Cambridge Assessment International Education

Cambridge International AS & A Level

COMPUTER SCIENCE **9608/31**

Paper 3 Written Paper **May/June 2020**

MARK SCHEME

Maximum Mark: 75

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

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

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

© UCLES 2020

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:

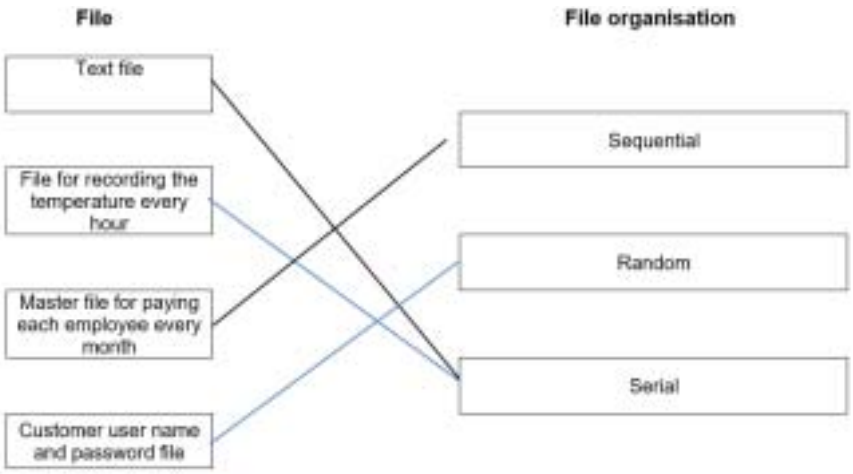
Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

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.

© UCLES 2020

Question	Answer	Marks
1(a)	= (0)11000000.1 (conversion to binary) [1] = 0.110000001×2^8 (evidence of shifting binary point appropriately) [1] = 0110000001 001000 (stored as mantissa and exponent) [1]	3
1(b)	1001111110 (one's complement of 10 bit mantissa) [1] 1001111111 (two's complement of 10 bit mantissa) [1] 1001111111 001000 (stored as mantissa and exponent) [1]	3
1(c)	Any **three** from: • Exponent too large to fit in 4 bits as a two's complement number • Exponent will turn negative/–8 • … therefore, point moves the wrong way • Value will be approx. +0.0029(296875)	3

Question	Answer	Marks
2	**One** mark for each correct line drawn 	4

Question	Answer	Marks
3(a)(i)	Any **three** from: • A circuit is established at the start of the communication • Between sender and receiver • This lasts for the duration of the call/data transfer • Then the links that make up the circuit are removed	3
3(a)(ii)	Any **two** from: • A dedicated channel // Not sharing channel • …can use all bandwidth • Two-way real time conversation • No delay as no switching • Data arrives in order it is sent	2

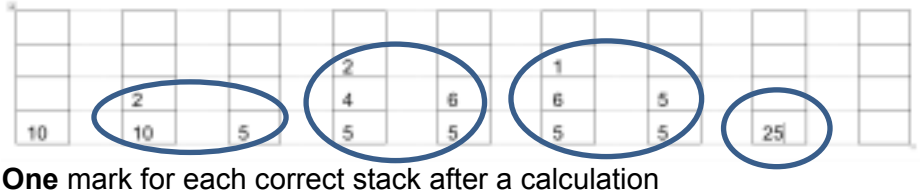
© UCLES 2020

Question	Answer	Marks
3(b)(i)	Any **three** from: • A circuit does not have to be established at the start of the communication • The data to be sent is divided into packets • That can travel along different routes • From node to node • Packets are reassembled in the correct order at the receiver's end • Must wait until the last packet is received to put the data back together	**3**
3(b)(ii)	Any **two** from: • Communication is asynchronous • Allows for error checking • Real time transmission is not required • Smaller amounts of data are sent (than voice calls) therefore dedicated line/higher bandwidth not required // can share the bandwidth • Doesn't matter if data arrives out of order	**2**

Question	Answer	Marks
4(a)	X = ((P XOR Q) XOR R) Y = ((P XOR Q) AND R) OR (P AND Q) or $X = \overline{\left(\overline{P}.Q + P.\overline{Q}\right)}.R + \left(\overline{P}.Q + P.\overline{Q}\right).\overline{R}$ $Y = \left(\overline{P}.Q + P.\overline{Q}\right).R + P.Q$ **One** mark for correct use of XOR **One** mark for correct use of AND **One** mark for correct use of OR **One** mark for X correct **One** mark for Y correct	**5**
4(b)(i)	X: Sum Y: Carry (out)	**2**
4(b)(ii)	Carry (in)	**1**

Question	Answer	Marks
5	• RISC / reduced instruction set computer • CISC / complex instruction set computer • Pipelining	**3**

