Lead Examiner Report 2001

January 2020

L3 Qualification in Computing

Unit 2: Fundamentals of Computer Systems

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January 2020
31769_2001_ER
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Grade Boundaries

What is a grade boundary?

A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade, at Distinction, Merit and Pass.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the external assessment. When we can see the full picture of performance, our experts are then able to decide where best to place the grade boundaries – this means that they decide what the lowest possible mark is for a particular grade.

When our experts set the grade boundaries, they make sure that learners receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure learners achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

Variations in external assessments

Each external assessment we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to learners if we set the same grade boundaries for each assessment, because then it would not take accessibility into account.

Grade boundaries for this, and all other papers, are on the website via this link:

http://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

Unit 2: Fundamentals of Computer Systems

Grade	Unclassified	N grade	Level 3		
			Pass	Merit	Distinction
Boundary Mark	0	11	23	36	49

Introduction

This is examination is now well established with this having been the sixth examination of Unit 2 (Fundamentals of Computer systems) for BTEC Level 3 National in computing which became available for first teaching in September 2016. Examination opportunities will continue to be available for this unit twice a year in January and May/June. This unit is a mandatory unit for all learners studying either the Extended Certificate (360 GLH), Foundation Diploma (510 GLH) or Extended Diploma (1080 GLH).

This unit, along with Unit 1 (Principles of Computer Science), are assessed through a written examination paper. The examination is designed to test learners' understanding of computer systems within a range of contexts. The paper is divided into four main questions, each with a number of sub parts. Each main question is based around a unique scenario; each scenario is outlined at the beginning of that question and additional information and/or stimulus is provided with individual parts as required.

While appropriate credit is given for learners who demonstrate appropriate 'stand-alone' knowledge, more successful learners can apply their understanding to the scenarios provided in the question.

The paper is designed to assess the full grade range of the qualification; as such the paper is ramped so that it gradually increases in difficulty as the questions progress with a higher percentage of 'Pass' targeted marks in the earlier parts of the paper and the higher-grade questions towards the end.

Introduction to the Overall Performance of the Unit

While detailed analysis of specific questions in the paper appears later in this report it should be noted that overall learner performance in this series improved significantly compared to the January 2019 series and performance was broadly similar to that of the summer 2019 series

Understanding of the basic subject knowledge and vocabulary was an area identified as one of concern in previous examination series and there continue to be pockets of learners showing significant gaps in basic computing terminology and shortfalls in knowledge from the core content of the specification, which prevents learners form accessing marks in a number of questions.

Improvement continues to be seen in exam general exam technique, learners are aware of the requirements of most command verbs, and as a result their answers are usually structured and presented in an appropriate way. Many learners still appear to struggle when responding to 'Describe how…' style questions, where learners often failed to show the required technical understanding to adequately provide technically accurate descriptions of how technology work (for example see Q3a).

It was pleasing to see that in this series there was a evidence of some improvement in the quality of responses in the extended writing questions, in particular in Q4a and Q4b, with a much greater range of responses seen. A greater number of learners were able to provide responses of sufficient quality to access the middle and upper mark bands.

Centres are reminded that the extended questions are designed to differentiate across Pass, Merit and Distinction, therefore when preparing learners they should be aware that to access the middle and top mark bands, responses should demonstrate good subject knowledge that is applied in context.

While it was clear that some centres have made use of a range of support materials, such as the sample assessment materials, there was still a pocket of learners repeated answers verbatim from sample materials/past papers when presented with similar topics. While these learners were able to demonstrate some understanding and were duly credited, these responses were often not applied to the given scenario and therefore often only demonstrated superficial understanding. Centres are encouraged to work with learners in exploring Computing use in a range of scenarios and adapting responses to suit these scenarios.

Individual Questions

Q1a

Performance on this question was generally good with most learners able to access marks and the majority gaining at least 2 out of the three marks available.

