H

National
Qualifications

CS(H)20AMS

Computing Science
Marking Instructions

General Marking Principles for Higher Computing Science

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.
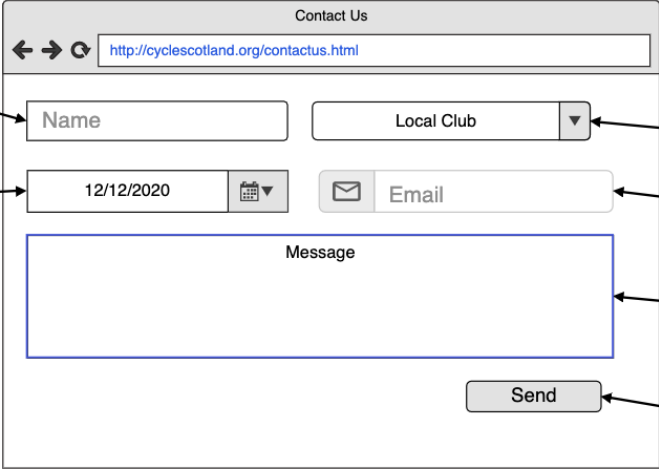
(a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.

(b) If a 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.

(c) Award marks regardless of spelling, as long as the meaning is unambiguous

(d) Candidates may answer programming questions in any appropriate programming language or pseudocode. Award marks regardless of minor syntax errors, as long as the intention of the coding is clear.

(e) For a describe question, candidates must provide a statement or structure of characteristics and/or features. This will be more than an outline or a list. It may refer to, for example, a concept, process, experiment, situation, or facts, in the context of and appropriate to the question. Candidates must make the same number of factual/appropriate points as there are marks available in the question.

(f) For an explain question, candidates must relate cause and effect and/or make relationships between things clear, in the context of the question or a specific area within the question.

Number			Question	Instructions	Marks
1			Convert the following 8-bit two's complement number into denary. 1011 0101	-75 **(1 mark)**	1
2			A foreign key is an example of a key. Describe what is meant by a foreign key in a relational database.	A primary key from another table used to link a table with another to create a relationship. **(1 mark)**	1
3			Instructions are fetched and executed by the processor. Complete the missing steps of the fetch-execute cycle for the execution of an instruction at memory address 4817. Step 1 The processor sets up the address bus with the address 4817. Step 2 Step 3 Step 4 The instruction in the instruction register is then interpreted by the decoder and carried out.	Step 2: The processor activates the read line on the control bus **(1 mark)** Step 3: Instruction is fetched from memory location 4817 using the data bus and stored in the instruction register. **(1 mark)**	2
4			A database table is shown below. (see paper) Complete the table below showing the output from the following SQL statement. SELECT Country, Count(*) AS 'Number of Customers' FROM Customer GROUP BY Country;	<table><tr><td>Country</td><td>Number of Customers</td></tr><tr><td>Germany</td><td>2</td></tr><tr><td>France</td><td>3</td></tr></table> **Award 1 mark for each correct row, max 2 marks**	
5			Convert binary number 0·0001010111 to floating-point representation. There are 16 bits for the mantissa and 8 bits for the exponent.	Mantissa sign bit = 0 **(1 mark)** Mantissa magnitude = 101 0111 0000 0000 **(1 mark)** Exponent is -4 so convert to two's complement Exponent is 1111 1100 **(1 mark)**	3
6			A web site is being designed for a restaurant. A wireframe design for the home page is shown below.		

Number			Question	Instructions	Marks
	a		State two reasons why this is not an efficient user-interface design.	• No details for the content of two of the drop-down on the page. • No details of the media items/images show • None of the interface elements are labelled. • Destinations of menu items not identified • Other valid **1 mark each bullet, max 2 marks**	2
	b		HTML5 elements have been used to define different parts of this page. State which elements have been used for the parts labelled A and B.	A. Header **B.** Nav **1 mark each bullet, max 2 marks**	2

7			Stock codes in a warehouse are generated from the first 5 characters of an item's name, and the aisle and shelf it is found on. These variables have been assigned using the code below.
			
