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0478/13

October/November 2019

1 hour 45 minutes

No Additional Materials are required.

No calculators allowed.

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 syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **12** printed pages.

- 1 A library has a system that allows customers to check out the books that they want to borrow.

Each book has a barcode that can be used to identify the book.

- (a) (i) Identify **two** input devices that may be used in the library's system.

Input device 1

Input device 2 [2]

- (ii) Identify **two** storage devices that may be used in the library's system.

Storage device 1

Storage device 2 [2]

- (iii) Identify **two** output devices that may be used in the library's system.

Output device 1

Output device 2 [2]

- (b) The data stored by the library is archived at the end of each day. The archive is held on a server in the library office.

The data is encrypted with an 8-bit key. As some of the data is confidential, the library wants to make the encryption more secure.

- (i) State how the library could make the encryption more secure.

.....

..... [1]

- (ii) The term used to describe data before it is encrypted is plain text.

State the term used to describe encrypted data.

..... [1]

- (iii) The library's archive system uses an error detection and correction system that combines a parity check with an automatic repeat request (ARQ).

Describe how this system uses the parity check and ARQ.

[6]

- (c) The library has a website that customers can use to search for a book.

- (i) The website has a background colour with the hexadecimal colour code #F92A10

The colour code is stored in two 12-bit binary registers.

Show how the colour code would be stored in the registers.

F92												
A10												

[6]

- (ii) Videos on the library website show customers which books the library will soon have in stock.

The library wants the file size of a video to be as small as possible.

Identify **and** describe a method the library could use to reduce the file size of a video as much as possible.

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..... [4]

- (d) The library often holds events that introduce new authors.

At the events, the library has a Liquid Crystal Display (LCD) screen that displays data, including an image and information about the author.

Describe how an LCD screen operates to display this data.

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..... [5]

2 A programmer uses a high-level language to write a computer program.

(a) **Four** statements are given about high-level programming languages.

Tick (✓) to show if each statement is **True** or **False**.

Statement	True (✓)	False (✓)
High-level languages need to be translated into machine code to run on a computer		
High-level languages are written using mnemonic codes		
High-level languages are specific to the computer's hardware		
High-level languages are portable languages		

[4]

(b) **Tick (✓)** to show which of the following is an example of a high-level language program.

Example program	Tick (✓)
1011100000110000 0000011011100010	
INP STA ONE INP STA TWO ADD ONE	
a = input() b = input() if a == b: print("Correct") else: print("Incorrect")	

[1]

- 3 Blair writes a paragraph about data transmission in her Computer Science examination.

Use the list given to complete Blair's paragraph by inserting the correct **five** missing terms. Not all terms will be used. Terms can be used more than once.

- duplex
- half-duplex
- parallel
- serial
- simplex

..... data transmission is when data is transmitted a single bit at a time. data transmission is when multiple bits of data are sent all at once. If a user wants to transmit data over a long distance, with the highest chance of accuracy, data transmission should be used. If data needs to be transmitted in one direction only, for example from a computer to a printer, data transmission should be used. If a user has a large amount of data to transmit and this needs to be done as quickly as possible data transmission should be used.

[5]

Question 4 starts on page 8.

- 4 A factory that manufactures cleaning products has a system that monitors conditions throughout the manufacturing process.

The inputs to the system are:

Input	Binary value	Condition
A	1	pH > 7
	0	pH ≤ 7
T	1	Temperature < 35 °C
	0	Temperature ≥ 35 °C
P	1	Pressure ≥ 80 %
	0	Pressure < 80 %

- (a) The system will sound an alarm (**X**) when certain conditions are detected.

The alarm will sound when:

- The pressure ≥ 80 % and the temperature ≥ 35 °C

or

- The temperature < 35 °C and the pH > 7

Draw a logic circuit to represent the alarm system in the factory. Each logic gate must have a maximum of two inputs.



[4]

[4]

- Explain how the sensor and microprocessor are used in the system.

[6]

- 5 The contents of three binary registers have been transmitted from one computer to another. **Odd parity** has been used as an error detection method.

The outcome after transmission is:

- **Register A** and **Register B** have been transmitted **correctly**.
- **Register C** has been transmitted **incorrectly**.

Write the appropriate **Parity bit** for each register to show the given outcome.

	Parity bit							
Register A		0	1	0	0	0	1	1
Register B		0	0	0	0	1	1	1
Register C		0	0	0	0	0	1	1

[3]

- 6 Jesse is taking his Computer Science examination. He answers **five** questions about ethics.

- (a) For the first question, he writes the answer:

“This type of software can be copied and shared without the permission of the owner.”

State what Jesse is describing.

..... [1]

- (b) For the second question, he writes the answer:

“With this type of software, the owner still retains the copyright for the software, but he gives away copies of it for free.”

State what Jesse is describing.

