Examiners' Report
June 2018

GCSE Computer Science 1CP1 01

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Introduction

This is the first time that candidates have sat examinations for this unit, which requires them to demonstrate and apply knowledge and understanding of key principles and concepts outlined in the specification content.

This is an un-tiered paper that has been specifically designed to allow candidates of all ability ranges to find questions that are both challenging and interesting throughout. Questions are contextualised in a scenario and candidates will find that 'command words' are used consistently in the paper to indicate the type of response expected.

Candidates who achieved high marks often provided more detailed responses, including examples and reasons where expansions or explanations were required.

Question 1 (a) (i)

Most candidates gained the mark for this question. Some expressions contained only the formula without it having been applied to the data provided.

Question 1 (a) (ii)

Few candidates gained marks for this question. Many responses incorrectly described 24bit colour depth, indicating that there are 24 or 48 different colours available. Some responses incorrectly identified that there are 24^2 available colours. Only a few candidates described the three primary colours are coded using a byte for each. Another common misconception was that colour depth improved the quality of the image.

(ii) An image file uses 24-bit colour depth.

Describe how 24-bits are used to represent the colour in the file.

(3)

Each pixel is encoded using 24 bits. 8 bits are used to encode for each of the 3 primary colours R G B. These colours are mixed to provide 2^{24} possible colour combinations. These pixels could ~~can~~ then be displayed on the monitor

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Examiner Comments

This response demonstrated good understanding of binary representation.

Question 1 (b)

Most candidates gained all three marks for this question for converting each binary nibble to Hexadecimal accurately. Where candidates did not achieve full marks, this was often either to do with not having a full understanding of the Hexadecimal number system, for instance assuming A=11 rather than 10, or wrongly converting the binary to denary, adding each nibble together to produce a total which they then converted to a 2-digit Hexadecimal number.

(b) One of the colours used in an image is 'cadet blue'.

'Cadet blue' in binary is 0101 1111 1001 1110 1010 0000

Convert 0101 1111 1001 1110 1010 0000 to hexadecimal.

(3)

```
8 4 2 1      8 4 2 1      8 4 2 1      8 4 2 1      8 4 2 1      8 4 2 1
0 1 0 1      1 1 1 1      1 0 0 1      1 1 1 0      1 0 1 0      0 0 0 0

4+1=5        8+4+2+1=15   8+1=9        8+4+2=14     8+2=10
```

$$5 + 15 + 9 + 14 + 10 = 53 \qquad = 53$$

Question 1 (c)

Most candidates gained all six marks for this question.

Question 2 (a) (i)

Most candidates gained both marks for this question. Some responses incorrectly placed the least significant bit (representing 1 in this instance) on the left and the most significant bit (representing 128) on the right. This still gave the correct answer to the question in this instance. However, with most other numbers, this method would have resulted in an incorrect answer. Where candidates did not achieve full marks, this was often for situations such as not including leading zeroes, or where candidates had insufficient knowledge of place values in binary, for instance some candidates had the lowest most value as 2 and the highest as 256.

2   A car has many embedded systems.

   (a) An embedded system processes binary numbers.

      (i)   The speed limit for some roads is 60 miles per hour.

            Convert the denary number 60 to 8-bit binary.

            $32 + 8 = 40$

            64

            32 16 8 4 2 1
             1   1 1 1 0 0

            (2)

            $32 + 8 = 40$ $16 + 4 = 20$ $40 + 20 = 60$

            Expressed as   1 1 1 1 00

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Examiner Comments

This response gained one mark due to the lack of leading zeroes in the first nibble.

Question 2 (a) (ii)

Most candidates gained both marks for this question. Responses that did not gain marks due to incorrect binary places values (e.g. some responses gave the answer as '70', based on the rightmost value being 2 rather than 1) or due to a misunderstanding of method (for instance some responses gave the answer 23, using the method for converting binary to hexadecimal rather than denary).

Question 2 (a) (iii)

Most candidates gained both marks for this question. Where responses did not provide the correct answer, this was very often due to a lack of understanding of the rule 1+1 = 10 and carry overs when performing binary arithmetic.

Question 2 (b) (i)

Most candidates gained all three marks for this question. However, in some cases responses did not provide the required expansion.

Some responses related to the window wipers being turned on. Although marks were given for these types of answers as the question was assessing the understanding of embedded systems, not headlights specifically, which may have been beyond the experience of candidates. Very few responses showed understanding that a microprocessor would be used, only involving input/output. One common misconception was that solar panels would be used to measure light levels.

