The interrupted program continues its execution.

[4]

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4 A group of students broadcast a school radio station on a website. They record their sound clips (programmes) in advance and email them to the producer.

(a) Describe how sampling is used to record the sound clips.

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.....

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.....[3]

(b) The students use software to compress the sound clips before emailing them.

(i) Circle your chosen method of compression and justify your choice.

Lossy / Lossless

Justification: .....

.....

.....

.....[3]

Students also email images to the radio station for use on its website.

These are compressed before sending using run-length encoding (RLE).

(ii) Explain what is meant by run-length encoding.

.....

.....

.....

.....

.....

.....[3]

(iii) The following diagrams show:

- the denary colour code that represents each colour
- the first three rows of a bitmap image

Colour symbol	Colour code (denary)
B	153
W	255

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	B	B	B	B	B	B	B	B	B	B	W	W	W	B	B	B
1	B	B	B	B	B	B	B	B	B	W	W	W	W	W	W	B
2	B	B	B	B	B	B	B	W	W	W	W	W	W	W	W	W
…																
95																

Show how RLE will compress the first three rows of this image.

Row 1: .....

Row 2: .....

Row 3: .....[2]

5 Three types of software licensing and four descriptions are shown in the table below.

Put a tick (✓) in each row to match each description to the appropriate type of software licensing.

	Type of software		
Description	**Open source**	**Shareware**	**Commercial**
Software is purchased before it can be used			
Source code comes with the software			
Software is provided free on a trial basis			
The software can be modified by the user			

[4]

6 A team of software engineers is developing a new e-commerce program for a client.

State **three** of the principles of the ACM/IEEE Software Engineering Code of Ethics. Illustrate each one, with an example, describing how it will influence their working practices.

1 .....

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2 .....

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3 .....

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.....[6]

7 Access to World Wide Web content uses IP addressing.

(a) State what IP stands for.

.....[1]

(b) The following table shows four possible IP addresses.

Indicate for each IP address whether it is valid or invalid and give a reason.

Address	Denary / Hexadecimal	Valid or Invalid	Reason
`3.2A.6AA.BBBB`	Hexadecimal		
`2.0.255.1`	Denary		
`6.0.257.6`	Denary		
`A.78.F4.J8`	Hexadecimal		

[4]

(c) Describe **two** differences between public and private IP addresses.

1 .....

.....

2 .....

.....[2]

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8 A school stores a large amount of data. This includes student attendance, qualification, and contact details. The school's software uses a file-based approach to store this data.

(a) The school is considering changing to a DBMS.

(i) State what DBMS stands for.

.....[1]

(ii) Describe **two** ways in which the Database Administrator (DBA) could use the DBMS software to ensure the security of the student data.

1 .....

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.....

.....

2 .....

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.....[4]

(iii) A feature of the DBMS software is a query processor.

Describe how the school secretary could use this software.

.....

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.....[2]

(iv) The DBMS has replaced software that used a file-based approach with a relational database.

Describe how using a relational database has overcome the previous problems associated with a file-based approach.

.....

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.....[3]

(b) The database design has three tables to store the classes that students attend.

STUDENT(StudentID, FirstName, LastName, Year, TutorGroup)

CLASS(ClassID, Subject)

CLASS-GROUP(StudentID, ClassID)

Primary keys are not shown.

There is a one-to-many relationship between **CLASS** and **CLASS–GROUP**.

(i) Describe how this relationship is implemented.

.....

.....

.....[2]

(ii) Describe the relationship between **CLASS-GROUP** and **STUDENT**.

.....[1]

(iii) Write an SQL script to display the `StudentID` and `FirstName` of all students who are in the tutor group 10B. Display the list in alphabetical order of `LastName`.

.....

.....

.....

.....[4]

(iv) Write an SQL script to display the `LastName` of all students who attend the class whose `ClassID` is CS1.

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.....

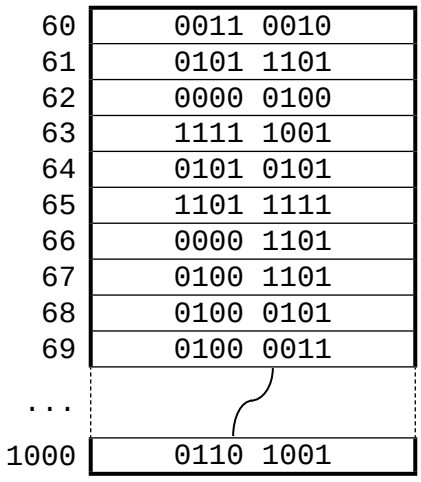
.....[4]

Question 9 begins on page 12.

9 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.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX).
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 screen the character whose ASCII value is stored in ACC.
END		Return control to the operating system.

(a) The diagram shows the current contents of a section of main memory and the index register:



Index register: | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

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

```
LDX 60
```

Accumulator: | | | | | | | | |

Show how you obtained your answer.

.....

.....

.....

.....[2]

(ii) Show the contents of the index register after the execution of the instruction:

```
DEC IX
```

Index register: | | | | | | | | |

[1]

(b) Complete the trace table on the opposite page for the following assembly language program.

50	LDD 100
51	ADD 102
52	STO 103
53	LDX 100
54	ADD 100
55	CMP 101
56	JPE 58
57	JPN 59
58	OUT
59	INC IX
60	LDX 98
61	ADD 101
62	OUT
63	END
...	
100	20
101	100
102	1
103	0

IX (Index Register)	1

Selected values from the ASCII character set:

ASCII Code	118	119	120	121	122	123	124	125
Character	v	w	x	y	z	{	|	}

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Trace table:

Instruction address	Working space	ACC	Memory address				IX	OUTPUT
			100	101	102	103		
			20	100	1	0	1	
50								
51								
52								
53								
54								
55								

[7]

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