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Cambridge Assessment International Education

# Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*3054613492*

**COMPUTER SCIENCE** **9608/12**

Paper 1 Theory Fundamentals **May/June 2021**

**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 **20** pages. Any blank pages are indicated.


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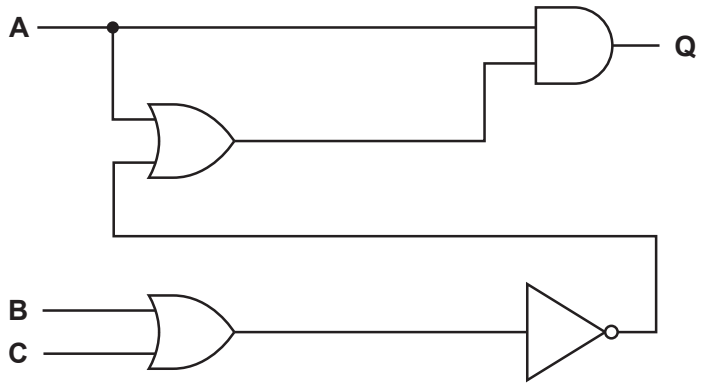
**1** Consider the following logic circuit:




**(a)** Complete the truth table for the logic circuit.

| A | B | C | Working space | Q |
|---|---|---|---|---|
| 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)** Identify the **three** logic gates used in the given logic circuit.

Gate 1 .....

Gate 2 .....

Gate 3 .....

[1]

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**2** The following diagram shows four register notations and seven descriptions.

Draw **one** line from each register notation to its **most appropriate** description.

| Register notation | Description |
|---|---|
| MDR | Holds the op code and operand of an instruction ready for it to be decoded |
| | Holds the address of the next instruction to be read |
| CIR | Holds flags that are set when the Arithmetic and Logic Unit (ALU) executes instructions |
| | Holds data read from, or to be written to, memory |
| MAR | Holds the current value in the Index Register |
| | Holds the address where data is to be written to or read from |
| PC | Holds the result of the last instruction executed by the ALU |

[4]

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[Turn over

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3 The table shows part of the instruction set for a processor. The processor 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 location at the given address 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 the 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). |
| JMP | <address> | Jump to the given address. |
| CMP | <address> | Compare the contents of ACC with the contents of <address>. |
| JPE | <address> | Following a compare instruction, jump to <address> if the compare was True. |
| END | | Return control to the operating system. |

The current contents of the main memory are:

| Address | Instruction |
|---|---|
| **50** | LDI 103 |
| **51** | CMP 101 |
| **52** | JPE 59 |
| **53** | ADD 102 |
| **54** | STO 102 |
| **55** | LDD 100 |
| **56** | INC ACC |
| **57** | STO 100 |
| **58** | JMP 51 |
| **59** | ADD 102 |
| **60** | STO 102 |
| **61** | END |
| ... | |
| **100** | 1 |
| **101** | 3 |
| **102** | 0 |
| **103** | 100 |

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**(a)** Trace the program currently in memory using the following trace table.

| Instruction address | ACC | Memory address | | | |
|---|---|---|---|---|---|
| | | 100 | 101 | 102 | 103 |
| | | 1 | 3 | 0 | 100 |
| | | | | | |
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[5]



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**(b)** The instruction in memory address `50` needs to be changed to use direct addressing to load the contents of the memory location at address `100`.

Give the new instruction to replace `LDI 103`.

..... [1]

**(c)** Each instruction in the assembly language program is encoded in 16 bits (8-bit op code followed by an 8-bit operand).

**(i)** The instruction `JPE 59` has the operand `59`.

Convert the operand `59` into 8-bit binary.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

[1]

**(ii)** Convert the denary value `59` into hexadecimal.

..... [1]

**(d)** The assembly language program uses direct and indirect addressing.

Identify **two other** modes of addressing used in an assembly language program.

1 .....

2 .....

[2]

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**4** K2 Mountain Guiding is a company that runs courses teaching people how to climb mountains.

The company uses a file-based approach to store and retrieve data.

**(a)** Describe **three** drawbacks of a file-based approach compared to a relational database.

Drawback 1 .....

.....

.....

.....

Drawback 2 .....

.....

.....

.....

Drawback 3 .....

.....

.....

.....

[6]

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**[Turn over**

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**(b)** Each course has a destination and a trip date, and is run by a guide.
Customers can book a place on one or more courses.

The following table shows part of the stored file:

| Customer name | Customer date of birth | Guide | Destination | Trip date |
|---|---|---|---|---|
| Jay Patel | 10/10/1976 | Artem | Elbrus | 06/03/2023 |
| Paul Schloss | 10/04/1999 | Kenton | K2 | 01/03/2022 |
| Mina Wang | 03/03/2000 | Kenton | K2 | 01/03/2022 |
| Paul Schloss | 10/04/1999 | Safia | Mont Blanc | 07/07/2024 |
| Jay Patel | 10/10/1976 | Safia | K2 | 04/04/2023 |

The company has decided to create a relational database to replace the current file-based approach.

Identify **three** reasons why the data in this table is not in First Normal Form (1NF).

1 .....

.....

2 .....

.....

3 .....

.....

[3]

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**(c)** The table, GUIDE_TABLE, is created.

Each guide has a unique guide ID.

Part of the table GUIDE_TABLE is shown:

| GuideID | Guide | DateOfBirth | Gender |
|---|---|---|---|
| 1 | Artem | 07/03/1992 | M |
| 2 | Kenton | 08/04/1984 | M |
| 3 | Safia | 10/10/1999 | F |

Write a Data Definition Language (DDL) statement to define the table GUIDE_TABLE.

