



National
Qualifications
2017

2017 Computing Science
Higher
Finalised Marking Instructions

© Scottish Qualifications Authority 2017

The information in this publication may be reproduced to support SQA qualifications only on a non-commercial basis. If it is reproduced, SQA should be clearly acknowledged as the source. If it is to be used for any other purpose, written permission must be obtained from permissions@sqa.org.uk.

Where the publication includes materials from sources other than SQA (secondary copyright), this material should only be reproduced for the purposes of examination or assessment. If it needs to be reproduced for any other purpose it is the centre's responsibility to obtain the necessary copyright clearance. SQA's NQ Assessment team may be able to direct you to the secondary sources.

These marking instructions have been prepared by examination teams for use by SQA appointed markers when marking external course assessments. This publication must not be reproduced for commercial or trade purposes.



General marking principles for Higher Computing Science

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

- (a) Marks for each candidate response must always be assigned in line with these general marking principles and the detailed marking instructions for this assessment.
- (b) Marking should always be positive, ie marks should be awarded for what is correct and not deducted for errors or omissions.
- (c) If a specific candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your Team Leader.
- (d) Marks should be awarded regardless of spelling as long as the meaning is unambiguous.
- (e) Candidates may answer programming questions in any appropriate programming language or pseudocode. Marks should be awarded, regardless of minor syntax errors, as long as the intention of the coding is clear.
- (f) Where a question asks the candidate to **describe**, the candidate must provide a statement or structure of characteristics and/or features. This should be more than an outline or a list. It may refer to, for instance, a concept, process, experiment, situation or facts in the context of, and appropriate to, the question. The candidates will normally be required to make the same number of factual/appropriate points as are awarded in the question.
- (g) Where a question asks the candidate to **explain**, marks should only be awarded where the candidate goes beyond a description, for example by giving a reason, or relating cause to effect, or providing a relationship between two aspects. These will be related to the context of the question or a specific area within a question.

Detailed marking instructions for each question

Section 1

Question		Expected answer(s)	Max mark	Additional guidance
1.		-32,768 to +32,767 OR -2^{16-1} to $(2^{16-1}) - 1$	2	1 mark for lower integer 1 mark for upper integer 1 mark for -32,767 to 32, 768
2.		<ul style="list-style-type: none"> • Requirements elicitation eg <ul style="list-style-type: none"> ○ Interview Client ○ Inspect documentation ○ Observation • Produce(software) specification • Identify inputs/processes/ outputs • Identify scope/boundaries • Functional requirements detailing features of software 	2	1 mark for any bullet - maximum 2 marks
3.		$96000 \times 16 \times 120 \times 2$ $= 368\ 640\ 000/8$ $= 46\ 080\ 000/1024$ $= 45\ 000/1024$ $= 43.9\ Mb$	3	2 marks for 4 correct values OR 1 mark for 3 correct values 1 mark for converting to correct units 3 marks for correct answer & units with no working Allow rounding to one decimal place
4.		<p>A compound key is a key field made up of two or more fields (that are primary keys in other tables/foreign keys)</p> <p>A surrogate key is created to introduce a primary key (in the absence of a natural primary key)</p>	2	<p>Automatic generation of surrogate key on its own is not sufficient for a mark</p> <p>Allow two fields for compound key if linked to transition table/ associate entity</p>
5.		Unauthorised access to personal data (sent to third parties through the tracking cookie)	1	<p>Award 0 marks for a description of a cookie eg “stores personal data”</p> <p>Accept browsing history as indication of personal data</p>
6.		<ul style="list-style-type: none"> • A public key is used to encrypt the personal data (1 mark) • A private key is used to decrypt the personal data (1 mark) 	2	