			`Line 1    DECLARE itemname INITIALLY "Radiator"`
			`Line 2    DECLARE aisle INITALLY "W20"`
			`Line 3    DECLARE shelf INITIALLY "3L"`
			`Line 4    _____`
			
			The variable `stockcode` is to be assigned with value 'RadiaW203L' using substring operations.
			
			Using a programming language of your choice write line 4.
				• Substring of itemname **(1 mark)**
				• Assignment and concatenation of strings **(1 mark)**
				
				Examples:
				VB
				Stockcode = LEFT(itemname, 5) & aisle & shelf
				
				JavaScript
				var stockcode = itemname.substring(0,5) + aisle + shelf;
				
				Live code
				Put (character 1 to 5 of itemname) & shortcode & aisle & shelf INTO stockcode
					2

8			Describe why the iterative development process places more emphasis on the initial analysis and design phases of development than the agile development process does.	Iterative Development Process attempts to understand the whole problem at the beginning **(1 mark)** and then complete the whole design before moving to implementation **(1 mark)**. **OR** Agile process introduces features individually to software **(1 mark)** so only requires to analyse and design each feature as it is introduced **(1 mark)**.	2

Number			Question	Instructions	Marks
9			A low-fidelity prototype has been created for a mobile phone app. Describe how this is used when performing usability testing.	• Provide scenario/give prospective users a task to perform • Observe users • Receive feedback • Identify problems with navigation eg missing/orphan pages/ hyperlink destinations • Record difficulties or improvements needed **One mark each bullet, max 2 marks**	2
10			Review the following code. (see paper) Describe a potential issue with the code shown above.	There is an issue with the scope of the variable 'tax' **(1 mark)** It is declared as both a global variable and a local variable in the function (which may lead to conflict with the value it holds). **(1 mark)**	2
11			Data which belongs to a music store is shown below. (see paper)		
	a		Complete the entity-occurrence diagram below to represent the relation between Album, Singer and Label.	Connections corrections: Singer to Album) **(1 mark)** Label to Album **(1 mark)**	2
	b		State the relationship between		
		i	Singer and Album	One-to-many **(1 mark)**	1
		ii	Label and Album	One-to-many **(1 mark)**	1
12			Cycle Scotland is an organisation which promotes cycling to groups across Scotland. A web site is being created to display information about activities and to provide a way to contact the organisation. The home page for the site is shown below. (see paper)		

Number			Question	Instructions	Marks

	a		The header and footer elements of the pages have the same CSS styles however the footer requires an additional property to center align text.
			
			The CSS rule applied to the footer element at present is shown below.
			
			footer {
			    background: gray;
			    color: white;
			    width: 100%;
			    text-align: center;
			}
			
			Write the new CSS rules required to style both the header and the footer elements in the most efficient way. Your answer should include the use of grouping selectors.
				header, footer {
				    background: gray;
				    color: white;
				    width: 100%;
				}
				
				footer {
				    text-align: center;
				}
				
				1 mark for use of group selector (header, footer)
				1 mark for footer CSS rule with text-align:center
					2

	b		The buttons on the home page change from "Read more" to "Click for more" when the mouse moves over them. (see paper) Part of the HTML code for the home page is shown below. (see paper) The button should change back to "Read more" when the mouse moves off the image.		

		i	Write a new function to display the original image when the mouse is moved off the image.	function readmore(buttontext) {
				  buttontext.src = 'readmore.png';
				}
				
				1 mark for function name and parameter in brackets
				1 mark for change source attribute of parameter
					2

		ii	Re-write the HTML element to call the function created in part (i) when the mouse is moved off the image.	HTML element has onMouseOut="readmore(this)" **1 mark for onMouseOut** **1 mark for function name and (this)**	2
	c		The following HTML is used in another part of the site. (see paper) The following CSS defines the rule for "important-text" (see paper) Explain why this CSS styles both paragraphs with a red background.	Descendant selectors (p tags) **(1 mark)** within divs of the .important-text class all inherit the background red property **(1 mark)**	2