(b) One example of an embedded system in a car is windscreen wipers that automatically come on when it rains.

(i) Explain how an embedded system could control the headlights of a car.

(3)

> The embedded system for car lights could use light sensors to detect when the levels of light around the car becomes below a certain level to where it is too dark. Once the sensor detects it's too dark the actuator would then turn on the car lights on.

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Examiner Comments

An excellent response that gained all three marks.

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Examiner Tip

To gain maximum marks for 'explain' questions, the response must include a valid point, which is then supported by an expansion or reason.

Question 2 (b) (ii)

Most candidates gained both marks for this question. However, a significant number of candidates referred incorrectly to ASCII and indicated that each character needed 7 or 8 bits based on this. Other responses related to the 26 letters and the fact that binary had two states, with division and multiplication applied to the result with '13' and '52' being common incorrect responses. There was also confusion between the highest number that can be represented (31) and the number of different values that can be represented (32).

should turn on immediately.✓

(ii) A bit can have two different states.

State how many bits are needed to represent the 26 capital letters A to Z.

Give a reason for your answer.

(2)

Number of bits

~~~~~~ 5

Reason

Because binary is a base -2 system and for there to be 26 combinations, you need at least 2⁵ (32), so 5 bits. If it was 2⁴, that would only be 16 combinations (16 possible letters).

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Examiner Comments

A response that demonstrates excellent understanding in its reasoning.

Question 2 (c) (ii)

Most candidates gained both marks for this question.

Question 2 (c) (iii)

Few candidates gained marks for this question. Where responses did not gain marks, answers gave features of the Caesar Cypher algorithm but not special conditions, such as the ability to shift forwards/ backwards. Some candidates referred incorrectly to the handling of numbers and symbols.

(iii) Explain **one** special condition a Caesar Cipher algorithm must handle.

(2)

Carry onto a after z anth

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Examiner Comments

This response showed just enough understanding to gain both marks.

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Examiner Tip

Tip: Practice with practical application to better support candidates' ability to understand standard as well as special cases.

Question 3 (a) (i)

Most candidates gained one mark for this question, most commonly for answers related to sharing peripherals, files/data or communication. Some candidates gave responses that can be seen as a benefit of networked devices, but which are not reasons for connecting devices in the first place. For instance, some candidates mentioned network monitoring software or the ability for employers to monitor their employees, which was not a valid answer for this question. Some candidates gave answers which were too vague, such as 'to share resources', which is not sufficiently clear as to whether the candidate is referring to physical resources (peripherals) or files/ data.

3 An organisation that supplies audiobooks over the internet is moving into a new office building.

(a) One reason for networking devices is to provide access to the internet.

   (i) Give **two** other reasons for connecting devices to networks.

(2)

1 To be able to Share data over things such as email

2 To be able to back up data to a system such as the cloud.

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Examiner Comments

This response gained both marks from the first part of the response which mentions sharing data and a communication method (email). Examiners look to positively award marks where possible.

Question 3 (a) (ii)

Few candidates gained marks for this question, but some responses identified the advantage of portability and easily being able to reconfigure the offices. A smaller number identified the ease with which new users could be added to the system, but did not provide enough detail to gain marks. Responses that did not gain marks included money saving (already excluded as a possible answer by the question), the fact that it would be easier to install or maintain, it being faster or allowing use from home.

(ii) The organisation has chosen wireless connectivity over wired connectivity for its new office building. There is no significant difference in the cost of installing either.

Give **three** reasons why the organisation might prefer wireless connectivity.

(3)

1 First it is because of the space the wires would take up and would look messy.

2 the wireless connection doesn't require special wires so so they don't have to worry about breaking the wires.

3 it allows you to access the internet and else without having to attach wires to your device.

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Examiner Comments

This response gained one mark for the first part of the response, which shows understanding that wireless saves space in the building. The understanding is unclear in the second part of the response and the third essentially restates the question.

Question 3 (b) (i)

Few candidates gained marks for this question. Some candidates were able to achieve the first mark for this question by indicating that most people do not notice the difference between the original and compressed versions of the file. However, in many cases, responses did not give sufficient detail to achieve the second mark. Some responses referred to the benefits of lossy compression, e.g. smaller file size, less storage space required, faster download times in their answer, but these did not gain marks. Some responses confused lossless and lossy compression.

