AS
Computer Science

Paper 2
Report on the Examination

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1.1, 1.2 and 1.3
Students struggled with the number systems, both in recalling which symbol represents which set of numbers, and which set best fits a particular purpose. Particularly confusing was the $\mathbb{R}$ and $\mathbb{Q}$ symbols with students becoming confused between real and rational numbers.

2.1
Whilst most students demonstrated the ability to convert from binary to hexadecimal, and a number of methodologies were demonstrated, a large number were not able to fully explain the process followed. Some did not identify that the hexadecimal equivalents would be characters (or show an understanding of the need to use letters to cover values of 10-15).

Where a division methodology was used a large number of students ended up with reversed characters (7 1) and few using this method showed understanding of dealing with numbers bigger than FF_{16}.

Some students showed only an explanation, or only a worked example. This limited the students to only one mark on this question part. Commonly students would explain part of the process and finish by saying the final part of the process was completed by converting to hexadecimal. This does not explain the process and didn't receive marks. It was pleasing to see more students using subscripts to denote number bases.

2.2
The majority of students were successful with this question part. Occasionally a student provided a decimal answer which is not acceptable for this question as binary result is clearly stated. It is to be noted that when an answer field is provided, that is what will be accepted as the student's final answer.

Occasionally students converted to denary, added up and converted back to binary. Whilst this method is not precluded in the question, students are encouraged to learn binary addition and such an approach may lose marks in the future. Curiously, students did not tend to subscript this answer as much as in 2.1.

2.3
A large proportion of students were able to demonstrate binary multiplication successfully. A number of students did include unnecessary steps (such as multiplying by zero). Whilst the expectation was for students to conduct binary multiplication, decimal multiplication was not precluded in the question and therefore was accepted for the working (although a binary result was still expected). Students are encouraged to not rely on this in future.

2.4
The majority of students were successful in identifying the correct position for the binary point.

2.5
It was pleasing to see the majority of students were able to successfully complete this question part. However, from the working it seems some students are counting the number of zeroes in the bit pattern, and adding a 1 or 0 as a parity bit to keep the number of zeroes even. Whilst this is acceptable on a bit-pattern with an even number of digits, this may not always be the case and students are encouraged to follow best practise and count ones.

2.6
It was disappointing to see some poor answers to this question part. A significant number of students were not awarded marks due to poor terminology (particularly when referring to data as opposed to bits, bytes or bit patterns). A number also failed to gain marks by simply explaining how majority voting worked without tackling the question that was asked.

3.1
Many students demonstrated an ability to identify, calculate and convert the correct values for this question part. Common mistakes included using 44 rather than 44,000 for the sample rate and forgetting to include the bit rate in the calculation. A number of students divided by 1,024 rather than 1,000 and a reasonable number of students showed a lack of understanding in the conversion between units, doing so either incorrectly or not at all. Overall, only a third of students achieved full marks.

A number of students rounded their final answer to 0dp. This was not requested and only received marks where the correct final answer was shown in the working. Students are encouraged to only carry out calculations that are requested in the question part. Occasionally students accidentally gained the correct answer by using 44 as the sample rate but only dividing by 8,000 in the file size conversion. This was not awarded full marks unless it was annotated as a deliberate shortcut, as otherwise it showed an incomplete understanding of the required area of content.

3.2
This question part was quite poorly answered. Whilst a large number of students understood at a basic level what happened in the conversion from analogue sound to digital data, most struggled to express this at a suitable level. There was particular confusion about when and where some aspects of the process occurred and what the process was acting on. An example of this is the first stage of sampling an analogue/electrical signal – many students believed it was the sound itself which was sampled. Stronger students understood where a signal was being processed and where the process was acting on a sample. Frequently students referred to other sound representation theory such as Nyquist's theorem or the impact of sample resolution on file size. This was irrelevant to the question and did not receive marks. Some students showed some understanding of PAM/PWM which, despite being beyond the scope of this specification, was pleasing to see.