..... [1]

- (c) For the third question, he writes the answer:

“This type of software is often a trial version of the full software. To use the full version the user normally needs to pay a fee.”

State what Jesse is describing.

..... [1]

(d) For the fourth question, he writes the answer:

“This is when a person copies another person’s computer program and tries to claim it as his own.”

State what Jesse is describing.

..... [1]

(e) For the fifth question, he writes the answer:

“This is the legal protection that a person can obtain, to provide protection against his work being stolen.”

State what Jesse is describing.

..... [1]

7 The Von Neumann model for a computer system has several components that are used in the fetch-execute cycle.

(a) One component is main memory.

(i) Describe what is meant by main memory and how it is used in the Von Neumann model for a computer system.

.....

 [3]

(ii) State **two** other components in the Von Neumann model for a computer system.

1
 2 [2]

(b) Computer systems often use interrupts.

Five statements are given about interrupts.

Tick (✓) to show if each statement is **True** or **False**.

Statement	True (✓)	False (✓)
Interrupts can be hardware based or software based		
Interrupts are handled by the operating system		
Interrupts allow a computer to multitask		
Interrupts work out which program to give priority to		
Interrupts are vital to a computer and it cannot function without them		

[5]

8 A company discovers malware on its network.

Explain **two** ways that the malware could have been introduced to the company's network.

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.....

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..... [4]

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COMPUTER SCIENCE

0478/13

Paper 1

October/November 2019

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

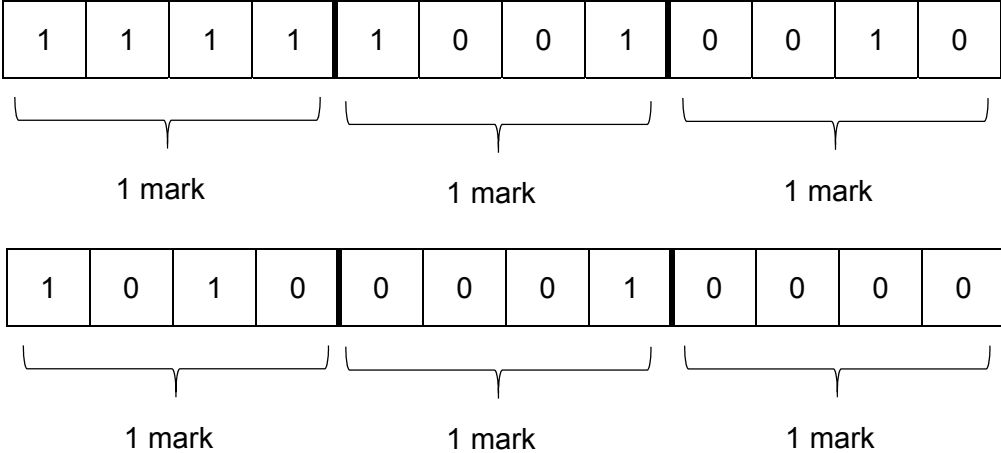
GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)(i)	Two from: <ul style="list-style-type: none"> • 2D scanner • Touchscreen • Keypad/keyboard • Card reader • Mouse • Digital camera 	2
1(a)(ii)	Two from: <ul style="list-style-type: none"> • HDD • SSD • USB flash memory drive • SD card • Any optical 	2
1(a)(iii)	Two from: <ul style="list-style-type: none"> • Monitor/Touch screen • Speaker • Printer • LED // Light 	2
1(b)(i)	<ul style="list-style-type: none"> • Increase the length of the key // make key 12-bit, etc. 	1
1(b)(ii)	<ul style="list-style-type: none"> • Cypher text 	1

