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 will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.
1 (a) \( +3.5 \)
\[
01110000 \ 00000010
\]
Give full marks for correct answer (normalised or unnormalised)

\[
= 11.1 \quad [1]
\]
\[
= 0.111 \times 2^2 \quad // \text{evidence of shifting binary point appropriately} \quad [1]
\]

[Max 3]

(b) \( -3.5 \)
\[
10010000 \ 00000010
\]
3 marks for correct answer

One’s complement of 8-bit mantissa for \( +3.5 \) \( 10001111 \) – allow f.t.
+1 to get two’s complement \( 10010000 \)

[Max 3]

(c) \( 14 \)
3 marks for correct answer

\[
= 0.111 \times 2^4 \quad // \text{exponent is 4} \quad [1]
\]
\[
= 1110.0 / (1/2 + 1/4 + 1/8) \times 16 \quad [1]
\]

[Max 3]

(d) (i) Normalised

(ii) Leftmost two bits are different for normalised representation
\quad // because the pattern starts with 01

(e)
\[
\begin{array}{cccccccc}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 1 & 1 & 1 & 1 & 1
\end{array}
\]

[1]
2 (a) Statement

This stage can improve the time taken to execute the statement:
\[ x = y + 0 \]

This stage produces object code.

This stage makes use of tree data structures.

This stage enters symbols in the symbol table.

Compilation stage

Lexical analysis

Syntax analysis

Code generation

Optimisation

1 mark for each correct line

(b) \[ P \ Q \ + \]
\[ R \ S \ / \ - \]

(c) (i)

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
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<tr>
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<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-2</td>
</tr>
</tbody>
</table>

1 mark per ring

(ii) \[ b * a \]
\[ - (c + d + a) \]
Order must be correct for both parts

(iii) Rules of precedence means different operators have different priorities // by example multiply is done before add
In RPN evaluation of operators is left to right // operators are used in the sequence in which they are read
No need for brackets // infix may require the use of brackets

Max 2]
3 (a) The page is present in memory

Loaded at / stored / present in page frame 542 // its memory address is 542

(b) (i) Next instruction is first instruction in Page 6

Page 6 is not present in memory

Instruction can only be executed if present in memory

Program cannot continue until Page 6 is loaded

[ii] When there is an attempt to load an instruction for a page not in memory

A page fault occurs // Page 5 finishes …

this generates an interrupt

ISR code is executed

Causes the OS to load page 6 into memory

(c) (i) Time of entry (NOT time in memory)

(ii) When the procedure call is made – Page 1 is swapped out and Page 3 is swapped in

At the end of the procedure call – Page 3 is swapped out and Page 1 is swapped in

Page 1/3 is always in memory shortest amount of time

The entire sequence is repeated for every iteration

(iv) Thrashing // continually swapping pages
4 (a) (i) A set of rules … governing communications/transmission of data /sending and receiving data  
(ii) For example, (Web) browser / email client  
(iii) For example, Web server / email server  
(iv) Security //example: for example, alteration of transmitted messages  
Privacy // for example, only intended receiver can view data
Authentication // for example, trust in other party

[Max 2]

(b) For example:

which protocol will be used… there are a number of different versions of the two protocols
session ID … uniquely identifies a related series of messages between server and client
session type … reusable or not
encryption method … public / private keys to be used // asymmetric/ symmetric
authentication method … use of digital certificates / use of digital signature
compression … method to be used

[Max 2 parameters]

[Max 4]

(c) For example:

banking
private / secure email
shopping
financial transactions
secure file transfer

[Max 2]
5 (a) (i) 

<table>
<thead>
<tr>
<th>Input</th>
<th>Working space</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Q</td>
<td>R</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
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<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

1 mark each column
If zero marks then
6 or 7 pairs correct – 1 mark

(ii) Full adder

(iii) C / Carry
S / Sum
represents the carry part of the addition of three bits
represents the sum part of the addition of three bits

(b) (i) \[ A. (A+B).C \]

(ii) Allow follow through from (b)(i)

\[
A. ((A+B).C) \\
= A.(A.C + B.C) \\
= A.A.C + A.B.C \\
= A.C + A.B.C \\
= A.C (1 + B) \\
= A.C.1 \\
= A.C
\]

1 mark for each correct simplification line – max 3 [3]
1 mark for A.C if correct answer to part (b)(i) [1]
6  (a) 

Computer A  
Computer B  
Server  

Computer C  
Computer D  
Switch  

(b) 

<table>
<thead>
<tr>
<th>Statement</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>All packets must be routed via the server.</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Computer B can read a copy of the packet sent from the Server to Computer A.</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>No collisions are possible.</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

(c)  (i)  Router / Switch / Bridge  

(ii)  Router uses IP addresses in making decisions  
Router has routing table  
Routing table has entry for associated network ID // routing table has entry for host address // routing table used to make decision on where to route packet  
Switch / Bridge use MAC addresses  
MAC address table created  
Switch / bridge use MAC address table to make decision on where to route packet  

[Max 2]