GCSE
COMPUTER SCIENCE
8525/2

Paper 2 Computing concepts

Mark scheme

June 2023

Version: 1.0 Final

2 3 6 G 8 5 2 5 / 2 / M S

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

The following annotation is used in the mark scheme:

; - means a single mark

// - means alternative response

/ - means an alternative word or sub-phrase

A. - means acceptable creditworthy answer. Also used to denote a valid answer that goes beyond the expectations of the GCSE syllabus.

R. - means reject answer as not creditworthy

NE. - means not enough

I. - means ignore

DPT. - in some questions a specific error made by a candidate, if repeated, could result in the candidate failing to gain more than one mark. The DPT label indicates that this mistake should only result in a candidate losing one mark on the first occasion that the error is made. Provided that the answer remains understandable, subsequent marks should be awarded as if the error was not being repeated.

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity, you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level, you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Qu	Part	Marking guidance	Total marks
01	1	**Mark is for AO1 (recall)** **D** 16; **R.** if more than one lozenge shaded	1

Qu	Part	Marking guidance	Total marks
01	2	**2 marks for AO1 (understanding)** **B** Hexadecimal is easier for people to read than binary; **F** Hexadecimal takes less time to type than binary; **R.** if more than two lozenges shaded	2

Qu	Part	Marking guidance	Total marks
02	1	**Mark is for AO2 (apply)** `1010 1011`; **I.** Leading zeros	1

Qu	Part	Marking guidance	Total marks
02	2	**2 marks for AO2 (apply)** `0010`; `1101`; If the answer given is not fully correct then award **a maximum of 1 working mark** as follows: • 2 converted to `0010` • D converted to `1101` • D converted to decimal `13` • Conversion to decimal `45` **A.** missing leading zeros **I.** additional leading zeros	2

Qu	Part	Marking guidance	Total marks
03		**2 marks for AO2 (apply)** 10111; 100;	2

Qu	Part	Marking guidance	Total marks
04		**2 marks for AO2 (apply)** 2;; If the answer given is not fully correct then award a **maximum of 1 working mark** as follows: • Division by 8; • Division by 1000; • Division by 1 000 000;	2

Qu	Part	Marking guidance	Total marks
05		**Mark is for AO1 (understanding)** (Shift the number) two (binary) places / bits to the right;	1

Qu	Part	Marking guidance	Total marks
06	1	**Mark is for AO1 (recall)** One (sound) sample per second; **A.** one cycle (of the wave) per second	1

Qu	Part	Marking guidance	Total marks
06	2	**3 marks for AO2 (apply)** 0.5MB;;; If the answer given is not fully correct then award a **maximum of 2 working marks** as follows, even if the resulting intermediate calculation is incorrect: • Multiplying 50 **or** 4 by 20 000; • Multiplying 50 **or** 20 000 by 4; • Dividing result of calculation by 8 **or** 8000; • Dividing result of calculation by 1 000 000 **or** 1000;	3

Qu	Part	Marking guidance	Total marks
07	1	**Mark is for AO1 (recall)** Single point in an image; // Smallest (addressable) part / bit of an image // A single dot / point of colour **A.** square for point / dot as long as the context is clear **R.** Picture Element	1

Qu	Part	Marking guidance	Total marks
07	2	**3 marks for AO1 (understanding)** **Maximum of 3 marks**. 1. The pixels are stored consecutively (in memory locations); 2. (With 2 bits) 4 (**A.** 3) combinations of bits are possible // each colour could be represented by a unique 2-bit pattern; 3. the bitmap will need the width and height / dimensions and colour depth / bits per pixel to be stored / included; **A.** metadata would need to be stored **Maximum of 2 marks** for mark points 4–6 4. black pixels could be represented as 00; 5. white pixels could be represented as 01; 6. grey pixels could be represented as 10; **A.** any 2-bit bit pattern for each colour as long as they are distinct from each other **A.** answer that shows Figure 1 with each colour labelled in binary	3

Qu	Part	Marking guidance	Total marks
07	3	**2 marks for AO2 (apply)** 300;; If the answer given is not fully correct then award a **maximum of 1 working mark** as follows: identifying the colour depth as 3; 10 x 10 x their colour depth (even if colour depth incorrect);	2

