Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

COMPUTER SCIENCE **9608/32**

Paper 3 Written Paper **May/June 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 May/June 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U 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)	**2 marks** for working **1 mark** for correct answer Working: • = 0. 0110111 x 2^5 places // exponent = 5 • = 1101.11 (moving bp 5) Answer: • = 13.75 // 13 ¾	**3**
1(a)(ii)	The first two bits of the mantissa are 0 / the same / not different / are not 01	**1**
1(a)(iii)	**1 mark** per bullet point • Mantissa = 01101110 • Exponent = 0100	**2**
1(b)(i)	**2 marks** for working **1 mark** for correct answer Working: • 01011.101 • 0.1011101 × 2^4 // showing calculation of exponent = 4 Answer: • 01011101 0100	**3**
1(b)(ii)	**2 marks** for working **1 mark** for correct answer Working: • 10100.011 // 10100011 correct use of two's complement or other method • Exponent = 4 Answer: • 10100011 0100	**3**
1(c)	**1 mark** per bullet point (max 3) • 0.2/0.4 cannot be represented exactly in binary / rounding error • 0.2 has been represented by a value just greater than 0.2 // 0.4 has been represented by a value just greater than 0.4 • Therefore multiplying these two representations together increases the difference • difference after the calculation is significant enough to be seen (given the number of positions after the decimal place)	**3**

Question	Answer	Marks
2(a)	Circuit switching	**1**
2(b)	**1 mark** Any real-time application e.g. video conferencing // live streaming of a concert Justification **1 mark** per bullet to max 2 • reduced latency • there are little/no delays in sending/receiving data once the circuit is set up • because (stringent) error checking (as used in packet switching) is not required • circuit made available is dedicated to this communication stream	**3**

Question	Answer	Marks
3(a)(i)	**AB** **C** 00 01 11 10 0: 1 1 0 1 1: 1 1 0 1	**1**
3(a)(ii)	1 mark for each correct loop **AB** **C** 00 01 11 10 0: 1 1 0 1 1: 1 1 0 1	**2**
3(a)(iii)	1 mark per bullet point • $\overline{A}$ • $+\overline{B}$ $X = \overline{A} + \overline{B}$	**2**

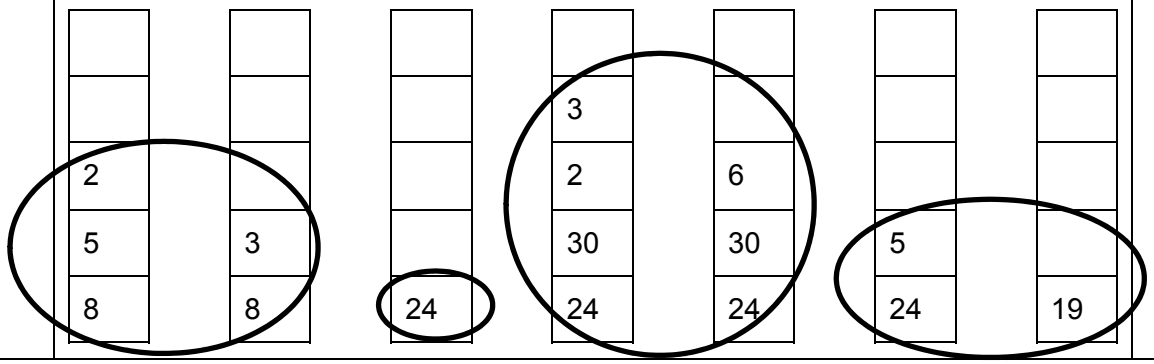
Question	Answer	Marks
3(b)(i)	**1 mark** correct values and order of row and column headings **3 marks** fully correct table entries (based on headings) or **2 marks** table entries contain one error (based on headings) or **1 mark** table entries contain two errors (based on headings)	**4**
3(b)(ii)	**1 mark** per loop	**2**
3(b)(iii)	**1 mark** for each bullet point • $\overline{A}.C$ • $+ A.\overline{C}$ $X = \overline{A}.C + A.\overline{C}$	**2**

AB

CD	**00**	**01**	**11**	**10**
00	0	0	1	1
01	0	0	1	1
11	1	1	0	0
10	1	1	0	0

AB

CD	**00**	**01**	**11**	**10**
00	0	0	1	1
01	0	0	1	1
11	1	1	0	0
10	1	1	0	0

Question	Answer	Marks
4(a)	**1 mark** per bullet point (max 4) • Working from left to right in the expression • If element is a number PUSH that number onto the stack • If element is an operator then POP the first two numbers from stack … • … perform that operation on those numbers • PUSH result back onto stack • End once the last item in the expression has been dealt with	**4**
4(b)	**1 mark** per ring (not all stacks are shown) Do not allow operators in stacks Accept intermediate correct stack values  	**4**