Q1b

Performance on this question was generally very good with most learners able to provide a 2 mark linked response (e.g. 'The signal is being blocked (1) by the roof of the building (1)'). However, while most learners were able to provide appropriate responses to gain marks, many often showed a lack of technical understanding about the technicalities of the core technology (GPS). Centres are advised that they should ensure learners have sound understanding of HOW specific technologies work and not just what they are. The list of technologies that should be covered can be found in the 'Technology Update'.

Q1c

Performance on this question was quite disappointing with many learners not providing responses that were able to gain credit. Where learners were not able to gain marks this was usually due to misinterpreting the question, most commonly learners explained the use of RFID tags rather than an alternative method as required by the question. Centres are encouraged to work on developing examination technique with learners to help them ensure that they can access the requirements of the question, for example highlighting or underlining key words (in particular the commands) can be a useful technique.

Where learners did access marks, there was a general improvement in the quality and structure of answers, with many learners providing linked responses that were able to gain at least 2 marks.

Q1c Example Response:

(c) The managers of the park have placed Radio Frequency Identification (RFID) chips in signs around the museum.

The handheld device can scan for the RFID chips. This will allow users to access information relevant to a specific location when GPS does not work.

Explain **one other** way the device could be used to solve this problem.

(3)

The park manager can place QR codes next to the attraction, they can ~~fix~~ ~~into~~ install a QR code scanner on the handheld device, so when GPS doesn't work they can scan the code and get the relevant information.

Commentary

QR codes (1)

Scanner on the handheld device …scan the code (1) – Alternative wording for 'the device could scan'.

And get the relevant information (1) – enough to award 'load specific information' as it shows and understanding of the whole process as part of a linked response.

3 marks total

Q1d

This response was very well answered by learners with most accessing at least 1 mark and the majority of learners able to provide a linked response to access both available marks.

Q1e

The overall improvement in the structure of 'explain' style answers was evident for this question with the majority of learners able to provide a linked response to gain 2 out of the three marks. A pleasing number of learners were able to access all three marks for this question, but developing learners' ability to produce more extended linked responses should continue to be a focus for centres. Centres are advised to make use of the training materials and 'pre-recorded events' that are available on the Pearson website.

Q1e Example Response 1:

(e) The device will output the audio to headphones.

Explain **one** reason why the device uses headphones instead of speakers.

(3)

Using headphones allows each user to listen to their own devices information rather than being interrupted by other people's device information. The device may not have a built in speaker and only a headphone jack.

Commentary

'listen to their own devices' (1) – alternative wording for 'Audio is provided to that user only'.

'rather than being interrupted by other people's device' (1) – awarded against 'audio is not mixed up'.

2 marks awarded

This response could be further developed by extending the response with consideration of the impact for example:

'listen to their own devices' (1) 'rather than being interrupted by other people's device' (1) which may make it difficult to hear the content' (1)

Q1e Example Response 2:

(e) The device will output the audio to headphones.

Explain **one** reason why the device uses headphones instead of speakers.

(3)

One reason they may use headphones instead of speakers is because speakers will come out loud, and with other surrounding noise they may not be able to hear it. So having headphones allows them to listen peacfully.

Commentary

'other surrounding noise' (1)

'may not be able to hear it' (1)