Qu	Part	Marking guidance	Total marks
07	4	**2 marks for AO2 (apply)** **1 mark** for the left-hand eight bits correct; **1 mark** for the right-hand eight bits correct; 1 1 0 0 0 0 0 0 0 0 0 0 1 1 1 1 If **neither** of the mark points above have been awarded then award a **maximum of 1 working mark** as follows: 1 mark if the first bit is 1 **and** the ninth bit is 0; 1 mark if right-hand seven bits of each byte are correct;	2

Qu	Part	Marking guidance	Total marks
08	1	**Mark is for AO1 (recall)** Physical / electrical / electronic Component(s) / part(s) / element (of a computer system);	1

Qu	Part	Marking guidance	Total marks
08	2	**3 marks for AO1 (recall)** **Maximum 1 mark** for each component **Clock** Regulates the timing and speed of (computer) operations // sends out a regular electronic pulse / timing signal; **Control Unit** Coordinates the actions of the CPU // decodes instructions // sends control signals; **A.** controls the flow of data through the CPU **Register** Holds data used when executing an instruction // holds the result of executing an instruction // holds an instruction (CIR) // holds a memory address (MAR);	3

Qu	Part	Marking guidance	Total marks
08	3	**Mark is for AO1 (understanding)** The processor with two cores may be able to process **two** instructions / tasks / processes in parallel / at the same time / simultaneously;	1

Qu	Part	Marking guidance	Total marks
08	4	**Mark is for AO1 (recall)** Non-volatile memory retains data when power is lost / does not lose its contents when power is lost;	1

Qu	Part	Marking guidance	Total marks
08	5	**Mark is for AO1 (understanding)** RAM; Cache; Register; **A.** examples such as DRAM, SRAM	1

Qu	Part	Marking guidance	Total marks
08	6	**2 marks for AO1 (understanding)** Storing data / files; When the computer is turned off // on a long-term basis // using non-volatile storage; **A.** to (temporarily) store data in virtual memory // (to implement) demand paging // to buffer processes	2

Qu	Part	Marking guidance	Total marks
09	1	**Mark is for AO1 (recall)** program / code / instructions (executed by / controls the operation of the hardware);	1

Qu	Part	Marking guidance	Total marks
09	2	**Mark is for AO1 (recall)** (System software) controls / manages / runs the computer // (System software) enables the computer to function // (System software) manages the computer hardware / application software // (System software) provides a platform for other software / provides a platform to run application software; **R.** references to pre-installed / downloaded software **NE.** brand names unless used as an example to support a correct response	1

Qu	Part	Marking guidance	Total marks
09	3	**Mark is for AO1 (recall)** (Application software) is for (end) user tasks; **R.** references to pre-installed / downloaded software **NE.** brand names unless used as an example to support a correct response	1

Qu	Part	Marking guidance	Total marks
10	1	**2 marks for AO1 (understanding)** Data required (by an instruction) may be fetched from main memory // (An instruction) may load / fetch / get data from main memory; Result (of instruction) may be stored in main memory // (An instruction) may store a value in main memory; **R.** references to information	2

Qu	Part	Marking guidance	Total marks
10	2	**2 marks for AO1 (understanding)** **1 mark** for each stage described. **Fetch stage** The (next) instruction is fetched from the memory (to the CPU); **Decode stage** The instruction is decoded (to work out what it is);	2

Qu	Part	Marking guidance	Total marks
11	1	**Mark is for AO1 (recall)** **A** | **B** | **A XOR B** 0 | 0 | 0 0 | 1 | 1 1 | 0 | 1 1 | 1 | 0 **Mark as follows:** 1 mark if column A XOR B is correctly completed; **A.** F / FALSE / False / Off instead of 0 **A.** T / TRUE / True / On instead of 1	1

Qu	Part	Marking guidance	Total marks
11	2	**Mark is for AO1 (understanding)** AND (gate); **I.** case	1

Qu	Part	Marking guidance	Total marks
11	3	**2 marks for AO2 (apply)** A.B + C // C + A.B;; **Mark as follows:** 1 mark for A.B or B.A; 1 mark for + C or C +; Examples of responses worth 1 mark: A.B.C mark is for A.B A + B + C mark is for + C (A.B).C mark is for A.B (A+B) + C mark is for + C **I.** brackets that don't change the value of the expression **I.** Case **A.** other commonly recognised symbols such as ¬ ∧ ∨ ~ **R.** if words used (eg AND, OR, NOT etc) **Max 1** if any errors.	2