Question		Expected answer(s)	Max mark	Additional guidance
7.	(a)	<ul style="list-style-type: none"> • High resolution displays • High-contrast themes • Icons supplemented with auditory feedback • Screen magnifying software • Screen reader software • Speech recognition software • Braille display/keyboard • Appropriate colour schemes 	1	1 mark for any bullet 0 marks for “changing the colour of the font”
	(b)	<ul style="list-style-type: none"> • Subtitles/closed caption/text transcript • Replace system sounds like beeps with visual notifications and captioned text • Use visual warnings, such as a blinking title bar or a flashing border, whenever the computer generates a sound • (Noise cancelling) headphones 	1	1 mark for any bullet
8.		<ul style="list-style-type: none"> • Uses classes/sub-classes • Classes are created with attributes and methods • Subclasses inherit code of a superclass • Objects of these classes can be instantiated • Methods perform an operation • Attributes store properties/values (for an instance) • Subclasses need only define additional attributes and methods 	2	1 mark for any bullet - maximum 2 marks
9.	(a)	RECORD BookDetails IS {STRING title, STRING author, INTEGER number of pages, REAL price}	2	1 mark for named record structure 1 mark for all fields with correct data types Accept language specific data types eg single, currency
	(b)	Create variable ListOfBooks [999] of (data type) BookDetails OR DECLARE ListOfBooks AS ARRAY OF BookDetails INITIALLY [] * 999	2	1 mark for array with value 1 mark for data type from record created in (a)

Section 2

Question	Expected answer(s)	Max mark	Additional guidance
10. (a)	<pre> SET minpos TO 0 SET minimum TO temps(0) FOR index FROM 1 TO 23 DO IF temps (index) < minimum THEN SET minpos TO index SET minimum TO temps (index) END IF NEXT index SEND " The... was" & minimum & "Celsius..." at hour" & index OPEN "low.txt" SEND minimum TO FILE Close "low.txt" SET minpos TO 0 FOR index FROM 1 TO 23 DO IF temps (index) < temps(minpos) THEN SET minpos TO index END IF NEXT index SEND " The... was" & temps(minpos) & "Celsius..." at hour" & minpos OPEN "low.txt" SEND temps(minpos) TO FILE Close "low.txt" </pre>	7	<p>1 mark for initialising minimum before loop AND assigning minimum within loop 1 mark for use of fixed loop (with end loop or indentation) 1 mark for IF statement with correct condition (with end if or indentation) 1 mark for assigning minpos 1 mark for output showing minimum and position 1 mark for open and close file 1 mark for send minimum to file</p> <p>OR</p> <p>1 mark for initialising position 1 mark for use of fixed loop (with end loop or indentation) 1 Mark for IF statement with correct conditions (with end if or indentation) 1 mark for assigning minpos 1 mark output showing minimum and position 1 mark for open and close file 1 mark for send minimum to file</p> <p>Accept minimum > temps (index) Accept loop 0 to 23</p>

Question		Expected answer(s)	Max mark	Additional guidance									
10.	(b)	<ul style="list-style-type: none"> • File management (1 mark): <ul style="list-style-type: none"> ○ identifies a free space on backing storage to place file (1 mark) <li style="text-align: center;">OR ○ Updates/checks file directory (1 mark) • Memory management (1 mark): <ul style="list-style-type: none"> ○ locates data in main memory (1 mark) <li style="text-align: center;">OR ○ allocates main memory for process (1 mark) • Input/Output (1 mark): <ul style="list-style-type: none"> ○ transfer from memory to backing storage (1 mark) • Resource allocation (1 mark): <ul style="list-style-type: none"> ○ managing processes and memory (1 mark) 	2	1 mark for function 1 mark for description Accept error reporting, process management or accepting user commands with appropriate description.									
	(c)	(i)	2	1 mark for each correct line									
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Iteration</th> <th style="width: 25%;">Total</th> <th style="width: 25%;">Average</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">18</td> <td style="text-align: center;">9</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">30</td> <td style="text-align: center;">10</td> </tr> </tbody> </table>	Iteration	Total	Average	2	18	9	3	30	10		
Iteration	Total	Average											
2	18	9											
3	30	10											
		(ii)	2	Accept round functions									
		Calculation results in the wrong data type ie real for the variable average (1 mark) Make average a real variable (1 mark)											