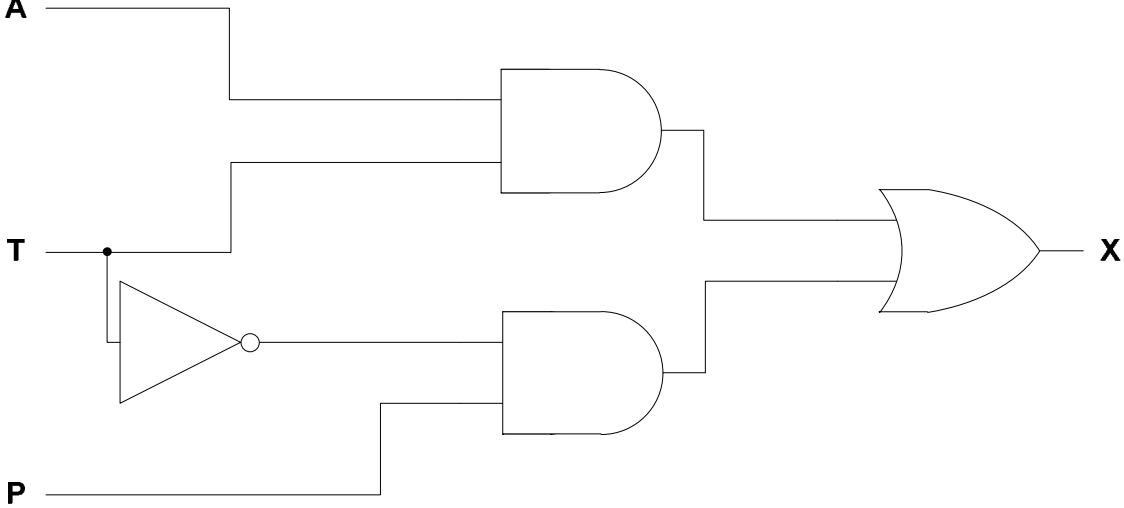
Question	Answer	Marks
1(b)(iii)	<p>Six from:</p> <ul style="list-style-type: none"> • The system could use <u>odd</u> or <u>even</u> parity • A parity bit is added • The data is checked to see if it has incorrect/correct parity // by example • If parity is correct no error is found • An acknowledgement is sent that data is received correctly • The next packet of data is transmitted • If incorrect parity is found an error has occurred • A signal is sent back to request the data is resent • The data is resent until data is received correctly/timeout occurs 	6
1(c)(i)	 <p>The diagram shows two 12-bit data packets. Each packet is divided into three groups of four bits by vertical bars. Below each group, a bracket indicates that each group is worth 1 mark.</p> <p>Packet 1: 1 1 1 1 1 0 0 1 0 0 1 0</p> <p>Packet 2: 1 0 1 0 0 0 0 1 0 0 0 0</p>	6

Question	Answer	Marks
1(c)(ii)	<p>One mark for identification:</p> <ul style="list-style-type: none"> • Compression <p>Three from e.g.:</p> <ul style="list-style-type: none"> • Best compression would be lossy • Use compression algorithm • This would remove all the unnecessary data from the file // removes detail/sound that the human eye/ear may not see/hear • Reduce colour palette ... • ... so each pixel requires fewer bits • Reduce resolution • Only store what changes between frames // temporal redundancy 	4
1(d)	<p>Five from:</p> <ul style="list-style-type: none"> • The display is made up of pixels ... • ... that are arranged together as a matrix • Each pixel has three filters, red, blue and green • Shades of colour are achieved by mixing red, blue and green • The screen is backlit • Light is shone through the liquid crystals • The liquid crystals can be made to turn solid or transparent/on or off ... • ... by changing the shape of the crystal 	5

Question	Answer	Marks															
2(a)	<p>One mark for each correct row</p> <table> <tr> <th>Statement</th><th>True (✓)</th><th>False (✓)</th></tr> <tr> <td>High-level languages need to be translated into machine code to run on a computer</td><td>✓</td><td></td></tr> <tr> <td>High-level languages are written using mnemonic codes</td><td></td><td>✓</td></tr> <tr> <td>High-level languages are specific to the computer's hardware</td><td></td><td>✓</td></tr> <tr> <td>High-level languages are portable languages</td><td>✓</td><td></td></tr> </table>	Statement	True (✓)	False (✓)	High-level languages need to be translated into machine code to run on a computer	✓		High-level languages are written using mnemonic codes		✓	High-level languages are specific to the computer's hardware		✓	High-level languages are portable languages	✓		4
Statement	True (✓)	False (✓)															
High-level languages need to be translated into machine code to run on a computer	✓																
High-level languages are written using mnemonic codes		✓															
High-level languages are specific to the computer's hardware		✓															
High-level languages are portable languages	✓																

Question	Answer	Marks								
2(b)	<p>One mark for the correct tick</p> <table><tr><th>Example program</th><th>Tick (✓)</th></tr><tr><td>10111000000110000 0000011011100010</td><td></td></tr><tr><td>INP STA ONE INP STA TWO ADD ONE</td><td></td></tr><tr><td>a = input() b = input() if a == b: print("Correct") else: print("Incorrect")</td><td>✓</td></tr></table>	Example program	Tick (✓)	10111000000110000 0000011011100010		INP STA ONE INP STA TWO ADD ONE		a = input() b = input() if a == b: print("Correct") else: print("Incorrect")	✓	1
Example program	Tick (✓)									
10111000000110000 0000011011100010										
INP STA ONE INP STA TWO ADD ONE										
a = input() b = input() if a == b: print("Correct") else: print("Incorrect")	✓									

Question	Answer	Marks
3	<p>One mark for each correct term in the correct order</p> <ul style="list-style-type: none"> • Serial • Parallel • Serial • Simplex • Parallel 	5