Qu	Part	Marking guidance	Total marks
12	1	**2 marks for AO1 (understanding)** |	**A, B or C**
---	---
Assembly language	B
High-level language	A
Machine code	C	 **Mark as follows:** 1 mark for one correct row; 2 marks if all correct;; **R.** repeated letters	2

Qu	Part	Marking guidance	Total marks
12	2	**Mark is for AO1 (understanding)** **Maximum 1 mark for any of the following:** • Programs written in assembly language run faster // use less processor time; • Programs written in assembly language can interact directly with hardware (when executing); • Assembly language programs require less memory (when executing); • Programs written in assembly language have no unnecessary code added by a compiler; **A.** assembly language requires less translation **A.** the programmer can take advantage of knowledge about the program / problem that isn't available to the compiler **A.** assembly language is faster to translate	1

Qu	Part	Marking guidance	Total marks
12	3	**Mark is for AO1 (understanding)** **A** A compiler translates all the original program code before execution. **R.** if more than one lozenge shaded	1

Qu	Part	Marking guidance	Total marks
13	1	**2 marks for AO1 (understanding)** **Maximum of 2 marks** from: • PAN centred round a person / up to 10 metres, WAN is (spread) over a large area; **NE** personal on its own • PAN and WAN use different protocols (**A.** examples); • PAN (typically) has one user, WAN has many users; • PAN connects a few devices, WAN connects many devices; • PAN owned by one person; WAN owned / managed by multiple large organisations; **Both PAN and WAN must be referred to (accept implicit comparisons) for each mark.** eg WAN connects <u>more</u> devices (the more acts as an implicit comparison).	2

Qu	Part	Marking guidance	Total marks
13	2	**2 marks for AO1 (recall)** **C.** LANs are usually controlled or owned by a single organisation. **E.** LANs cover one room, building or site. **R.** if more than two lozenges shaded	2

Qu	Part	Marking guidance	Total marks
13	3	**2 marks for AO1 (understanding)** **Maximum of 2 marks from:** • A bus network has all computers connected to a backbone / main cable, computers on a star network connect to a central device / switch / hub; • All devices / computers on a bus network see all data transmitted, on a (switched) star network the data is only seen by the intended device; • If the backbone / main cable on a bus network fails the whole network fails, on a star network a single cable breaking is unlikely to affect the whole network; • Bus backbone / main cable has a terminator at each end, network cards in star act as terminators; • Data collisions are less frequent on a star network;	2

Qu	Part	Marking guidance	Total marks
13	4	**2 marks for AO1 (recall)** (A set of) rules; that allow devices / networks to communicate / transfer data; **R.** instructions in place of rules	2

Qu	Part	Marking guidance	Total marks
13	5	**2 marks for AO1 (recall)** **1 mark** for each correct answer. • Internet (layer); • Link (layer) // Network interface (layer) // Network access (layer); **R.** Network Layer on its own	2

Qu	Part	Marking guidance	Total marks
14	1	**2 marks for AO1 (understanding)** **B** Redundant data is less likely to be stored; **D** There are less likely to be data inconsistencies; **R.** more than two lozenges shaded	2

Qu	Part	Marking guidance	Total marks
14	2	**Mark is for AO2 (apply)** **Max 1 mark from:** CopyID; StudentID; **I.** case and spaces in field name **R.** spelling mistakes	1

Qu	Part	Marking guidance	Total marks
14	3	**Mark is for AO2 (apply)** Real // float // decimal // currency // (small)money; **R.** integer or string data types	1