Number			Question	Instructions	Marks
	d		The "Contact Us" page allows a message to be sent to the site owners via form. When using the form, a user submits this information. • Name • Date of birth • Local Club (either Aberdeen, Dundee, Inverness or Glasgow) • Email Address • Message Content Using this information, draw a wireframe design for the form.	• Name, Email and Message inputs • Suitable control for selecting date (validation of input) • Dropdown for Local club (validation of input) • Submit button **1 mark for each bullet, max 4 marks**	**4**
	e		The menu for the site makes use of the following CSS code. (see paper)		
		i	Write the CSS code which is missing from line 2.	list-style-type: **(1 mark)** none; **(1 mark)**	**2**
		ii	Describe how the menu changes when the pointer is moved over one of the hyperlinks.	The background changes to ghostwhite and the text to slate grey **(1 mark)**	**1**
		iii	Explain the purpose of the line 14 of the CSS code.	Display block means the element is display in a block which means it has whitespace above and below. **(1 mark)**. This means there is a larger area in the menu making it easier to use with the mouse pointer **(1 mark)**.	**2**

Number			Question	Instructions	Marks
13			Oxford Analysis is a data processing company with has stored the results of an assessment of happiness for every country in the world in a csv file. This data includes country name, unique happiness rank, score for freedom and score for healthy living. An extract, is show below. … Norway,3,3,12 Iceland ,4,7,13 Netherlands,5,19,18 … There are 195 rows in the csv file. The values are to be read from the csv file and stored in a suitable record structure.		
	a		The data from the file is to be read into an array of records.		

		i	Using a programming language of your choice, define a suitable records structure.	RECORD happiness IS {
				    STRING country,
				    INTEGER rank,
				    INTEGER freedom,
				    INTEGER healthyliving
				}
				
				1 mark for record declaration
				1 mark for four items
				1 mark for correct types
					3

		ii	Using a programming language of your choice, declare a variable that can store the data for the 195 rows in the csv file.	DECLARE happinessArray AS array of happiness * 195 INITIALLY [] **1 mark for declaring array or record** **1 mark for 195 records**	2
			The following code is used to read the contents of the csv file. (see paper)		
	b	i	Explain the purpose of lines 1 to 3.	• This sets the file name and opens the file • Declares a variable and reads the first row from the file into it. **1 mark each bullet, max 2 marks**	2

Number			Question	Instructions		Marks
		ii	Explain the purpose of lines 10 and 11.	If a comma is found at the position in the row **(1 mark)** then the preceding characters are written to the array **(1 mark).** *Answers should indicate that candidates understand that this is selecting the delimited text from the row.*		2

	c		A file with the following values is used to test the program.
			
			Scotland,6,45,23
			Ireland,7,67,29
			France,8,54,31
			
			A watchpoint has been set which breaks the program at line 14 when "character" has a value of 11.
			
			The variables in the table below are inspected.
			
			Complete the table to show the values stored.
				Variable
				
				`arraypointer`
				
				`startValue`
				
				`happinessRow[ character]`
				
				1 mark each value, max 3 marks
					Value
					
					3
					
					12
					
					"," (comma)
						3

	d		A hacker group has carried out a denial of service attack on the Oxford Analysis servers using resource starvation. Describe two ways that resource starvation may prevent a system from functioning correctly.	• Repeated requests for processor time can mean that the processor is unable to respond to other tasks. • Uploading many files to the server can fill the available storage meaning the system is unable to store data. • Forcing multiple processes to be loaded into memory may exhaust the available RAM and cause the system to fail. • Other valid **1 mark each bullet, max 2 marks**		2

Number			Question	Instructions	Marks

	e		A function is required which will return the position of the lowest value for "healthy living".
			
			 Using a programming language of your choice, write the code for this function. The function should make use of the data structure from (a)(ii).
				FUNCTION minHealthyLiving(happiness[]) {
				
				 minHL = happiness(1).healthyliving
				 FOR row = 2 TO length(happiness) DO
				   IF happiness(row).healthyliving < minHL THEN
				     SET minML to happiness(row).healthyliving
				   END IF
				 END FOR
				
				   RETURN minHL
				 }
				
				 1 mark for function passing in array of records
				 1 mark for setting minimum to first array element and the correct record field.
				 1 mark for LOOP for remaining elements in array
				 1 mark for comparison and assigning new minimum
				 1 mark for RETURN minimum value.
					5