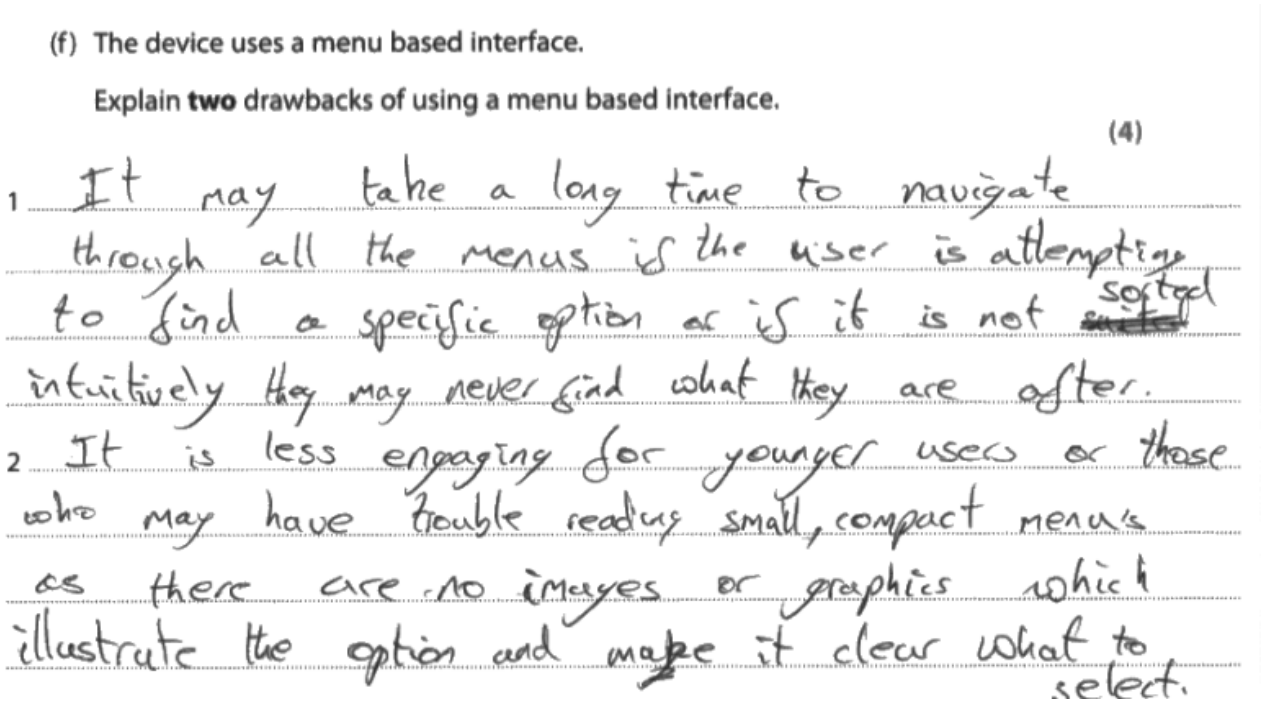
"Allows them to listen peacefully" (1) enough to award for audio provided to that user only.

3 marks awarded

Q1f

The performance on this question was not very strong, with the majority of learners unable to move beyond providing only a single drawback which was often not expanded. A lack of understanding of the different interfaces appeared to be at the heart of the problem, for example many learners' responses showed that they didn't know the difference between command line interfaces and menu based interfaces.

Q1f Example Response:



(f) The device uses a menu based interface.

Explain **two** drawbacks of using a menu based interface.

(4)

1 It may take a long time to navigate through all the menus if the user is attempting to find a specific option or if it is not sorted intuitively they may never find what they are after.

2 It is less engaging for younger users or those who may have trouble reading small, compact menu's as there are no images or graphics which illustrate the option and make it clear what to select.

Commentary

Response1:

'take a long time to navigate' (1) – alternative wording for 'Can be inefficient'

'though all the menus' (1) – awarded against 'as user may have to go through sub menus'

Response 2:

'Less engaging for..those that may have trouble reading' (1) – Awarded against 'less accessible'

'as there are no images' (1) – Awarded against 'less likely to use icons'

4 marks total

Q1g

Performance on this question could be improved in some areas, in particular the way in which technical ideas are expressed. Learners overall performed quite well in what was designed to be a challenging question designed to differentiate across all grades. Learners generally could identify that the single-user single-task OS reduced access to system settings or reduced multi-tasking, where many learners were also able to expand upon these points. Where learners were less successful, and where centres should focus on supporting learners, is in how learners express a point. In particular, many learners did not go beyond repeating the question for example 'it means it can only perform a single task so it is more secure'.