Question		Expected answer(s)	Max mark	Additional guidance
10.	(d)	<ul style="list-style-type: none"> • Change the number 23 to END OF LIST • Use a conditional loop that utilises END OF LIST/FILE as a condition • Use a function to determine the size of the array • Accept a parameter that is used to define the size of the array 	1	1 mark for any bullet
	(e)	<ul style="list-style-type: none"> • Remote access to control heating when not at home • Use of geolocation can automatically turn heating off when no one is home • Takes account of external weather forecast and adjusts temperature accordingly • Real time temperature monitoring through mobile devices can reduce unnecessary gas/fuel use • Data can be analysed to determine how quickly a home heats and how slowly it loses heat meaning that the boiler can be used more efficiently • Multi room control systems prevent rooms being overheated when not in use 	2	<p>1 mark for any bullet - maximum 2 marks</p> <p>Answer must refer to the control/intelligence of the heating system.</p>

Question		Expected answer(s)	Max mark	Additional guidance
11.	(a)	<pre> classDiagram Customer -- Booking Booking -- Driver Driver -- Car </pre>	3	1 mark for each correct relationship. Maximum of 3 marks
	(b) (i)	Customer.Known As Booking.Booking ID Booking.From Booking.To Booking.Cost Car.Registration OR Driver.Registration	3	1 mark for three correct tables (Customer, Booking, Car OR Driver for registration) 1 mark for at least five correct fields 1 mark for relating fields to tables Do not penalise for additional field that could refer to image
	(ii)	(Booking.)Booking ID=12345	1	
	(c)	<ul style="list-style-type: none"> The onmouseover event is triggered executing the mouseOver function changing the (style) colour to yellow(of the phrase "Welcome to Super Taxi" /heading) 	2	1 mark for any bullet - maximum 2 marks No mark for third bullet if changing just the word "Welcome" A description of moving the mouse without referring to event or function in the first two bullets does not get a mark
	(d)	<meta <u>name</u> ="keywords" <u>content</u> ="super,taxi,.....">	2	1 mark for name 1 mark content

Question		Expected answer(s)	Max mark	Additional guidance
11.	(e)	<ul style="list-style-type: none"> • Search (index) for key words in <ul style="list-style-type: none"> ○ title tags ○ alt tags ○ body/page/content ○ URL • Checking links to the site from other sites • Data analytics eg hit rate, location by proximity, filters, prominent social media presence • Algorithms to determine relevance 	2	<p>1 mark for any bullet - maximum 2 marks</p> <p>Answers referring to key words must specify location of key words.</p>
	(f)	Head section of the HTML	1	
	(g)	<ul style="list-style-type: none"> • External more efficient as loaded once/cached but used by several pages • Internal loaded every time a page is accessed 	2	1 mark for a comparison of loaded “once vs multiple times” without reference to pages.
12.	(a)	<ul style="list-style-type: none"> • Arrival <p>OR</p> <ul style="list-style-type: none"> • departure <p>Any one bullet from:</p> <ul style="list-style-type: none"> • A formal parameter can be a copy of the actual parameter • A formal parameter can be a pointer/placeholder to the actual parameter • A formal parameter can control the flow of data eg. by reference or by value 	2	<p>1 mark for identifying parameter</p> <p>1 mark for explanation of formal parameter</p>
	(b)	<ul style="list-style-type: none"> • The values are switched/passed into the incorrect parameters • 10 - 13 results in -3 • hours_parked is less than 1 	2	1 mark for any bullet - maximum 2 marks

Question		Expected answer(s)	Max mark	Additional guidance
12.	(c)	<p>Watchpoints are used to stop execution when the value of a specific variable changes/pre-determined conditions are met (1 mark)</p> <p>This allows the programmer to compare the value with the expected value (1 mark)</p>	2	2 nd mark can only be awarded if clear indication that value is compared with an expected value/test table result etc.
	(d)	<ul style="list-style-type: none"> • More efficient as memory assigned to a local variable becomes available once function is terminated • Allows variables of the same name in different modules without affecting others • Aids modularity 	2	1 mark for any bullet - maximum 2 marks
13.	(a)	<ul style="list-style-type: none"> • Users given task/scenario to perform on the software • Suitable target set of users eg novice, experienced • Observation of performance of users • Feedback is given to developers 	2	<p>1 mark for any bullet - maximum 2 marks</p> <p>Accept specific observation methods eg eye-tracking, think aloud</p>
	(b)	<ul style="list-style-type: none"> • Sort by • Your basket • Page styles/(Gallery/List View) • Buttons: Buy; Pre Order; View Selection; View All • “i” icon (next to pre-order) 	1	<p>1 mark for any bullet - maximum 1 mark</p> <p>Go and Checkout buttons not included. No requirement for scripting behind these buttons.</p>
	(c)	<ul style="list-style-type: none"> • Connection with server/database established OR reference to PHP/server-side scripting • Data captured on webpage form is used to construct a query • A query is used to check number of available items and release date • The result of the query is processed/returned (to update the webpage) 	3	<p>1 mark for any bullet - maximum 3 marks</p> <p>Do not award a mark for “displaying a message”</p> <p>Do not award a mark for “returns a report”</p>