14			A video publishing and sharing site is to be set up. The site will allow video creators to setup channels and publish videos to these channels. The site will record how many people like or dislike a video and how many people have watched each video. Creators will be able to see their total views per channel and for all the videos they create.		
	a		State two functional requirements of the relational database.	• Setup channel • Publish videos • Record views • Total views per channel • Total views per video **1 mark each bullet, max 2 marks**	2
	b		An initial design for the tables in the database is shown below. (see paper) Draw an entity relationship diagram (without attributes) to show the relationships that exist in the database. Your answer should show the entity names and cardinality.	A three entities **(1 mark)** Correct 1-to-many relationships with a name applied to each **(1 mark)**	2
	c		A query is designed which displays all the channels for creators in Scotland. (see paper)		

Number			Question	Instructions		Marks
		i	The answer table from Query 1 can be used in a second query to show the number of channels per creator sorted from the largest to the smallest number of channels.	Field(s) and calculation(s)	Creator.Name, count(channelID) AS "Number of channels"	
				Table(s) and query	[Query 1 – Channels in Scotland]	
				Search criteria		
				Grouping	Creator.CreatorID	
				Sort order	"Number of Channels" DESC	
				• **Creator.Name and COUNT of channels** • **Reference to Query 1** • **Grouping by CreatorID (or Name)** • **Sort on Count DESC** **1 mark each bullet** *Accept CreatorID in fields rather than Creator.Name. Accept use of COUNT in sort.*		4
		ii	Query 1 makes use of a wildcard (*). Describe the purpose of the wildcard operator in Query 1.	The wildcard is used to include all the fields from the Creator table. **(1 mark)**		1
	d		Describe what is meant by an "alias" in an SQL statement.	An alias is used to give an alternative name to a field or calculation in an answer table **(1 mark)** OR An alias can be given to a table in the FROM clause, to allow a shorter name to be used for it in the statement **(1 mark)**		1
			Some sample data from each of the tables is shown below. (see paper)			
	e		A report is created to show the channels with the total number of likes for all their videos. Write the SQL statement to produce the output shown below.	SELECT Channel.channelID, SUM(likes) AS "Total Likes" FROM Channel, Video WHERE Channel.channelID = Video.channelID GROUP BY Channel.channelID ORDER BY Channel.channelID ASC **1 mark for use of SUM function with alias "Total Like"** **1 mark for correct GROUP BY clause with correct ORDER BY** **1 mark for correct equi-join of channelID**		3

Number			Question	Instructions	Marks
	f		A report is created for the maximum views for a single video for each creator. The expected results are: (see paper) The following SQL statement is executed. SELECT name, AVG(views) FROM Creator, Videos WHERE Creator.creatorID = Channel.creatorID AND Channel.channelID = Video.channelID GROUP BY Video.videoID When tested, the actual output did not match the excepted output. Identify the three errors in the above SQL statement.	• AVG should be MAX • Channel missing from FROM clause • Incorrect GROUP BY clause **1 mark each bullet, max 3 marks**	**3**
	g		A new user called 'Paul Aman' with the email address 'pa@mymail.com' joins the site. Paul is from Wales and has a password of "mypassword". His creatorID will be 8775. He is going to take over ownership of the channel "CupcakeJemma".		
		i	Using SQL, write the two queries required to complete this task.	**Query 1: Insert new user** INSERT INTO Creator **(1 mark)** (name, email, password, location) **(1 mark)** VALUES ("Paul Aman", "pa@mymail.com", "mypassword","Wales") **(1 mark)** **OR** INSERT INTO Creator **(1 mark)** VALUES (8775, **(1 mark)** "Paul Aman", "pa@mymail.com", "mypassword","Wales") **(1 mark)** **Query 2** UPDATE Channel SET creatorID = 8775 **(1 mark)** WHERE channelName ="CupcakeJemma" **(1 mark)**	**5**