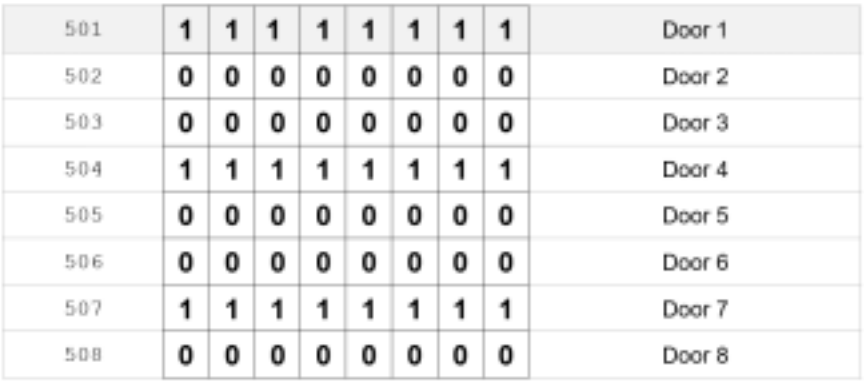
Question	Answer	Marks
6(a)	`P Q + P Q - *` **One** mark for `P Q +` **One** mark for `P Q - *`	**2**

Question	Answer	Marks
6(b)(i)	 **One** mark for each correct stack after a calculation	**4**
6(b)(ii)	`((P + Q) * M) - (R - P)` **One** mark for `((P + Q) * M)` **One** mark for `- (R - P)`	**2**
6(c)	Any **two** from: • Expressions are always evaluated left to right • Each operator uses the two previous values on the stack (except unary minus) • Description of pushing and popping on a stack	**2**

Question	Answer	Marks
7(a)	For each task: **One** mark for correct state **One** mark for suitable reason • Temperature: ready • Reason: waiting for the 10 seconds to be finished • Windspeed: running • Reason: it is currently recording the windspeed • Sending: blocked • Reason: it is waiting for the internet connection	**6**
7(b)	Any **four** from: • Uses a timer // uses two timers • Each timer is continually checked to see if 10 seconds has passed • …if it has, an interrupt is sent to the OS • …OS checks interrupt status • …and may pass control to the interrupt handling routine • (If 10 seconds has passed) then the ISR switches process state to running/ready • When finished it passes control back to OS • The timer is restarted	**4**

Question	Answer	Marks
8(a)	Any **three** from: • a hashing algorithm • a public key • serial number • dates valid	**3**

© UCLES 2020

Question	Answer	Marks
8(b)	Any **six** from: • Martha's message is encrypted using Joshua's public key (provided by Joshua's digital certificate). • Martha's hashing algorithm is used on the message to produce the message digest. • The message digest is then encrypted with Martha's private key to provide a digital signature. • Both the encrypted message and the digital signature are sent. • The message is decrypted with Joshua's private key. • Martha's digital signature is decrypted with Martha's public key (provided by the Martha's digital certificate) to obtain the message digest. • Martha's hashing algorithm (provided by the Martha's digital certificate) recreates the message digest from the decrypted message. • The two message digests are compared, if they are the same then the message should be authentic/has not been tampered.	**6**
9(a)	 **One** mark for open doors correct **One** mark for closed doors correct	**2**

Question	Answer	Marks
9(b)(i)		**4**

Instruction			ACC	501
Label	**Op code**	**Operand**		
CHECK1:	LDD	500	&AA	
	AND	&80	&80	
	CMP	&00		
	JPE	DOOR1		
	LDM	&FF	&FF	
DOOR1:	STO	501		&FF
	WAIT			
	LDM	&00	&00	
	STO	501		&00
	WAIT			
	JMP	CHECK1		

Two marks for all values of ACC correct
Or
One mark for 3 values of ACC correct

Two marks for both values of `501` correct
Or
One mark for one value of `501` correct

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>9(b)(ii)</td><td>
<table>
<tr><th colspan="3">Instruction</th></tr>
<tr><th>Label</th><th>Op code</th><th>Operand</th></tr>
<tr><td>CHECK2:</td><td>LDD</td><td>500</td></tr>
<tr><td></td><td>AND</td><td>&40</td></tr>
<tr><td></td><td>CMP</td><td>&00</td></tr>
<tr><td></td><td>JPE</td><td>DOOR2</td></tr>
<tr><td></td><td>LDM</td><td>&FF</td></tr>
<tr><td>DOOR2:</td><td>STO</td><td>502</td></tr>
<tr><td></td><td>WAIT</td><td></td></tr>
<tr><td></td><td>LDM</td><td>&00</td></tr>
<tr><td></td><td>STO</td><td>502</td></tr>
<tr><td></td><td>WAIT</td><td></td></tr>
<tr><td></td><td>JMP</td><td>CHECK2</td></tr>
</table>

One mark for correct LDM values
One mark for correct AND value
One mark for correct labels and jumps
One mark for fully correct code
</td><td>4</td></tr>
<tr><td>9(c)</td><td>• Either the value in 500 is always zero which means the light is off
• Or it alternates between zero (light off) and 1 (light on) every second</td><td>2</td></tr>
</table>

© UCLES 2020