Q1g Example Response 1:

(g) The device uses a single-user single task operating system.

Explain why using this type of operating system could improve security.

(3)

Because the device is locked to its task it can stop users doing malicous activities on it and prevent malicous intenc.

Commentary

'locked to its task' (1) – awarded against 'to restrict tasks/access/permissions'.

'stop users doing malicious activities' (1) alternative wording for 'to prevent malicious software/actions'.

2 marks awarded

Q1g Example Response 2:

(g) The device uses a single-user single task operating system.

Explain why using this type of operating system could improve security.

(3)

Single-user single task operating systems allow for one user to do one thing only. This improves security since the device cannot access unauthorised information. Will make it hard for someone to hack the main server using the device.

Commentary

'allow for one user to do one thing only' (1) - enough understanding shown to award against 'restricts the number of tasks it can perform'.

'cannot access unauthorised information' (1) – Marked against 'restricts access'.

'hard for someone to hack the main server (1) – enough to award against 'to prevent malicious software/actions'.

3 marks total

Although it was thought that the learner had clearly demonstrated enough to be awarded the marks. The clarity of the response could have been improved. As a teaching activity you may wish to use this with your learners and get them to suggest ways in which the wording of the response could be improved.

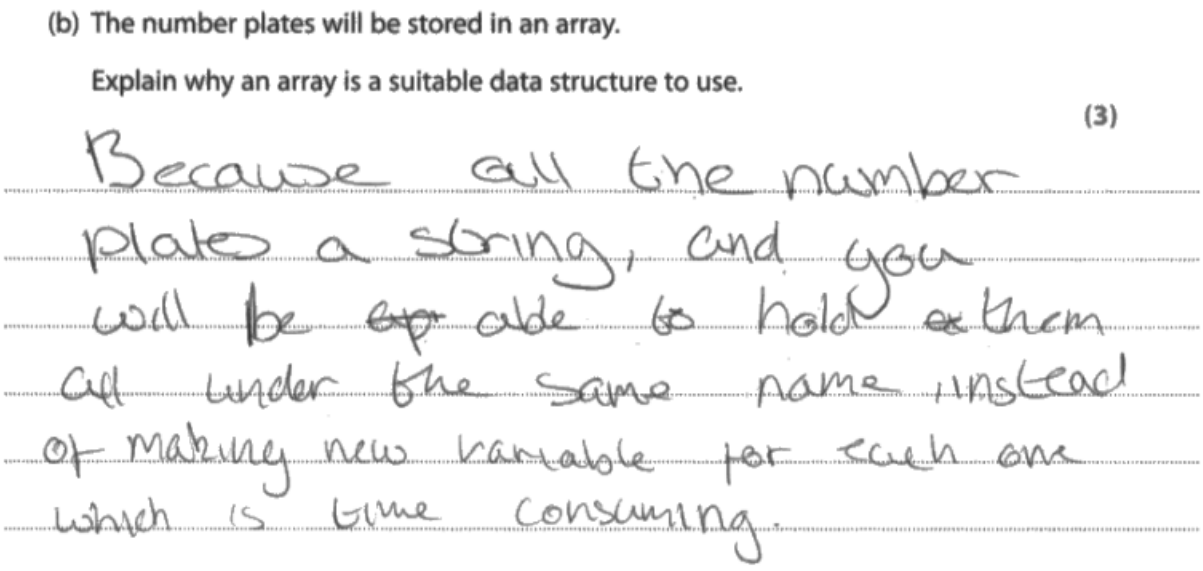
Q2a

Performance on this question was very disappointing with many learners not providing any credit worthy answers. What was striking here was the significant gaps in basic, core subject knowledge. In particular, many learners did not have a clear grasp of the difference between input and output devices. Where learners did show an understanding of input devices, many did not meet the demands of the question and suggested things that were not appropriate to the way the system worked as listed in the given system specification.