Number			Question	Instructions	Marks
		ii	A hacker is able to guess Paul's password and deletes all the videos on his channel. State the law that the hacker has broken and the offence that has been committed.	Law: Computer Misuse Act **(1 mark)** Offence: unauthorised modification of programs or data on a computer **(1 mark)**	2
15			A golf tournament uses a program to collect the players scores. The names of players and their scores are written into two separate 1-D arrays. On day one there are 140 players. Any player who has a score which is more than the average score doesn't progress to the second day. The program calculates the average score and then counts how many players will progress to day two. The average is the total of all scores divided by the number of scores.		
	a		During the analysis stage boundaries are identified. State two boundaries for this program.	• Use of 2 1-D arrays • Day one 140 players • Day 2 players only if less than or equal to average. 1 mark for each bullet, max 2 marks	2
	b		Using a recognised design technique, create a solution to display the number of players who will take part in the second day of the tournament.	• **1 mark for correct calculation of day 1 average** • **1 mark for use of loop structure to iterate through score (twice)** • **1 mark for use of IF with condition to compare with average** • **1 mark for displaying result**	4

				SET total TO 0
				FOR EACH score IN playerScore DO
				   SET total TO total + score
				END FOR
				SET average TO total / 140
				
				dayTwoCount = 0
				
				FOR EACH score in playerScore DO
				  IF score <= average THEN
				    SET dayTwoCount TO dayTwoCount + 1
				  END IF
				END FOR
				
				SEND "Number of Day Two Players is" & dayTwoCount	

Number			Question	Instructions	Marks
	c		When testing the program a dry run is used to resolve some errors. Explain how a "dry run" is used to test a computer program.	Typically, this involves manually stepping through the code, **(1 mark)** writing down the value of variables as they change to identify any errors **(1 mark)**	2
	d		Some code from another part of the program is shown below. This code is intended to find any player of the first 140, who has beaten the course record and display his or her details. (see paper) An evaluation has been carried out and this code is not efficient. Describe two reasons why this code does not make efficient use of coding constructs.	• Course record is entered from keyboard for each score that is compared – inefficient as it will be entered 140 times. • The number of players is known, so using a fixed FOR loop from 1 to 140 would remove the need for counter. • Sending output to the screen at line 209 is inefficient as it would be best done once all scores have been reviewed. **1 mark each bullet, max 2 marks**	2
	e		The players attending the tournament are driven to the golf course in cars which have management systems to reduce their impact on the environment. Describe two features of car management systems and explain why each feature reduces the car's impact on the environment.	Start/stop systems shut down engine when the car is not moving, **(1 mark)** reducing the amount of time the engine is running therefore reducing fuel use/emissions. **(1 mark)** Engine control systems **(1 mark)** ensure optimum operation of the engine, making it more efficient, using less fuel and reducing emissions. **(1 mark)** Other valid **(1 mark)** with reason for efficiency **(1 mark)** **1 mark each feature (max 2), 1 mark each reason for impact reduction (max 2), max 4 marks.**	4
16			Sally is creating a web site which will allow users to upload their photos from their mobile phones and share them with their friends. The users will need either their mobile phone number or a username to access the site. They will be challenged with a password to check it is them. The site will allow users to upload photos and tag their friends in the photos using their friends' usernames. When a user is tagged in a photo, a message is sent to his or her phone with the link to the tagged image. Clicking on the link will display the image.		

Number			Question	Instructions	Marks
	a		From the information provided and the detail of inputs and outputs above, state the processes required to create the software for the web site.	• Upload and store photo • Display photo • Login to site • Check password • Tag friends • View tagged photo **1 mark each bullet, max 3 marks**	**3**
	b		A new feature is designed for the website which identifies the user with the most photos uploaded and then compares the uploads with the current logged in user. The results of this feature are shown below. (see paper) A structure diagram has been created for this new feature. Add the data flow for the sub-programs below. (see paper)	**1 mark for outputs of first process** **1 mark for inputs of second process** **1 mark for outputs of second process** **1 mark for all inputs to third process** **Max 4 marks**	**4**

	c		A database will be used to hold the data for web site. A partially complete data dictionary for this is shown below. (see paper)		
		i	State the validation required for "UploadedBy".	Lookup of Login from User **(1 mark)**	**1**
		ii	State the type of key used for the entity "Tagged".	Compound **(1 mark)**	**1**