3.4
Most students were able to secure the first mark point by identifying that in lossless compression no data was lost. Where this mark was not awarded it was normally for omission or oversight rather than an obvious lack of knowledge.

Whilst a good number of students identified that lossy compression would affect the quality of the sound, some suggested it would affect the quality of the music. Quality of music can be taken as a subjective measurement based on taste which does not achieve this mark. A significant number of students tried to describe the actual quality of loss, with many of these suggesting there would be gaps in the music if lossy compression was used. This is not correct.

4.1
Many students were able to demonstrate a good understanding of the difference between a compiler and an interpreter. One common misconception demonstrated was the belief that interpreters convert code line by line. Interpreters execute code directly and do not normally convert into another format. Others included the conversion to assembly code, and that compilers are unable to deal with errors.

Common mistakes included not specifically stating that compilers translate the whole code at once – 'compilers translate the whole code' not demonstrating enough understanding. References to intermediate code were also not relevant.

It was pleasing to see that the majority of high-scoring students approached the question from both sides, not focussing on just the interpreter or the compiler.

4.2
Many students demonstrated a lack of understanding of the reasons to choose assembly code over high level code. In some cases, this was a lack of understanding of the advantages, with 'cheaper' and 'harder to steal', and 'quicker to write/debug' being frequently asserted. A common confusion was that assembly code is quicker to translate. Whist this may well be correct, it is irrelevant in this scenario.

On a more significant level, fundamental misconceptions were demonstrated with many students stating that assembly code is easier to understand, is universal and will run on any processor, and that it is more suitable for simple tasks whereas high level languages are only suitable for problem solving. The need to apply knowledge to specified scenarios is a skill which needs to be developed in the classroom.

5.1
The majority of students were able to correctly identify the NAND symbol.

5.2
Most students were able to secure some marks on the truth table with over half securing full marks. Where marks were dropped students tended to not follow a logical sequence of steps to calculate NOT B, then NOT A, leading to A OR (NOT B), (NOT A) AND B and then finally NOT ((NOT A) AND B).

5.3
It was pleasing to see that the majority of students tackled this question and a large number did so successfully using a number of approaches. The most common mistakes included not identifying Y AND NOT Y as being equal to 0, or not fully simplifying to a final answer. Some students dropped marks by making leaps which, whilst arithmetically correct, were not Boolean identities and could not be followed directly. In this case it is impossible to distinguish between correct understanding and a lucky guess.

6.1
A significant number of students demonstrated a lack of understanding of the difference between Harvard and von Neumann architectures. Of those that did demonstrate understanding, marks were frequently lost for not being clear enough about how data and instructions are separated/held together, with many students just saying they were separate or stored in different memory locations. This was not enough.

More students referred to memory being shared/not shared with comparatively few referencing shared/separate busses.

6.2
Just over half of students were able to identify that the Harvard architecture is typically used for digital signal processing. Not only is this a common example, it was also mentioned in the specification.

6.3
Most students were able to achieve some marks on the Fetch-Execute cycle with marks spread throughout the mark range. The cycle has been represented on previous series although on this occasion a levels of response mark scheme required a thorough understanding across all three stages rather than just identifying six points.

Common problems included incorrect points (leading to a thorough understanding not being demonstrated) or only one or two stages being covered. Frequently students were not able to demonstrate an understanding of the decode stage, believing the CIR split the instruction rather than the CU. There were also a reasonable number of answers that talked through what happened in each stage as a verbal overview rather than describing the steps. This did not receive any marks.