Q2b

Learner performance on this question was also quite disappointing with many learners not accessing marks. Where did gain marks responses typically did not move beyond identifying that an array would hold data of a single data type, in this case a string, appropriate expansions were not often seen.

Q2b Example Response:



(b) The number plates will be stored in an array.

Explain why an array is a suitable data structure to use.

(3)

Because all the number plates a string, and you will be ~~exp~~ able to hold ~~ex~~ them all under the same name, instead of making new variable for each one which is time consuming.

Commentary

'all the number plates are string' (1) – enough to award against 'All data will be of the same type'.

'hold them all under the same name' (1) – Awarded against 'so you can store them using a single identifier'.

2 marks awarded

There is an attempt to extend the response further with a 3rd point but this does not show sufficient understanding to gain an additional mark.

Q2c

This question performed quite well with many learners able to achieve at least 2 out of the 4 marks available. Typically learners were able to identify the need to connect to a bank or similar to process card payments but were often not able to provide a second reason. Where learners were less successful it was when their responses were not clearly referencing the use of external resources/data. For example, many learners talked about accessing the number plates of the cars in the carpark but did not make it clear why or when this might be externally stored rather than stored locally within the system.

Q2d

This question was generally very well answered by learners with most learners being able to identify an issue with compressing images (typically 'loss of quality'), the majority of learners were able to provide a valid expansion (typically 'making the plate more difficult to read').

Q2e

Learner performance on this question was quite varied. While most learners were able to access at least one of the four marks available and many were able to access a second mark, very few accessed marks beyond this. Typically, learners were able to gain marks for providing a suitable logical statements in boxes A and B but often could not provide a suitable calculation/formula for box C. Where learners failed to gain marks in boxes A and B this was either due to incorrect use of '>' and '<' often getting the logic the wrong way around, and also a common error in box A was checking for 'less than 30' rather than 'less than or equal to 30'.

Q2f

Learner performance on this question was generally quite good, with the majority of learners able to gain 2 out of the three marks available. Typically learners provided quite well drawn flowcharts with appropriate use of symbols, correct use of a decision box to test the 'paid?' condition which led to appropriate outcomes. Where learners tended to do less well, was the sensor check. Many learners did not use a decision or a loop to keep the sensor checking until a car approaches the barrier.

Q3a

Learner performance on this question was quite disappointing with very few learners unable to move beyond a single mark, typically for identifying that an instruction set provides a set of specific commands. Generally learners had significant shortfalls here in their technical knowledge, with many learners responses related to device drivers rather than instruction sets.

Q3b

Performance on this question was quite disappointing with many learners leaving the question blank. Where learners did respond, they typically demonstrated an understanding of that registers are high speed memory locations, and made some reference to specific registers. More successful learners were able to distinguish between specific special registers and general purpose registers and use examples to support their response. Again however there were often significant shortfalls here in their technical knowledge which hampered learner performance.

Q3b Example Response 1:

(b) Analyse how the functions of registers impact on the way computer systems work.

You should consider general registers and examples of special registers in your answer.

(6)

Registers are ~~this~~ incredibly useful in that they store small data for a short time.

The Memory Address Register (MAR), for example; only needs to store an ~~address~~ address in memory for a few internal ticks. But this, in and of itself, is vital so the system can operate. By separating the data between the relevant registers, computers systems become faster ~~and~~ and more ~~complex~~ complex. As well as this, the code used becomes far more compact.

Commentary

Knowledge and understanding.

The response shows a sound understanding of the subject matter. It is technically accurate throughout but the scope of the answer is limited.

Breaks the situation down

The response has broken the situation in to smaller parts and has the purpose of registers and covered a specific example (MAR).

Analysis

The response provides descriptions of the points made and there is an attempt to expand these and make linked points.

The response however does not cover both special and general register, so using best fit the response is placed in the middle mark band.

3 marks awarded

Q3b Example Response 2:

(b) Analyse how the functions of registers impact on the way computer systems work.

