Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

COMPUTER SCIENCE **9608/32**

Paper 3 Written Paper **October/November 2018**

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 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

PUBLISHED

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)	1 mark per bullet point: • Correct value for exponent identified e.g. (0.010101 × 2^)5 • Used to give correct value e.g. 1010.1 or 21/64 x 32 • Correct answer i.e. 10.5 // 10½	**3**
1(a)(ii)	1 mark per bullet point: • Correct binary value i.e. 111.1 • Value for exponent identified e.g. (0.1111 × 2^)3 • Correct answer i.e. 01111000 00000011	**3**
1(a)(iii)	1 mark per bullet point: • Any working method for conversion • Applied accurately • Correct answer i.e. 10001000 00000011	**3**
1(b)(i)	Largest (positive) number (in this format)	**1**
1(b)(ii)	Overflow // too large to represent // would become negative	**1**

Question	Answer	Marks
2(a)	1 mark per bullet point to max 3: • Must have a central device • Each node is connected to the central device • Each node has a dedicated connection • Each connection must be bidirectional • Nodes may operate under different protocols	**3**
2(b)(i)	1 mark per bullet point to max 2: • dedicated circuit/channel/(physical) path • connection established before/at the start of the communication • which lasts for duration of connection // circuit released at end of the communication • all data is transmitted along the same route	**2**

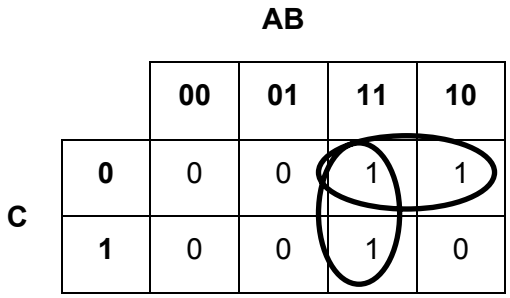
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)(ii)</td><td>1 mark for each row:
<table>
<tr><th>Statements</th><th>Circuit switching</th><th>Packet switching</th></tr>
<tr><td>Shares bandwidth</td><td></td><td>✓</td></tr>
<tr><td>Data may arrive out of order</td><td></td><td>✓</td></tr>
<tr><td>Data can be corrupted</td><td>✓</td><td>✓</td></tr>
<tr><td>Data are less likely to get lost</td><td>either✓</td><td>or✓</td></tr>
</table></td><td>4</td></tr>
</table>

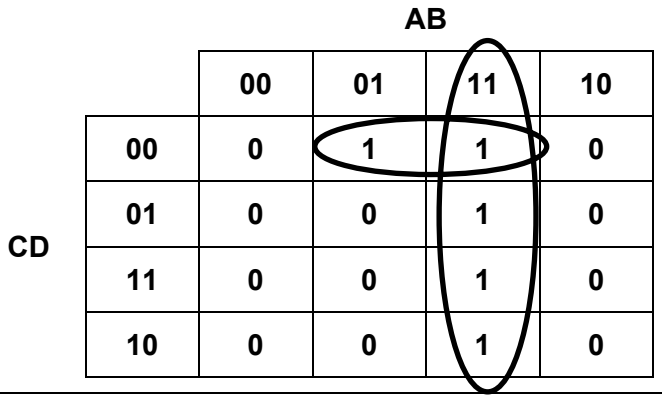
Question	Answer	Marks
3(a)	1 mark per bullet point to max 3: • Correct use of Idempotent law $Y = Y.Y \quad Y = Y + Y$ • Correct use of Complement law $0 = Y.\overline{Y} \quad 1 = Y + \overline{Y}$ • Correct use of Distributive law $X(Y + Z) = X.Y + X.Z$ • Correct use of Redundancy law $X.\overline{Y} + Y = X + Y$ • Correct use of identity law $X.1 = X$ 1 mark for the correct answer For example: $X = A.\overline{B}.\overline{C} + A.B.\overline{C} + A.B.C$ Idempotent law $X = A.\overline{B}.\overline{C} + A.B.\overline{C} + A.B.\overline{C} + A.B.C$ Distributive law $X = A.\overline{C}.(\overline{B} + B) + A.B.(\overline{C} + C)$ Complement/Inverse law $X = A.\overline{C} + A.B$ $X = A.(\overline{C} + B)$ Correct answer $X = A.\overline{B}.\overline{C} + A.B.\overline{C} + A.B.C$ Distributive law $X = A.\overline{C}.(\overline{B} + B) + A.B.C$ Complement/Inverse law $X = A.\overline{C} + A.B.C$ $X = A.(\overline{C} + B.C)$ Redundancy Law $X = A.(\overline{C} + B)$ Correct answer	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(b)(i)</td><td>1 mark for first four as 0, 1 mark for 1011