7.1
Answers to the assembly code question were generally better than the previous series, although more than half of students were not able to secure a mark. It was pleasing to see that previous advice has been heeded as far fewer students were using terminology that can be identified from the Little Man Computer, with the majority having instructions which were obviously AQA assembly code. Most commonly low-end marks were lost due to incorrect syntax – missing a comma In the `ADD` instruction is enough to lose the mark as syntactic correctness is essential. Whilst most students that scored well identified that a comparison was needed, getting the correct value for the comparison (`#10` or `#11`) combined with the correct termination criterion proved harder and students are encouraged to work through a number of practical tasks using a simulator if possible.

7.2
A good number of students were able to provide a correct answer to this question. Although the answer was intended to be in denary, binary answers were not precluded in this question so either received the mark. Students should not rely on this in future series and should be able to answer in either base.

The most common mistake was 700, indicating the student was aware of what a shift was, but not the correct way to implement this.

7.3
Whilst many students showed some understanding on this question, it was quite common for the mark to be dropped when it wasn't clear that they were referring to the operand. "Immediate addressing uses a value whereas direct addressing uses a memory address" is insufficient while "Immediate addressing uses the operand as a value whereas direct addressing uses the operand as a memory address" would suffice.

It seems quite common for students to believe an immediately addressed operand can only be an integer value. Whilst this could possibly be inferred from the instruction set used by AQA in programming questions, it would be beneficial for students' wider knowledge for them to understand the operand could refer to any binary data of any form.

8.1
Many students were able to secure at least two of the marks, primarily for identifying that parallel transmission required additional hardware and therefore endured higher installation and manufacturing costs. Whilst a reasonable number of students were able to identify cross-talk and skew as downsides to parallel transmission, it was less common for applicable understanding points to be made for these. A number of students came close to describing skew or cross-talk but were not quite able to show enough knowledge to gain the marks.

Common mistakes included confusing a wire for a bus, assuming devices could become ‘overloaded’ by parallel data, and believing that parallel communication led to increased collisions or is the only way for data corruption to occur. Neither of these are true and as such did not receive credit.

8.2
Most students were able to achieve at least one mark for this question – most commonly for correctly identifying that bit rate was the number of bits transmitted in a period of time. Fewer were able to correctly identify latency, often confusing time taken due to transmission speed and rate for issues such as network problems.

8.3
There were two marks available, for identifying that the network would be ‘hidden’ and for the need to know the SSID to be able to connect. A good number of students were able to achieve one mark by a statement that covered one or other of these points but did not distinguish between them.

8.4
Despite being reasonably well answered, there are still a lot of students making similar mistakes to previous cohorts. The most common mistake with answers to this question part was not being clear that a MAC address is unique to a single device. However, a number of students also laboured under the impression that a MAC address is analogous to an IP address or identified a user. Some students discussed web address whitelisting.

9
Although many students achieved at least some marks in this question part, few showed the depth and breadth of understanding required for the highest marks. Some students appear to have answered the question provided in the specification rather than this question, possibly because both featured Google Street view. Unfortunately, because the questions were significantly different this led to few if any crossover marks and highlights the importance of reading questions carefully. Other students referred to the service entering private homes or being based on public streets. These did not receive marks unless the concern was still relevant for the context given. Stronger answers looked in depth at all aspects of the question but did not go into too much depth about each point – those who did tended to repeat themselves and receive limited marks for extended sections of writing.

Although specific laws are not on the specification, a number of students referenced acts such as the DPA, CDPA, etc. In these cases, a significant lack of understanding was shown, where students are taught about the acts, it is encouraged that sufficient levels of understanding are ensured so as to not inadvertently contradict themselves and hence lose marks.

10
Despite being specifically identified in the specification, a large number of students showed a lack of understanding of the workings of a laser printer. In some cases, students referred to ink rather

than toner which lost some marks. However all too often a lack of understanding was shown with many students believing the laser burnt the paper to make the mark, or burnt the toner onto the paper to make the colour. In some examples students suggested that the laser burnt an outline which was then filled in with toner. It is suggested that all students have sufficient understanding to answer this level of question about each of the hardware devices identified in section 3.7.4.1 of the specification.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.