You should consider general registers and examples of special registers in your answer.

(6)

Registers are small stores of data within a system's CPU which assist with the flow of data throughout the processor. There are 2 types of registers, general purpose registers (GPRs) and specialised registers.
GPRs are usually only a couple of bytes and assist in pipelining which is where instructions and data are preloaded from ~~secondary storage~~ RAM to be carried out / acted upon. This greatly increases the speed and efficiency of the CPU as it doesn't have to depend on the speed of RAM.
Specialised registers also greatly increase the efficiency of modern CPUs and many would be unrecognisable without them. For example the accumulator is a register in the ALU which stores data which is still needed by the ALU to be compared or changed / acted upon. Without this the CPU would have to repeatedly read + write from RAM greatly slowing it down. Another specialised register is the program counter. The PC is like the pacemaker of the CPU, it holds the ~~data~~ position of the next data / instruction to be fetched from ~~the~~ RAM and it ticks up each time the fetch-decode-execute cycle is carried out. The PC pretty much sets the clock speed of the CPU.

Commentary

Knowledge and understanding.

The response shows a sound understanding of the subject matter. It is technically accurate throughout.

Breaks the situation down

The response has broken the situation in to and has made points that are all relevant to the situation/scenario of the question. The points made are supported by well-chosen and appropriate examples

Analysis

The response provides some analysis of the points made and considers how the identified registers impact on the performance of the system as a whole.

6 marks awarded

Q3c

Performance on this question was also disappointing with again a significant number of blank responses seen. Where learners did provide a response, these often did not go beyond defining what the stored program model is or providing a description of Von Neumann or Harvard architecture. Where learners were more successful, they were able to consider the wider implications of the stored program model and how this made computers available to more people.

Q3c Example Response:

(c) The stored program model revolutionised computing and was a key factor in making computer systems available to all.

Discuss the factors that support this statement.

(8)

The stored program model allowed computers to perform a wide range of tasks & through the use of instruction sets held on the computer. Combining the instructions allowed for an almost limitless number of function to be performed (within the capacity of the computing power). This meant you did not need a differently hardwired device for each function and would allow devices to become much more compact and accessible. The Von Neumann architecture used the stored program model keeping data and instructions in the same memory and through the use of address and data buses the CPU could access all necessary data and the instructions which needed to be used on the data. The Harvard architecture improved on the Von Neumann architecture by storing data and instructions seperately allowing the instructions and the data to have their own address and data buses. This greatly improves efficiency as the components of the CPU can access both memory sets simultaneously increasing the capability of modern computers

Commentary

Knowledge and understanding

The response shows a good understanding of the technical concepts relating to the stored program model.

Relevance to the context

The points made are all relevant to the stored program model but reference to the concept of making computing available for all is less well covered.

Discussion

The points made are expanded upon and the ideas linked together. However, the second half of the response becomes more of a description than a discussion.

The response is placed in mark band 3

Due to only limited reference to 'making computer systems available to all' the response is paced at the bottom of the band rather than the top.

7 marks awarded

Q4a

Learner performance on this question, and Q4b, showed improvements relative to questions of similar demand in previous series. Generally learners were able to provide answers that showed a good understanding of the subject matter and a greater number of learners progressed in to the higher mark bands than previously on such questions.

Where learners did less well they typically did not support their responses with specific examples of technologies that would be relevant, and what would need to be considered in relation to, or how these would impact on, the factors listed in the question (i.e. ease of use, performance, availability, accessibility).

While progress is clearly being made in relation to extended responses there are still areas of focus that centres should address with learners.

1. The extended questions are an opportunity to demonstrate deeper knowledge. Centres should work with learners to develop ideas and expand on points made. Using examples and reasons where appropriate
2. More successful learners make use of the context provided. To access the higher mark bands knowledge from the specifications core concepts should be considered and applied to the give scenario.

Q4a example response:

4 Ramesh owns a small tech development company.

He plans to make a wearable fitness tracker that would link to a smartphone app or computer.