<table>
<tr><th>A</th><th>B</th><th>C</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>
1 mark
1 mark</td><td>2</td></tr>
<tr><td>3(b)(ii)</td><td>1 mark for correct K-map

<table>
<tr><td></td><td></td><td>AB</td><td></td><td></td></tr>
<tr><td></td><td></td><td>00</td><td>01</td><td>11</td><td>10</td></tr>
<tr><td>C</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td></td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
</table></td><td>1</td></tr>
</table>

Question	Answer	Marks
3(b)(iii)	1 mark for each correct loop to max 2  	**2**
3(b)(iv)	1 mark per bullet point: • $A.\overline{C}$ • + A.B $X = A.\overline{C} + A.B$	**2**
3(c)(i)	1 mark per bullet point to max 2: • Correct column headings and row headings – values only • Correct column headings and row headings – order 1 mark for 2 correct rows or columns, 2 marks for 4 correct rows or columns (based on headings) **AB** **CD** **00** 0 1 1 0 **01** 0 0 1 0 **11** 0 0 1 0 **10** 0 0 1 0	**4**

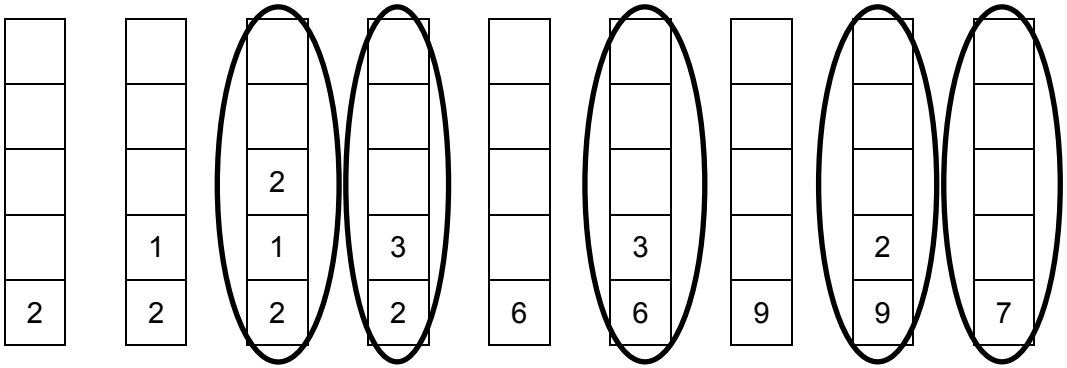
Question	Answer	Marks
3(c)(ii)	1 mark for each correct loop to max 2:  	**2**
3(c)(iii)	1 mark per bullet point: • A.B • + $B.\overline{C}.\overline{D}$ $X = A.B + B.\overline{C}.\overline{D}$	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)</td><td>1 mark per row

<table>
<tr><th rowspan="2">Symbol</th><th colspan="2">Token</th></tr>
<tr><th>Value</th><th>Type</th></tr>
<tr><td>Number1</td><td>60</td><td>Variable</td></tr>
<tr><td>Number2</td><td>61</td><td>Variable</td></tr>
<tr><td>Answer</td><td>62</td><td>Variable</td></tr>
<tr><td>10</td><td>63</td><td>Constant//Literal</td></tr>
<tr><td>0</td><td>64</td><td>Constant//Literal</td></tr>
</table></td><td>3</td></tr>
<tr><td>4(b)</td><td>1 mark for each circled section

<table>
<tr><td>51</td><td>60</td><td>51</td><td>61</td><td>51</td><td>62</td><td>4A</td><td>62</td><td>03</td><td>60</td><td>02</td><td>61</td><td>4B</td><td>52</td><td>63</td><td>4D</td><td>52</td><td>64</td><td>4C</td></tr>
</table></td><td>2</td></tr>
<tr><td>4(c)(i)</td><td>(Code) Optimisation</td><td>1</td></tr>
<tr><td>4(c)(ii)</td><td>1 mark per bullet point:
• <pre>LDD 236
ADD 237
ADD 238
SUB 239
STO 235</pre> Copy the instructions