(b) Each audiobook is compressed before it is released.

  (i) A lossy compression algorithm reduces the size of a file by removing data.

  Explain why data loss is acceptable when using lossy compression.

  (2)

loss of data is acceptable as the human brain can fill in the parts where data is essenth lost so we don't realise it has been compressed.

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Examiner Comments

This response gained both marks for 'fill in the parts' and 'so we don't realise'.

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Examiner Tip

Notice the use of connective 'so' in this response. The use of connectives helps to construct appropriate responses to 'explain' questions.

Question 3 (b) (ii)

Few candidates gained marks for this question, with common incorrect responses referring to the text being unreadable when RLE is applied. Some responses confused compression and encryption, referring to the ease with which the 'encrypted' text could be deciphered by an unauthorised person.

(ii) A run-length encoding (RLE) algorithm reduces the size of a file based on runs of repeated items. For example, wwwbbbwwbbbbbbwwww would be reduced to 3w3b2w6b4w.

Explain why RLE may **NOT** be a good choice for encoding a text file.

(2)

RLE won't be a good choice for encoding because it won't make a big difference it in reducing the storage. For ~~example~~ example 'computer' will be ~~tttttt~~ 1c1o1m1p1u1t1e1r it will increase the storage. and it won't have a pattern

> **ResultsPlus**
> **Examiner Comments**
>
> This response gained both marks as it relates to the fact that storage will be increased due to the fact that it will not have a pattern.

Question 3 (c)

On average, candidates gained over two marks for this question. When 4 marks were awarded, it was usually because the responses had not converted from bytes to bits. Some candidates converted the units incorrectly, e.g. using $54,000^2$ rather than 54×1000^2. Others inverted the numerator and denominator.

(c) The organisation calculates how long it takes to transmit the audiobook over the internet.

$1 \text{ Mbps} = 1000^2 \text{ bps}$

$1 \text{ MB} = 1024^2 \text{ bytes}$

The network transmission speed is 54 Mbps.

An audiobook file is 81 MB in size.

Construct an expression to show how many seconds it will take to transmit the audiobook file. Show your unit conversions. You do not have to do the calculations.

(5)

81 MB = 1024 × 81 bytes

8 bits = 1 byte   (1024 × 81) × 8 = (1024 × 81) × 8 bits

54 Mbps = 1000 × 54 bits per bps

((1024 × 81) × 8) ÷ (1000 × 54) = seconds

Question 4 (a) (ii)

Few candidates gained marks for this question, with many discussing volatility or stating what ROM and RAM stand for. Candidates were more likely to give a valid answer for ROM than RAM.

(ii) State what ROM and RAM store.

(2)

ROM

boots the system, ~~collects the data needed before sent~~
~~to CPU~~

RAM

keeps the running programs, collects the data needed before
it is sent to the CPU

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Examiner Comments

The first part of this response did not gain the mark, as it is not a statement of what ROM stores.

The second response is enough to gain the second mark.

Question 4 (a) (iii)

Few candidates gained marks for this question. Responses that did not gain marks did not articulate an understanding of the stored program concept/von Neumann architecture.

Question 4 (b) (i)

Few candidates gained marks for this question, with many responses describing incorrectly how a computer might estimate how the processor would allocate a certain amount of time to a given process, with others suggesting incorrectly that it was the clock that would determine how long to allocate to a process.

(b) The computer needs an operating system and utility software.

   (i) The operating system controls the scheduling of processes.

        Describe how the operating system uses scheduling to allocate processor time.

        (2)

The operating system uses multitasking to make it appear tasks are running concurrently. It prioritises tasks, giving more time to tasks with more instructions. It switches between processes.

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Both marks were awarded for this response for 'prioritises tasks' and 'switches between processes' (1)

Question 5 (a)

Few candidates gained marks for this question.

Many responses used the colloquial terms 'low level', 'limited', 'partial' or 'basic' to describe access, none of which have a definition as regards access to files. Some responses did go on to give a valid reason why a work experience student should not be given full access to the files. Where candidates correctly identified 'read only' or 'no access', many went on to identify a valid reason for this.

5   A company recycles digital devices. It uses computers and networks in its business.

   (a) The company stores details of its business such as recycling statistics on a server.

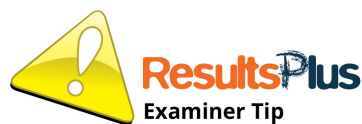   Users do not all have the same access to files stored on the server.

   Explain the type of access to the statistics file a student on work experience at the company should be given.

   (2)

The student should have limited acess to data which may contain personal detail like names or addresses.

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Examiner Comments

The response did not gain marks because it contains the word 'limited' but did not explain what limited means in relation to file access.

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Examiner Tip

Use technical language rather than colloquialisms.

Question 5 (c)