Number			Question	Instructions	Marks
	d		The web server for the site is upgraded. The size of the data bus has been doubled. Explain why increasing the width of the data bus will improve system performance.		2
		i	Explain why increasing the width of the data bus will improve system performance.	The greater the bus width, the more bits can be fetched **(1 mark)** in a single operation **(1 mark)**.	2
		ii	State one other factor that could account for the server performing better than previously.	• Increase in cache memory • Faster cache memory • Increase in processor clock speed **1 mark for any bullet**	1
	e		A design for the site on mobile devices is shown below. Evaluate this design in terms of usability.	• The interface screen layout is appropriate for a mobile web page with large contact areas for touch. • There is a helpful confirmation dialogue shown for tagging a user with confirmation. • Both buttons at the bottom of the screen appear to have help icons which would load appropriate further information. • There is a collapsed menu icon in the top right minimising the need for an on-screen menu. 1 **mark each bullet, max 3 marks**	3

Detail of Sources / Mark Allocations and Balance

Question	Mark	Skills	Detail	Unit
1	1	Application of CS knowledge	Two's complement	CS
2	1	Design	Foreign key	DDD
3	2	Application of CS knowledge	Fetch-execute cycle	CS
4	2	Implementation	SELECT, WHERE, GROUP BY	DDD
5	3	Application of CS knowledge	Floating-point representation	CS
6a	2	Design	Wire-framing design	WDD
6b	2	Implementation	HTML5 elements (header and nav)	WDD
7	2	Implementation	Substring operations	SDD
8	2	Application of CS knowledge	development methodologies	SDD
9	2	Evaluation	Usability	SDD
10	2	Implementation	scope of local and global variables	SDD
11a	2	Design	Entity-occurrence diagram	DDD
11bi	1	Design	Cardinality 1-to-many	DDD
11bii	1	Design	Cardinality 1-to-many	DDD
Total	25			

Question	Mark	Skills	Detail	Unit
12a	2	Implementation	CSS Grouping Selectors	WDD
12bi	2	Implementation	JavaScript	WDD
12bii	2	Implementation	JavaScript	WDD
12c	2	Testing	media content displays correctly / CSS descendant selectors	WDD
12d	4	Design	Wireframe	WDD
12ei	2	Implementation	CSS - list-style-type: none	WDD
12eii	1	Testing	Navigational bar works	WDD
12eiii	1	Implementation	CSS - display: block	WDD
13ai	3	Implementation	record structure	SDD
13aii	2	Implementation	Array of records	SDD
13bi	2	Design	Read and explain code/ Opening file and reading row	SDD
13bii	2	Design	Read and explain code	SDD
13c	3	Testing	watchpoint, debugging techniques	SDD
13d	2	Application of CS knowledge	DOS attack	CS
13e	5	Design	Finding minimum	SDD
14a	2	Analysis	Requirements	DDD

14b	2	Design	Entity Relationship Diagram	DDD
14ci	4	Design	Query design	DDD
14cii	1	Implementation	SQL - Wildcard	DDD
14d	1	Implementation	SQL - Alias	DDD
14e	3	Implementation	SQL - SUM, GROUP	DDD
14f	3	Testing	Expected output	DDD
14gi	5	Implementation	SQL - Insert, SQL - Update	DDD
14gii	2	Application of CS knowledge	Computer Mis-use Act	CS
15a	2	Analysis	Boundaries	SDD
15b	4	Design	Exemplify solutions	SDD
15c	2	Testing	Dry-run	SDD
15d	2	Evaluation	Efficient use of coding constructs	SDD
15e	4	Application of CS knowledge	Environmental impact	CS
16a	2	Analysis	Processes	SDD
16b	4	Design	Data flow	SDD
16ci	1	Design	Data dictionary - validation	DDD
16cii	1	Design	Compound Key	DDD
16di	2	Application of CS knowledge	Data bus - system performance	CS
16dii	1	Application of CS knowledge	System performance	CS
16e	2	Evaluation	Usability	SDD
Total	**85**			

Content	% of course assessment	Range of QP marks	Allocated
SDD	40%	34–44	43
WDD	25%	20–35	20
DDD	25%	20–35	30
CS	10%	12–20	17

Skills	% of course assessment	Range of QP marks	Allocated
Analysis	5%	0–6	6
Design	30%	35–51	36
Implementation	40%	26–42	32
Testing	10%	7–15	11
Evaluation	5%	0–6	6
Application of CS knowledge	10%	12–20	19