Qu	Part	Marking guidance	Total marks
14	4	**6 marks for AO3 (program)** **Note to examiners:** if there is more than one set of SQL code you should only mark the first set of code. **Note to examiners:** To award both marks D and E there must **not** be more than two conditions within the `WHERE` clause. **Maximum of 5 marks** if any errors. Mark A for the 4 correct fields in the `SELECT` clause **and no others** Mark B for **one** correct table in `FROM` clause Mark C for second correct table in `FROM` / `JOIN` clause **and no others** Mark D for correct identification of join, either through `WHERE` statement or using `INNER JOIN … ON` Mark E for correct condition for `YearGroup` in `WHERE` clause Mark F for correct `ORDER BY` clause **DPT.** consistent use of incorrect key words when their versions are meaningful in the context of the question, eg `GET` instead of `SELECT` or use of `AND` instead of commas in `FROM` clause. **DPT.** incorrect spelling of field names. **DPT.** consistent use of extraneous characters within the code. eg colons after keywords **A.** Table names in front of field names provided the table names are correct **A.** quotes around 11 in where clause **I.** missing ASC in `ORDER BY` clause **I.** case and spacing **R.** == in place of = **Sample answer:** `SELECT FirstName, LastName, CopyID, DepositPaid` **[A]** `FROM Student, Loan` **[B,C]** `WHERE Student.StudentID = Loan.StudentID` **[D]** `AND YearGroup = 11` **[E]** `ORDER BY LastName ASC` **[F]** **Alternative answer:** `SELECT FirstName, LastName, CopyID, DepositPaid` **[A]** `FROM Student` **[B]** `INNER JOIN Loan ON Student.StudentID = Loan.StudentID` **[C,D]** `WHERE YearGroup = 11` **[E]** `ORDER BY LastName ASC` **[F]**	6

Qu	Part	Marking guidance	Total marks
14	5	**2 marks for AO3 (program)** **1 mark** for `DELETE FROM` **`Loan`** **1 mark** for `WHERE` **`CopyID = "PB002"`** `AND` **`StudentID = "TUC004"`** **A.** PB002 and TUC004 with single quotes in the `WHERE` clause. **I.** case and spacing **R.** == in place of =	2

<table>
<tr><th>Qu</th><th>Part</th><th>Marking guidance</th><th>Total marks</th></tr>
<tr><td>15</td><td></td><td>
9 marks for AO2 (apply)
<table>
<tr><th>Level</th><th>Description</th><th>Mark Range</th></tr>
<tr><td>3</td><td>An answer at the top of the level contains a well-developed discussion of the benefits and issues related to the collection of personal, health-related data from wearable devices and data privacy and legal issues relating to the data collection.

An answer at the bottom of the level contains good explanations covering the benefits and issues related to the collection of personal, health-related data from wearable devices and data privacy and legal issues relating to the data collection.

The discussion is logically structured and considers a range of relevant points.</td><td>7–9</td></tr>
<tr><td>2</td><td>An answer at the top of the level includes an explanation of at least one benefit of collecting personal, health related data from wearable devices and data privacy or legal issues relating to the data collection.

An answer at the bottom of the level includes detailed descriptions of both the benefits of collecting personal, health related data from wearable devices and data privacy or legal issues relating to the data collection.

The answer has some structure and considers a range of points though these may not always be entirely focused on the topic.</td><td>4–6</td></tr>
<tr><td>1</td><td>The answer includes statements or brief descriptions of some of the benefits of collecting data from wearable devices, or related data privacy issues, or related legal issues.

The response lacks structure but some relevant points are made. These may not, however, remain focused on the topic.</td><td>1–3</td></tr>
<tr><td>0</td><td>No creditworthy material.</td><td>0</td></tr>
</table>
Note to Examiners:
Only content referring to wearable devices is creditworthy.
</td><td>9</td></tr>
</table>

		Indicative Content Benefits: • keeping and sharing the data allows convenient tracking of health and goal setting • individual data collected over time can be motivational for maintaining fitness • shared data increases social engagement with other users promoting healthy habits • could lead to lots of business opportunities with apps tying into trackers • sharing data could identify health issues early that can be treated before it is too late • data can be important in criminal investigations • provides a large, otherwise inaccessible pool of data which can be used in medical investigations and trials. Data privacy: • huge amount of personal data collected, could be used / sold by companies to insurance firms and affect life insurance quotes or be used for invasive advertising • often users are unaware of how much / type of data that is collected about them and what it is going to be used for • often users are unaware who the data is shared with • users sharing data with friends voluntarily may not be aware if the friends' privacy settings are protecting their own data / are passing their data on • not all companies collecting the data will have adequate protection against cyber security threats • criminals know the value of health-related data which can make companies involved more likely to be attacked, threatening the security of the data • if companies collecting the data get hacked, it can lead to criminal activity against the users compromising their safety, eg making some vulnerable users more likely to be targeted for physical break-ins, assault or a variety of social engineering attacks • personal data collected can be very private and a breach of the data security embarrassing • criminals getting hold of personal data could use it for blackmail • release of data could harm the professional reputation of users such as athletes or contractors or affect the value of companies where key personnel have had their data released • companies collecting the data may change their privacy settings and users are slow to check • companies other than the hardware provider may have / want / need access to the data. Legal: • users may be unaware of which country their data is being stored in and the data protection laws in place for them • can be unclear if the consent given is legally binding • future implications of consent rarely made clear and hard to predict future uses of the data – who has control over the future use of the data? How long for? • does the company controlling the data comply with data protection regulations?	