Question			Expected answer(s)	Max mark	Additional guidance
13.	(d)	(i)	Description of backup with frequency (2 marks) eg <ul style="list-style-type: none"> • Back up all data/(full back up) weekly/daily • Save changes since last full backup (differential) daily/hourly • Saving changes since last back up of any type (incremental) daily/hourly Backup type name and frequency (1 mark)	2	Description of type of backup without frequency - award 1 mark Do not award a mark if only a time is stated
		(ii)	Cloud Offline Off-site repository Distributed storage Mirror disk Full/incremental/differential (not mentioned in part (i))	1	Accept use of anti-virus software to prevent deletion of data by a virus or encryption of data (Ransomware)
	(e)		<ul style="list-style-type: none"> • All text in correct colours: “Welcome To” and “Glasgow” would be displayed in red; “PC Bits” in blue (1 mark) • Alignment & size: all text centred, PC Bits double size/200% (1 mark) <div style="border: 1px solid black; padding: 10px; text-align: center; margin: 10px 0;"> <p>Welcome To</p> <p>PCBits</p> <p>Glasgow</p> </div>	2	

Question		Expected answer(s)	Max mark	Additional guidance
14.	(a)	<ul style="list-style-type: none"> Public cloud does not mean open access Password protected space is rented to public Data may be encrypted Data protected by firewall 	2	1 mark for any bullet - maximum 2 marks
	(b) (i)	<p>Vector (1 mark) as:</p> <ul style="list-style-type: none"> You can drag individual objects without affecting others Ear could be grouped as a set of objects Objects can be layered Attributes/co-ordinates of ears can be changed 	2	1 mark for choosing vector 1 mark for any bullet
	(ii)	<ul style="list-style-type: none"> Vector increases Bitmap stays the same 	2	
15.	(a)	<ul style="list-style-type: none"> Address of instruction placed on address bus Read line (on control bus) is activated Contents of location (instruction) transferred to a register along data bus Instruction decoded/executed 	3	3 marks for all four steps in the correct order 2 marks for three steps in the correct order OR four steps in incorrect order 1 mark for two steps in the correct order OR three steps in incorrect order 0 marks for any other response
	(b) (i)	<ul style="list-style-type: none"> Stores frequently accessed instructions/data Faster access times than main memory Fewer accesses to slower main memory On the same chip as the processor Cache is static RAM (faster) 	2	1 mark for any bullet point - maximum 2 marks Do not accept closer to the processor
	(ii)	<ul style="list-style-type: none"> Instructions 2/3 will already be (pre-loaded) in cache ie a cache hit will occur Data in location 2000 will already be in cache improving access time/instruction time. 	2	Accept reference to Instruction 3 accessing registers not cache or main memory

Question		Expected answer(s)	Max mark	Additional guidance
15.	(c)	16777216 colours (1 mark) is better than 65536 (1 mark)	2	Values can be expressed as powers 2^{24} , 2^{16} 1 mark if only states “more colours”
	(d) (i)	<ul style="list-style-type: none"> • Interframe saves the differences between frames • Intraframe compresses a single frame (using RLE or ‘blocking’ shades of colours) 	2	Award 1 mark for good description which does not reference inter- or intra- frame
	(ii)	<ul style="list-style-type: none"> • More effective compression for a singer performer (1 mark) • (Differential/delta/i/p) Interframes will be smaller for a performance with fewer movements • (Differential/delta/i/p) Interframes will be larger for performance with more movement • More key/delta frames will be needed as dancers will be moving around 	2	1 mark for more effective for singer 1 mark for valid reason that clearly explains the compression and does not just compare levels of movement

[END OF MARKING INSTRUCTIONS]