• Remove line 4 <code>STO 540</code> correct lines 3 and 6 in original code
• Remove line 5 <code>LDD 540</code> correct lines 3 and 6 in original code</td><td>3</td></tr>
</table>

Question	Answer	Marks
4(c)(iii)	1 mark per bullet point: • Code has fewer instructions/occupies less space in memory • shortens execution time of program // time taken to execute whole program decreases	**2**
4(d)	 1 mark ← 1 mark → 1 mark 1 mark no operators on the stack anywhere	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>1 mark per bullet point to max 4:
• RISC has fewer instructions // CISC has more instructions
• RISC has many registers // CISC has few registers
• RISCs instructions are simpler // CISC’s instructions are more complex
• RISC has a few instruction formats // CISC has many instruction formats
• RISC usually uses single-cycle instructions // CISC uses multi-cycle instructions
• RISC uses fixed-length instructions // CISC uses variable-length instructions
• RISC has better pipelineability // CISC has poorer pipelineability
• RISC requires less complex circuits // CISC requires more complex circuits
• RISC has fewer addressing modes // CISC has more addressing modes
• RISC makes more use of RAM // CISC makes more use of cache/less use of RAM
• RISC has a hard-wired control unit // CISC has a programmable control unit
• RISC only uses load and store instructions to address memory
// CISC has many types of instructions to address memory</td><td>4</td></tr>
<tr><td>5(b)(i)</td><td>1 mark per bullet point:
• Completing the As correctly
• B in column 2, row 1 no other Bs in row 1
• Remainder correctly completed

<table>
<tr><th rowspan="2">Stage</th><th colspan="9">Time interval</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th></tr>
<tr><td>Fetch instruction</td><td>A</td><td>B</td><td>C</td><td>D</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Decode instruction</td><td></td><td>A</td><td>B</td><td>C</td><td>D</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Execute instruction</td><td></td><td></td><td>A</td><td>B</td><td>C</td><td>D</td><td></td><td></td><td></td></tr>
<tr><td>Access operand in memory</td><td></td><td></td><td></td><td>A</td><td>B</td><td>C</td><td>D</td><td></td><td></td></tr>
<tr><td>Write result to register</td><td></td><td></td><td></td><td></td><td>A</td><td>B</td><td>C</td><td>D</td><td></td></tr>
</table></td><td>3</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(b)(ii)</td><td>1 mark per bullet point:
• Correct number of cycles for pipelining 8
• Correct number of cycles without pipelining 4 × 5 = 20
• No of cycles saved 20 – 8 = 12</td><td>3</td></tr>
<tr><td>5(c)</td><td>1 mark for each row
<table><tr><th rowspan="2">Statement</th><th colspan="3">Architecture</th></tr><tr><th>SIMD</th><th>MIMD</th><th>SISD</th></tr><tr><td>Each processor executes a different instruction</td><td></td><td>✓</td><td></td></tr><tr><td>There is only one processor</td><td></td><td></td><td>✓</td></tr><tr><td>Each processor executes the same instruction input using data available in the dedicated memory</td><td>✓</td><td></td><td></td></tr><tr><td>Each processor typically has its own partition within a shared memory</td><td></td><td>✓</td><td></td></tr></table></td><td>4</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)</td><td>1 mark for each term/description

<table>
<tr><th></th><th>Description</th><th>Term</th></tr>
<tr><td>A</td><td>The result of encryption that is transmitted to the recipient</td><td>Cipher text</td></tr>
<tr><td>B</td><td>The type of cryptography where different keys are used, one for encryption and one for decryption.</td><td>Asymmetric or Public key</td></tr>
<tr><td>C</td><td>Electronic document used to prove the ownership of a public key // Electronic document used to prove that the data is from a trusted source</td><td>Digital certificate</td></tr>
<tr><td>D</td><td>Key needed to decrypt data that has been encrypted by a public key // Key needed to encrypt data so that it that can be decrypted by a public key
// the key used in asymmetric encryption which is not shared</td><td>Private key</td></tr>
</table></td><td>4</td></tr>
<tr><td>6(b)</td><td>1 mark for C in the correct place
1 mark for A followed by D in any position
1 mark for D followed by B in any position

1 Browser requests that the server identifies itself
2 C
3 Browser checks the certificate against a list of trusted Certificate Authorities
4 A
5 D
6 B
7 Server and Browser now encrypt all transmitted data with the session key</td><td>3</td></tr>
</table>