(a) Ramesh must choose appropriate hardware for the fitness tracker.

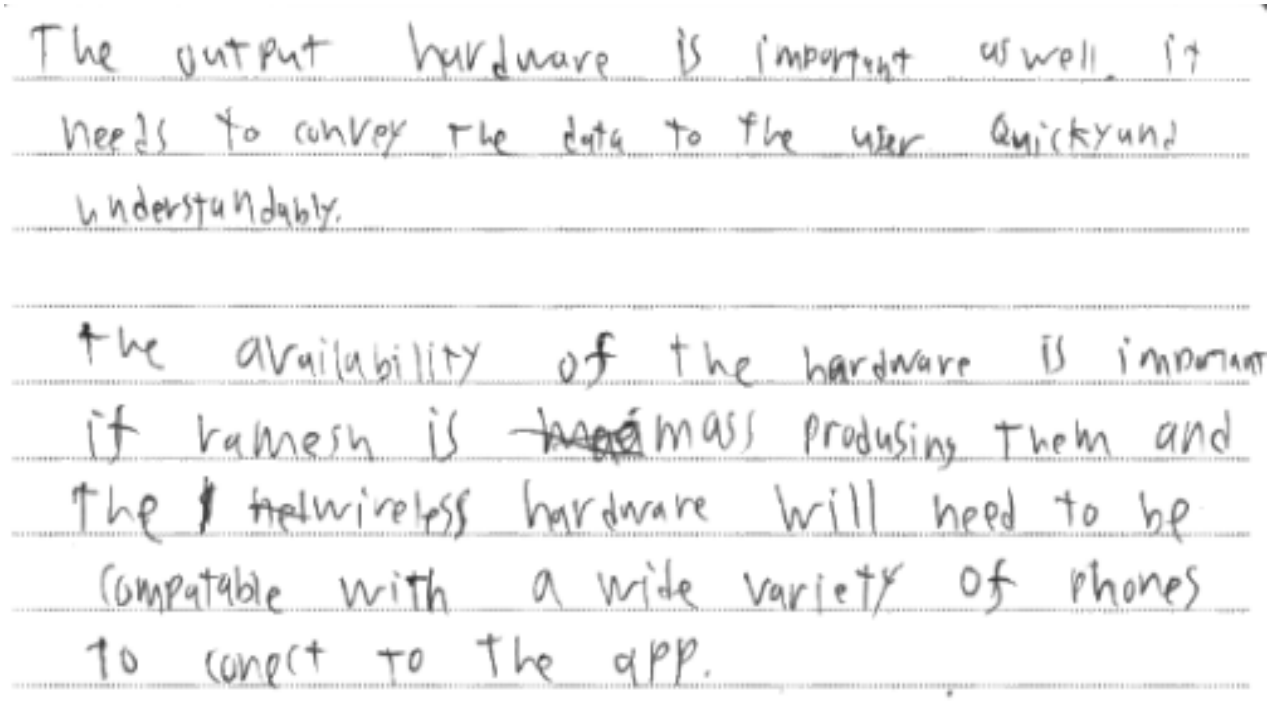
Discuss the factors Ramesh should consider so that the hardware he chooses gives a good user experience.

Some of the factors you may want to consider are ease of use, performance, availability and accessibility, but you may want to consider other factors. You should use examples to support your discussion.

(10)

ramesh will need a cpu capable of runing his software fast enogh that it responds quickly to user input otherwise the watch may be slow to respond which would make it hard to use.

he will also need to chouse an input method that alows people to controle the devise while exersiziny for example: a touch screen might be wable if the interface only has a few options however due to the small size of the watch it may not be posible to do this which would make a dial or speach to text interface more usable.



Commentary

Knowledge and understanding

The response uses accurate technical language and makes valid and correct points throughout.

Relevance to the context

The points made are all relevant to the scenario (fitness tracker) and there is good consideration of user experience.