Most candidates gained two marks for this question. Where responses did not gain marks it was often because the explanation related to the health effects of using (rather than disposing) digital technology or risks of data being stolen. Many responses related incorrectly to high levels of radiation. Many talked about greenhouse gases and climate change and the need to recycle more.

(c) Explain **two** ways in which the improper disposal of digital devices could be harmful to human health.

(4)

old computers are usually shipped overseas to developing countries and dumped in landfills. Computer systems contain substances and elements that are toxic to humans and animals, such as lead, mercury and cobalt. Over time, these substances can leak out into the ground, contaminating water supplies which is dangerous to the people living near the landfill. Computer technology also contains valuable precious metals which are in short supply, such as gold and silver. People in developing countries often live in poverty so they might try to recover these materials for their own benefit. However, dismantling computing technology without proper training and protection is dangerous because you can be exposed to harmful chemicals.

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Examiner Comments

An exemplary response that relates how disposal in landfill causes chemicals to leak into water sources and how dismantling for precious metals exposes people to harmful chemicals.

Question 5 (d) (i)

Few candidates gained marks for this question. Where responses did not gain marks, 'penetration testing' was discussed in terms of checking cabling or data transfer speeds. Many responses focused on ways of hacking/exploiting vulnerabilities on a network rather than exposing the loopholes and weaknesses that allow those vulnerabilities to be exploited.

(d) The company is concerned about the security of its own network. It employs a network specialist to secure the network.

    (i) Describe what is meant by the term 'penetration testing' when applied to networks.

                            (2)

The method 'penatration testing' is when someone is paid to attempt to gain access to a net work. If the network is penetrated then they will tell the company how to prevent this e.g. give an upgrade

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The response gained both marks as it identified that systems undergo an attempted break in and the company told about this to enable them to make changes.

Question 5 (d) (ii)

Few candidates gained marks for this question, with many responses suggesting a variety of tests that are not part of a code review, such as referring to validation techniques, tests that would be undertaken by the original coder (e.g. for syntax errors), or were simply too vague in their responses (e.g. checking for bugs/errors, checking to see if the code works). Where responses gained marks they often identified logic errors or security vulnerabilities.

(ii) The network specialist uses a software tool to carry out a code review.

State **two** checks that are carried out during a code review.

(2)

1 how safe it is

2 ~~it if works~~ to see if any one can hach it

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One mark was awarded for this response as the first response is too vague and the second response is just enough to imply security checks.

Question 6 (a)

Few candidates gained marks for this question. Some candidates were able to identify one or two features. Usually these were that the code is all converted at once, or that machine code is created. Some responses did not show adequate understanding, giving features of an interpreter.

6 Programmers write software that controls hardware and interacts with users. Some of this software ensures that networks function properly.

    (a) Compilers and interpreters translate source code written in programming languages.

       State **four** other features of a compiler.

(4)

1 ... A compiler performs optimisations to the code to make it run faster.

2 ... A compiler converts the source code into one manageable program known as object code all at once.

3 ... A compiler will not run if there are errors in the source code.

4 ... A compiler will only show the object code and hide the source code to increase security.

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This response gained all four marks.

Question 6 (b)

On average, candidates gained one mark for this question. Some responses give only a partial description and in some cases went beyond how routers direct data on the Internet to include detailed descriptions of the workings of TCP/IP. Some suggested incorrectly that it was the router that created packets ready to be sent. Many responses referred to home wireless access points (referred to colloquially as 'routers') with many responses referencing how they connect devices together and the role of the ISP. Many responses did not focus specifically on the router's role in the process.

(b) Routers have an important role in how the internet functions.

Describe how a router directs data on the internet.

(5)

When data ~~was~~ is sent over the internet, it is first sent to the router in the LAN. The router has created a table containing ~~all~~ possible locations and routes best to take for them. When the router recieres the data it checks with its table if the location is listed and then sends it to the next router on the route. This process repeats itself with data being sent from router to router until it reaches its destination. At the last router, the data then uses network related protocols to send it to the correct recipient within the LAN.

This response gained three of the available five marks.

A technical response was required here.

The response starts by referring to the fact that a router has a table containing 'possible locations', which was enough to imply a routing table and gain the first mark. However, 'possible locations' is not enough to imply IP addresses so no mark can be awarded for mark point 4 'IP addresses are stored'.