		• there is a question of who is responsible if too much data is collected or if data is stolen or misused – are the terms and conditions clear? Has the user read them? • tracking devices or apps could publish GPS location which could be exploited by criminals and the device or app company may be legally responsible for the damage caused by this • insecure devices may enable increased likelihood of identity theft and the company may be legally responsible for the damage caused by this • reliance on manufacturing / app development company for data security; the company may expose itself to legal action if there are any security breaches.	

Qu	Part	Marking guidance	Total marks
16	**1**	**2 marks for AO1 (recall)** (The processes / practices / technologies designed) to protect networks / computers / programs / data; from attack / damage / unauthorised access;	2

Qu	Part	Marking guidance	Total marks
16	**2**	**Mark is for AO1 (recall)** (Computer) Virus; Trojan; Spyware; **Maximum of 1 mark.** **A.** other types of malware not specified in specification, such as: Worms Adware Ransomware Rootkits **R.** specific malware names such as Stuxnet, WannaCry unless used as an example to support a correct answer	1

<table>
<tr><th>Qu</th><th>Part</th><th>Marking guidance</th><th>Total marks</th></tr>
<tr><td>16</td><td>3</td><td>
9 marks for AO2 (apply)

<table>
<tr><td>Level</td><td>Description</td><td>Mark Range</td></tr>
<tr><td>3</td><td>Answer tackles all of the threats listed in the question and demonstrates a clear understanding of both how the threats could be exploited and how AQAware could protect themselves against the threats. Explanations are clear and detailed.

A range of relevant examples are covered and these are clearly focused on how the company can protect its systems.</td><td>7–9</td></tr>
<tr><td>2</td><td>Answer tackles most or all of the threats listed in the question and demonstrates some understanding of how the threats could be exploited and how AQAware could protect itself against the threats. Explanations are generally clear but sometimes lack detail.

Some relevant examples are mentioned and these are generally focused on how the company can protect its systems but may sometimes stray into referring to individual users.</td><td>4–6</td></tr>
<tr><td>1</td><td>Answer tackles one or more of the threats listed in the question and demonstrates a limited understanding of how the threats could be exploited and/or how AQAware could protect itself against the threats. Explanations may not always be clear.

Examples may be provided but these may not always be focused on how the company can protect its systems and may stray into general points about computer security.</td><td>1–3</td></tr>
<tr><td>0</td><td>No creditworthy material.</td><td>0</td></tr>
</table>

<u>Indicative Content</u>

How the threat could be exploited:

Weak and default passwords
• hackers could use brute force methods to crack passwords
• weak admin passwords would allow hackers to gain admin level access
• default passwords allow hackers to gain access without any effort
• default / stolen passwords published online so that everyone can find them.

Misconfigured access rights
• allows staff to access areas they are not supposed to
• network admins might not know that secure areas had been breached as no-one has ‘broken in’
• staff could reconfigure network
• staff could create new user accounts to give themselves admin access.
</td><td>9</td></tr>
</table>

		Unpatched or outdated software • could allow staff or hackers to exploit known weakness / flaw • known weaknesses / flaws are published online • once in a hacker could install malware. **How AQAware could protect themselves:** **Weak and default passwords** • enforce a strong password policy, including admin accounts on all devices, across the company with passwords that are regularly changed // force users to change their passwords regularly to strong ones. • ensure default passwords are changed on all devices • implement biometric measures such as fingerprint / facial / retinal scans for user authentication. **Misconfigured access rights** • careful application of suitable access rights across the network reducing the level of access level of any one individual • make sure users only have access to the data / software they need • give read-only access instead of full access where possible • ensure that only relevant accounts have access to change DNS files. **Unpatched or outdated software** • software patches and updates are applied regularly (automatically) to keep the systems up to date, ensuring any recently discovered bugs or security issues are patched. **A.** Any sensible threat and relevant protection method	