Question	Answer	Marks
5(a)	**1 mark** per bullet point • Sanjeet's computer/software encrypts the message with the government department's public key • The government department's computer/software decrypts the message with their private key	**2**
5(b)	**1 mark** per bullet point (max 2) • The government department's computer/software creates the message digest • Sanjeet's computer/software recreates this message digest • If both copies of the message digest match the message has been verified	**2**

Question	Answer	Marks
5(c)(i)	For each of the two: **1 mark** for the identification of the **vulnerability** and **1 mark** for further description, effect or example e.g. not updating virus definitions (1 mark) which would allow for recently developed viruses to attack the computer system (1 mark) opening email from unknown sources (1 mark) download a virus (1 mark)	**4**
5(c)(ii)	**1 mark** from: • Anti-malware software running in the background • up-to-date anti-virus (definitions) • logging off when not using computer • ensuring firewall is enabled • strong password • not sharing passwords, etc.	**1**

Question	Answer	Marks
6	**1 mark** for identifying hardware**, 1 mark** for the purpose to **max 2** hardware devices. • Moisture sensor … • … to measure the level of moisture in the soil • Humidity sensor … • …to measure the level of moisture in the air • Pressure/Precipitation sensor … • …to measure the amount of rainfall • Actuator … • …to turn the sprinklers on/off • Analogue to Digital Converter/ADC … • …to convert analogue signal from a sensor to a digital value that can be stored / recorded	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(a)</td><td>1 mark for 2/3 rows correct
2 marks for 4/5 rows correct
3 marks for 6 correct rows

<table>
<tr><th>Statement</th><th>RISC</th><th>CISC</th></tr>
<tr><td>Larger instruction set</td><td></td><td>✓</td></tr>
<tr><td>Variable length instructions</td><td></td><td>✓</td></tr>
<tr><td>Smaller number of instruction formats</td><td>✓</td><td></td></tr>
<tr><td>Pipelining is easier</td><td>✓</td><td></td></tr>
<tr><td>Microprogrammed control unit</td><td></td><td>✓</td></tr>
<tr><td>Multi-cycle instructions</td><td></td><td>✓</td></tr>
</table>
</td><td>3</td></tr>
<tr><td>7(b)(i)</td><td>1 mark per bullet point

• SISD // Single instruction single data
• SIMD // Single instruction multiple data
• MISD // Multiple instruction single data
• MIMD // Multiple instruction multiple data</td><td>4</td></tr>
<tr><td>7(b)(ii)</td><td>1 mark per bullet point (max 3)

• Large number of processors
• … working collaboratively on the same program
• … working together simultaneously on the same program
• … communicating via a messaging interface</td><td>3</td></tr>
</table>

Question	Answer	Marks
8(a)	**1 mark** per bullet point **1 mark** for identifying the state, **max 2** for description M**ax 3** marks for each state • Ready • The process is not being executed • The process is in the queue… • … waiting for the processor's attention / time slice • Running • The process is being executed by the processor • The process is currently using its allocated processor time / time slice • Blocked • The process is waiting for an event … • … so it cannot be executed at the moment • …e.g. input/output	**6**
8(b)	For up to 2 maximisation techniques for each of memory and disk Max 2 for Memory, Max 2 for disk if no descriptions are given **1 mark** for identification of maximisation technique**, 1 mark** for description, **1 mark** for further description or information about improvement to **max 4 for memory** **Memory** • Moving frequently accessed instructions to cache (1) for faster recall (1) as SRAM is used rather than DRAM for cache (1) • Making use of virtual memory (1) with paging or segmentation (1) to swap memory to and from a disk (1) • Partitioning memory (1) dividing main memory into static/dynamic partitions (1) to allow for more than one program/task to be available //multiprogramming (1) • Removing unused items/tasks from RAM (1) by marking a partition as available (1) as soon as the process using it has terminated (1) **1 mark** for identification of maximisation technique, **1 mark** for description, **1 mark** for further description or information about improvement to **max 4 for disk** **Disk** • Disk caching (1) a disk cache holds data that is frequently transferred to/from the disk (1) the cache can be held on disk or in RAM (1) • Compression utility (1) decreasing the size of a file stored on disk (1) in order fit more / larger files on the disk (1) • Defragmentation utility (1) files are rearranged to occupy contiguous disk space (1) this reduces the time taken to access files// decreases latency (1)	**6**