No mark was awardable for 'routes best to take for them' as this is not something stored in the routing table, that is something decided dynamically.

A further mark was awarded for 'and then sends it (data) to the next router...from router to router' as it is enough to gain a mark from MP6. Although the word 'forwards' is not used, the evidence of the candidate's understanding of the concept is clear.

The third mark was awarded for 'send(s) it to the correct recipient within the LAN'.

Question 6 (c)

Few candidates gained marks for this question, with many responses demonstrating a lack of understanding of binary search algorithms. Some responses were applicable to a linear search algorithm, but more often responses were even more vague, stating that the best case was that the item was found quickly and the worst case, the item took a long time to find. Where one mark was awarded, it was most commonly for the best case scenario, with many responses correctly identifying that the target item would be the median in the list. The worst case responses commonly referred incorrectly to the target item being the first or last item in the list.

(c) Best case and worst case for search algorithms can be determined based on the number of comparisons necessary to find the target item.

Give the best case and worst case for a binary search algorithm.

(2)

Best case

In the best case the search algorithm will find the ~~target item~~ ~~value it is looking~~
~~for~~ as the medium of the list.

Worst case

In the worst case the ~~data~~ list would have to be split continuously ~~and~~
until it reaches the point where the list ~~it~~ consists of ~~two~~ only two possible
values, the exact number of comparisons depends on the number of
values ~~the list consists of~~ within the list.

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This response gains a mark in the first part of the response for medium as it is close enough to be awarded for 'middle'.
The second mark is given for the worst case as it relates to the maximum number of splits.

Question 6 (d)

On average, candidates gained one mark for this question. Many responses tried to restate the question without providing any evidence that they had understood it. Some suggested that there was no physical storage involved and one response stated that you can only see it (the cloud) with special goggles. Some responses suggested that abstraction might remove some of the data being stored (because it was not essential). Many discussed how abstraction improved security because the details were hidden from hackers. Where one or two marks were awarded, it was often for responses that were superficial and stated that the nature and location of the servers were hidden from the user. Many candidates tried in vain to argue the opposite, incorrectly assuming a balanced discussion was required.

(d) Virtualisation uses layers of abstraction to hide the details of hardware devices and processes from the end user.

'Cloud storage can be viewed as a virtualisation.'

Discuss this statement.

(6)

Cloud Storage is the concept system of storing data via a cloud server over a network, generally the internet. This system hides the details of hardware devices involved in storing & managing the clients data by allowing clients to access the cloud and view, or even edit in some cases, files from the cloud server. Users don't see that the server and hardware and storage devices that provide storage for their data, which is in a sense, virtualisation. Additionally the concept of data being stored on the 'cloud' comes from data and files being stored on some remote location that users do not know of or access or even know of. This hides the working servers that provide storage for the user's information, and making virtualisation becomes a key factor of the Cloud, & so user don't need to worry about what actually takes place when their files are stored. Users also don't see the systems that manage the way their data is sent to them over a network/ the internet, which is a form of virtualisation, hiding the process that actually goes into the sending and recieving of files to & from cloud storage providers. But more importantly users don't can not see where their information is stored, what devices are used to store their data and the processes that involve storing it, after updating it once more information has been added to the files, or files have been deleted and backing up their files that are saved on the cloud. These are all methods of hiding the actual processes and hardware that are involved in the Cloud Storage system which is essentially Virtualisation.

(Total for Question 6 = 17 marks)

(d) Virtualisation uses layers of abstraction to hide the details of hardware devices and processes from the end user.

'Cloud storage can be viewed as a virtualisation.'

Discuss this statement.

(6)

Cloud Storage is expensive and to hide the details of the hardware device will stop the information from getting lost and will be £ kept In the Same Place and no data Will be lost therefore it hides the details of the device So no information is lost or by the File or Size being reduced it is kept the same and Information is hidded about the deice and won't be Shured by anyone.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- Develop the good practice of expanding and explaining answers using examples and reasons, especially where more than a simple statement or list is required.

- Respond with the context of the question in mind.

- Do not repeat responses when more than one example/reason is required.

- Ensure responses match the requirements of the command word.

- Identify key words in the question to ensure responses reflect what the question asks.

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