Question	Answer	Marks
4(a)	<p data-bbox="286 248 1030 284">One mark for each correct logic gate with correct input(s)</p>  <pre data-bbox="309 343 1429 853">graph LR; A --- AND1[AND]; T --- AND2[AND]; T --- NOT1[NOT]; NOT1 --- AND2; P --- AND3[AND]; AND1 --- OR[OR]; AND2 --- OR; OR --- X[X]</pre>	4

Question	Answer	Marks																																													
4(b)	<p>Four mark for 8 correct outputs Three marks for 6 or 7 correct outputs Two mark for 4 or 5 correct outputs One mark for 2 or 3 correct outputs</p> <table><tr><th>A</th><th>T</th><th>P</th><th>Working space</th><th>X</th></tr><tr><td>0</td><td>0</td><td>0</td><td></td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td></td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td></td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td></td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td></td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td><td></td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td></td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td></td><td>1</td></tr></table>	A	T	P	Working space	X	0	0	0		0	0	0	1		1	0	1	0		0	0	1	1		0	1	0	0		0	1	0	1		1	1	1	0		1	1	1	1		1	4
A	T	P	Working space	X																																											
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1	0	1		1																																											
1	1	0		1																																											
1	1	1		1																																											
4(c)	<p>Six from:</p> <ul style="list-style-type: none">• Sensor sends a signal/reading/data to the microprocessor• Signal/reading/data is analogue and is converted to digital using ADC• Reading/data is stored in the system• Microprocessor compares data/reading to the pre-set value of 7• If value is greater than 7 ...• ... a signal/data is sent by the microprocessor to display a warning message on a monitor• The process is continuous	6																																													

Question	Answer	Marks																											
5	<p>One mark for each correct parity bit</p> <div><div>Parity bit</div><table><tr><td>Register A</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>Register B</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>Register C</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr></table></div>	Register A	0	0	1	0	0	0	1	1	Register B	0	0	0	0	0	1	1	1	Register C	0	0	0	0	0	0	1	1	3
Register A	0	0	1	0	0	0	1	1																					
Register B	0	0	0	0	0	1	1	1																					
Register C	0	0	0	0	0	0	1	1																					

Question	Answer	Marks
6(a)	• Free software	1
6(b)	• Freeware	1
6(c)	• Shareware	1
6(d)	• Plagiarism // Intellectual property theft	1
6(e)	• Copyright	1

Question	Answer	Marks
7(a)(i)	Three from: <ul style="list-style-type: none"> • RAM • Primary memory • Volatile memory • Holds currently in use data/instructions • Directly accessed by the CPU 	3
7(a)(ii)	Two from: <ul style="list-style-type: none"> • Arithmetic and logic unit (ALU) • Memory address register (MAR) • Memory data register (MDR) // Memory buffer register (MBR) • Accumulator (ACC) • Immediate Access Store (IAS) • Control Unit (CU) • Program counter (PC) • Current instruction register (CIR) • Address bus • Data bus • Control bus • Input device • Output device • Secondary storage device 	2

Question	Answer	Marks																		
7(b)	<p>One mark for each correct row</p> <table> <tr> <th>Statement</th><th>True (✓)</th><th>False (✓)</th></tr> <tr> <td>Interrupts can be hardware based or software based</td><td>✓</td><td></td></tr> <tr> <td>Interrupts are handled by the operating system</td><td>✓</td><td></td></tr> <tr> <td>Interrupts allow a computer to multitask</td><td>✓</td><td></td></tr> <tr> <td>Interrupts work out which program to give priority to</td><td></td><td>✓</td></tr> <tr> <td>Interrupts are vital to a computer and it cannot function without them</td><td>✓</td><td></td></tr> </table>	Statement	True (✓)	False (✓)	Interrupts can be hardware based or software based	✓		Interrupts are handled by the operating system	✓		Interrupts allow a computer to multitask	✓		Interrupts work out which program to give priority to		✓	Interrupts are vital to a computer and it cannot function without them	✓		5
Statement	True (✓)	False (✓)																		
Interrupts can be hardware based or software based	✓																			
Interrupts are handled by the operating system	✓																			
Interrupts allow a computer to multitask	✓																			
Interrupts work out which program to give priority to		✓																		
Interrupts are vital to a computer and it cannot function without them	✓																			

Question	Answer	Marks
8	<p>Four from:</p> <ul style="list-style-type: none">• A hacker could have hacked the network ...• ... and downloaded the malware onto the network• Clicking a link/attachment/downloaded a file from an email/on a webpage ...• ... the malware could have been embedded into the link/attachment/file• Opening an infected software package ...• ... this would trigger the malware to download onto the network• Inserting an infected portable storage device ...• ... when the drive is accessed the malware is downloaded to the network• Firewall has been turned off ...• ... so malware would not be detected/checked for when entering network• Anti-malware has been turned off ...• ... so malware is not detected/checked for when files are downloaded	4