Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

2689533703

COMPUTER SCIENCE **9608/12**

Paper 1 Theory Fundamentals **October/November 2020**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Blank pages are indicated.

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1 Different types of data can be represented in a computer system.

(a) Numeric is one type of data.

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

105

..... [1]

(ii) Convert the following two's complement binary integer into denary.

10111111

..... [1]

(iii) Convert the following hexadecimal number into denary.

AB

..... [1]

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(b) Character is another type of data.

The following tables show part of the ASCII code character set.

Character	Denary value
A	65
B	66
C	67
D	68
E	69

Character	Denary value
a	97
b	98
c	99
d	100
e	101

(i) Describe how the computer uses ASCII codes to represent characters.

.....

.....

.....

..... [2]

(ii) Convert the following string into ASCII codes.

```
Bed
```

.....

..... [1]

(iii) Give the denary ASCII code for the following character.

```
H
```

..... [1]

2 One method of compressing a file is run-length encoding (RLE).

(a) Describe, using an example, how a **text file** is compressed using RLE.

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..... [3]

(b) Explain why run-length encoding will sometimes increase the size of a text file.

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..... [2]

3 **(a)** Complete the following statements about CPU architecture by filling in the missing terms.

The Von Neumann model for a computer system uses the ..... program concept.

A program is a series of instructions that are saved in ..... .

The processor ..... each instruction, ... it and then

..... it.

The processor uses several ..... to store the data and instructions from

the program because they can be accessed faster than main memory.

[6]

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(b) The following table shows assembly language instructions for a processor that has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Op code	**Operand**	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC.
LDM	#n	Immediate addressing. Load the denary number n to ACC.
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second 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 the contents of ACC with the contents of <address>.
OUT		Output to screen the character whose ASCII value is stored in ACC.
INC	<register>	Add 1 to the contents of the register (ACC or IX).
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.
END		Return control to the operating system.

(i) The current contents of the main memory are:

Address	Instruction
50	LDD 80
51	ADD 80
52	STO 80
53	LDD 82
54	INC ACC
55	STO 82
56	CMP 81
57	JPN 50
58	LDD 80
59	OUT
60	END
…	
80	10
81	2
82	0

ASCII code table (Selected codes only)

ASCII Code	Character
38	&
39	‘
40	(
41	)
42	*

Trace the program currently in memory using the following trace table.
The first instruction has been completed for you.

Instruction address	ACC	Memory address			Output
		80	81	82	
		10	2	0	
50	10				

[5]

(ii) Assembly language instructions can be put into groups.

Tick (✓) **one** box in each column to identify the appropriate instruction group for each of the three assembly language instructions.

Instruction group	Assembly language instruction		
	`STO 80`	`JPN 50`	`INC ACC`
Input and output of data			
Data movement			
Arithmetic operations			
Unconditional and conditional jump instructions			
Compare instructions			

[3]

4 **(a)** Complete the truth table for the logic expression:

X = ((**A** NOR **B**) AND (**C** XOR **A**)) OR **B**

A	B	C	Working space	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]

(b) Describe the difference between the operation of an **AND** gate and a **NAND** gate.

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.....

.....

..... [2]

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5 A teacher uses a relational database, `RESULTS`, to store data about her students and their test results.

(a) Describe the benefits to the **teacher** of using a relational database instead of a file-based approach.

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..... [4]

(b) The teacher sets up the `RESULTS` database using a Database Management System (DBMS).

(i) Explain the ways in which the developer interface of a DBMS will help the teacher set up the database.

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..... [2]

(ii) The DBMS creates a data dictionary for the `RESULTS` database.

Identify **three** items that will be included in the data dictionary.

1 .....

2 .....

3 .....

[3]

(c) The RESULTS database has the following structure:

STUDENT(StudentID, FirstName, LastName, Class, TargetGrade)

TEST(TestID, Topic, MaxMarks)

STUDENT_TEST(StudentID, TestID, Mark)

(i) Complete the following table by giving **one** example of each database term from the database RESULTS. Give both the field name and the corresponding table name.

Database term	Field name	Table name
Primary key		
Foreign key		
Attribute		

[3]

(ii) Tick (✓) **one** box to identify whether the database RESULTS is in 1NF, 2NF or 3NF. Justify your choice.

1NF	2NF	3NF

Justification: .....

.....

.....

..... [3]

(iii) Complete the Data Manipulation Language (DML) script to display the Student ID, mark and maximum marks for all tests with the topic of 'Programming'.

```
SELECT StudentID, Mark, .....

FROM STUDENT_TEST, .....

..... Topic = "Programming"

AND ..... = .....;
```

[5]

(iv) The teacher wants to implement validation to make sure that all data entered into the database `RESULTS` are reasonable.

Name **three** different methods of data validation that can be used in the `RESULTS` database. Describe how each method will limit the data that can be entered in this database.

Method 1 .....

Description .....

.....

Method 2 .....

Description .....

.....

Method 3 .....

Description .....

.....

[6]

(d) The teacher stores the database on the desktop computer in her classroom.

(i) Explain why it is important to keep the database secure.

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..... [2]

(ii) Explain the ways in which the teacher can use data backup and disk mirroring to limit the amount of data lost in the event of hardware failure.

Data backup

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Disk mirroring

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[4]

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[Turn over

6 Malika has started a new job as a trainee software engineer.

(a) Malika's manager has asked her to work with a senior software engineer for the first week.

Explain the ways in which Malika's manager has acted ethically.

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.....

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..... [2]

(b) Malika researched the company and the programming languages used by the company before she started the job.

Explain the ways in which Malika has acted ethically.

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..... [2]

(c) Malika thinks that her colleagues do not like her, so she asks her manager for help.

Describe the actions the manager could take to support Malika in an ethical way.

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..... [2]

7 A web server has a public IPv4 address.

(a) Draw lines to link each characteristic to its appropriate IP address.

Characteristic	IP address
Can use hexadecimal notation	
Each group of digits is a number between 0 and 65535	IPv4
Consists of four groups of digits	
Uses double colons (::)	IPv6
The total length of the address is 32 bits	

[2]

(b) IP addresses can be static or dynamic.

Explain the reasons for the web server using a static instead of a dynamic IP address.

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..... [3]

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