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.....

..... [5]

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**5** A web page includes HTML and JavaScript code.

```
01 <html>
02 <body>
03
04 Calculate area of a triangle:
05 <form name = "Triangle">
06   <p>Base <input type = "number" name = "B" value = ""></p>
07   <p>Height <input type = "number" name = "H" value = ""></p>
08   <button onclick = "area()">Calculate</button>
09 </form>
10
11 <script>
12 function area() {
13   var base = document.forms["Triangle"]["B"].value;
14   var height = document.forms["Triangle"]["H"].value;
15   if (base == "" || height == "") {
16      alert("Both values must be entered");
17      return false;
18   }
19   else {
20      area = 0.5 * height * base;
21      alert("The area is: " + area);
22   }
23 }
24 </script>
25 </body>
26 </html>
```

**(a)** Give the **three** identifiers used in the JavaScript code.

1 .....

2 .....

3 .....

[2]

**(b)** State the purpose of the code on line `08`.

.....

..... [1]

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**(c)** The page is loaded and the values `2` and `8` are entered.

State the output when the calculate button is clicked.

.....

..... [1]

**(d)** State the meaning of the `||` operator in line `15` of the code.

..... [1]

**(e)** Data validation has been used in line `15` of the JavaScript code.

**(i)** Identify the type of data validation used in line `15`.

..... [1]

**(ii)** Identify **two** other data validation checks that could be used.

1 .....

2 .....
[2]

**Question 5 continues on the next page.**



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Cambridge International Holidays allows customers to make holiday bookings on its website.

**(f)** Bochen visits the Cambridge International Holidays website to book a holiday.

The sequence (1 to 8) below describes the steps that take place when he submits a booking.

Four of the statements **A**, **B**, **C**, **D**, **E** and **F** are used to complete the sequence.

| | |
|---|---|
| **A** | Any errors found at the server side are flagged, and step 1 is repeated. |
| **B** | HTML code is used on the client's web browser to validate the form data. |
| **C** | PHP code is executed to generate a confirmation (HTML) web page that is returned to the client's web browser. |
| **D** | The form data is transmitted to Cambridge International Holidays' web server. |
| **E** | JavaScript code is executed to generate a confirmation (HTML) web page that is returned to the client's web browser. |
| **F** | JavaScript code is executed on the client's web browser to validate the form data. |

Write **one** of the letters (**A**, **B**, **C**, **D**, **E** or **F**) in the appropriate row to complete the sequence.

1 Bochen completes the online booking and clicks 'Submit'.

2 .....

3 Any errors found are flagged, and step 1 is repeated.

4 .....

5 PHP code is executed to perform extra data validation checks on the form data.

6 .....

7 The booking details are added to the database.

8 .....

[4]

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**6** This question presents three scenarios.

Tick (✓) **one** box for each scenario to indicate whether you think the named person's behaviour is ethical or unethical. Justify your choice.

**(a)** Latifah has changed jobs and has started to work for a new company. The company uses an Integrated Development Environment (IDE) to develop code. Latifah decides not to use the IDE that the company has because she is familiar with a different IDE.

| | |
|---|---|
| Ethical | |
| Unethical | |

Justification

.....

.....

.....

.....

..... [2]

**(b)** Samid is in charge of a project to write a banking application. He is employing staff to work on the application. His daughter is a computer security expert. She is looking for a new job. Samid decides to employ his daughter.

| | |
|---|---|
| Ethical | |
| Unethical | |

Justification

.....

.....

.....

.....

..... [2]



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**(c)** Jason works for a social media company. He is concerned that users of the company's social media website have not been told how their personal data is being used.

Jason tells his manager his concerns. His manager tells him not to worry because there have been no complaints from the users. Jason takes no further action.

| | |
|---|---|
| Ethical | |
| Unethical | |

Justification

.....

.....

.....

.....

..... [2]



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7 Sam is a photographer. She has an image library of over 10 000 images. She stores the images on a high capacity magnetic hard disk.

**(a)** Explain why Sam would use the following utility software.

**(i)** Backup

.....

.....

.....

..... [2]

**(ii)** Defragmenter

.....

.....

.....

..... [2]

**(iii)** Disk repair

.....

.....

.....

..... [2]

**(b)** The images are stored as bitmap files.

Identify **four** items that will be stored in the header of a bitmap file.

1 .....

2 .....

3 .....

4 .....

[4]

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**[Turn over**

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**(c)** The bitmap images are compressed for use on a website.

Tick (✓) **one** box to select the **most appropriate** type of compression for the images used on the website and justify your answer.

| | |
|---|---|
| Lossy | |
| Lossless | |

Justification

.....

.....

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.....

.....

..... [3]



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8 **(a)** Complete the following table by identifying the **most appropriate** term for each description. Each term must be different.

| Description | Term |
|---|---|
| Ensures data is accurate and up to date | |
| Prevents accidental or malicious data loss | |
| Prevents unauthorised access to data | |

[3]

**(b)** Describe what is meant by a **digital signature**.

.....

.....

.....

..... [2]

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**[Turn over**

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**9** Networks can be either wired using cables or wireless using radio waves.

**(a)** Describe **one** benefit of using a wireless network compared to using a wired network.

.....

.....

.....

..... [2]

**(b)** Describe **two** drawbacks of using a wireless network compared to using a wired network.

Drawback 1 .....

.....

.....

.....

Drawback 2 .....

.....

.....

.....

[4]

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