Discussion

The points made are explored in greater detail and example are used effectively to support the response.

The response fully meets the descriptor for mark band 3

10 marks awarded

Q4b

Again, there was marked improvement in the quality of responses when compared to similar extended questions in previous series, with a higher percentage of mark band 2 and mark band three answers. Typically, learners made good use examples of hardware that could be used to collect data, but coverage of software was less well done.

Where responses could be further improved is in relation to 'discussion'. Often responses were a series of descriptions of isolated points rather than consideration of a number of different issues/pros/cons that relate to a point made and how these might interrelate to other issues which is required for a high quality 'discuss' response.

Q4b example response:

(b) The wearable fitness tracker will collect a range of data that includes:

- types of exercise completed
- duration of exercise
- user's heart rate
- number of steps taken per day
- distance walked/run/cycled.

The app must then allow the user to analyse this data.

Discuss how hardware and software would be used to collect and process data.

(12)

The fitness tracker could have a app, software, where you could basically pick all sorts of pre-installed exercises and information about it. You could possibly have a create your own exercise option for further freedom for the end-user. The duration of the exercise could be simply calculated with the time chip, which is built in basically any computer and further processed for more easy readings.
Users heart rate could simply use a sensor for twitching and used together with time it would be able to process the beats per minute or other measurements.
Number of steps taken could be used with the help of GPS as it could accurately tell if the user has moved and each step compared to a average step of a human so the steps would count approximately.
The distance walked/run/cycled could be again sensed with the GPU and be processed if it is running or walking if the user is moving 10km/h, for example, it is being counted as running and even more as cycling, but too much would not

count at all as this ✱ means that the user is potentially driving with a car.

Of course, the details can be even further explained about how the data could be processed and gathered, as there are multiple ways with ~~negatives~~ their own negatives and positives. For example, the tracker might not use a pre-installed software, but allow the user to download already existing one. The duration of the exercise might be better calculated from a phone as it will be always connected, but of course negative is that given phone might charge out. A step counter might be better used with a sensor on sending signals to GPS all the time might not be power efficient, but could be more accurate.

Knowledge and understanding

All the points made are accurate and show a detailed knowledge and understanding of the subject matter.

Relevance to the context

The points are relevant to the context in the question, the response covers both hardware and software, as well as a collection and processing of the data.

Discussion

There is expansion of the points made and the discussion links how the hardware and software will work together.

Placed in mark band 3

12 marks awarded

Summary

Overall learners' performance showed some areas of improvement in quality and structure of response, while the mean mark remained similar to Summer 2019. Improvements in this series were seen both in terms of level of knowledge and examination preparation.

Based on performance in this examination series, learners are offered the following advice to help continue this improvement:

- Continue to develop understanding of key terminology used in the unit so that you are able to access the context of the question. In particular the more technical topics.
- Improve the quality of technical descriptions, by ensuring you have a good depth of understanding of how technologies work to improve response to 'describe how…' type questions
- Further support on the requirements of command verbs can be found in the specification and in training materials published on the Pearson website.
- Ensure that when providing answers/information your response is applied to the given context.
- For shorter response questions (5 marks or less), make note of the number of marks available this will help you identify the number of points you need to make. For example, a 4 mark 'Explain one…' style question would need to make at least four linked statements, three of which expand/exemplify understating of a single point.
- When producing extended writing responses (6 marks or more) ensure you consider a range of points, each of which should be expanded or supported with examples and applied to the given context.
- Use the sample assessment materials, previous papers and sample marked learner work, when preparing for the examination. This will allow you to become more familiar with the style of the paper and the way in which you should respond to different types of questions.
- Make use of the 'Technology Update' which is published on the BTEC website ready for the start of each academic year. This document defines the scope of the technologies that may be used in examinations such as defining the range of 'common protocols', 'Input devices' 'utility software' etc. and should be used in conjunction with the specification when planning and delivering content.

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