Pearson
BTEC

Examiners' Report
Lead Examiner Feedback

June 2022

Pearson BTEC Nationals
In Computing (31768H)
Unit 1: Principles of Computer Science

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June 2022
Publications Code 31768H_2206_ER

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

Awarding BTEC qualifications in 2022

Ofqual has set out their plans for awarding qualifications in 2022 and intend to return to a normal, pre-pandemic, approach to grading standards over by 2023. They have confirmed that 2022 will be a transition year, to reflect that we are in a pandemic recovery period and students' education has been disrupted.

Our guiding principle and approach to awarding BTEC qualification results in 2022 will be to ensure parity in relation to the approach being taken for GCSE and A level learners. BTEC courses have a different structure and design to academic qualifications - BTECs are modular qualifications (with assessments taking place throughout the course) compared to GCSEs and A levels which

are linear (assessed and awarded at the same time at the end of the year), and therefore our approach needs to be different.

In 2022 we will return to the usual method of calculating BTEC qualification results, however adaptations including, U-TAGs and reduced internal assessment, are in place to provide a comprehensive package of support for students.

The basis of our awarding approach to BTECs this year is to ensure it is as fair as possible for all learners. We will use a range of evidence to set grade boundaries for the external units. Part of this evidence will be to closely monitor learner performance in all assessments that contribute to learners' final qualification grade, to ensure parity with A level and GCSEs.

Further information can be found on our website and via our Social Media channels.

Introduction

This was the 9th examination session for the BTEC Level 3 Nationals in Computing - Unit 1 Principles of Computer Science (31768H).

This unit is assessed through a single written examination which is two hours in length and the number of marks available is 90.

This unit is a mandatory unit for all learners studying the extended certificate, foundation diploma, all diplomas, and the extended diploma.

The examination for this unit will always contain four sections and each section will have a scenario that will be used throughout the whole of that section. The scenario will be clearly stated at the beginning of each section.

Each section is broken down into sub-questions which will then test learners on different areas of the specification and learners should be expected to apply their knowledge to the scenario.

Learners are given an information booklet during the assessment. They will be instructed to look at individual sections of this booklet during the examination to answer the questions.

The information booklet **may** give learners:

1. Information about problems that they need to solve.
2. Programming code for them to interpret, analyse or evaluate.
3. Requirements or designs for a new program that is needed.
4. An algorithm for them to interpret, analyse or evaluate.

At no point during the examination will learners be expected to write code in a particular language. Learners will only be given small pieces of pseudocode to interpret, analyse or evaluate.

All sections of the examination paper provides differentiation at all attainment levels, and the paper is designed to be ramped in difficulty so that a larger percentage of marks targeted at Merit and Distinction are allocated to the later stages of the paper.

Introduction to the Overall Performance of the Unit

It was evident throughout the range of responses that many learners had not covered the specification in full and subsequently were not fully prepared for the examination paper. This was particularly evident in questions that required learners to apply their knowledge.

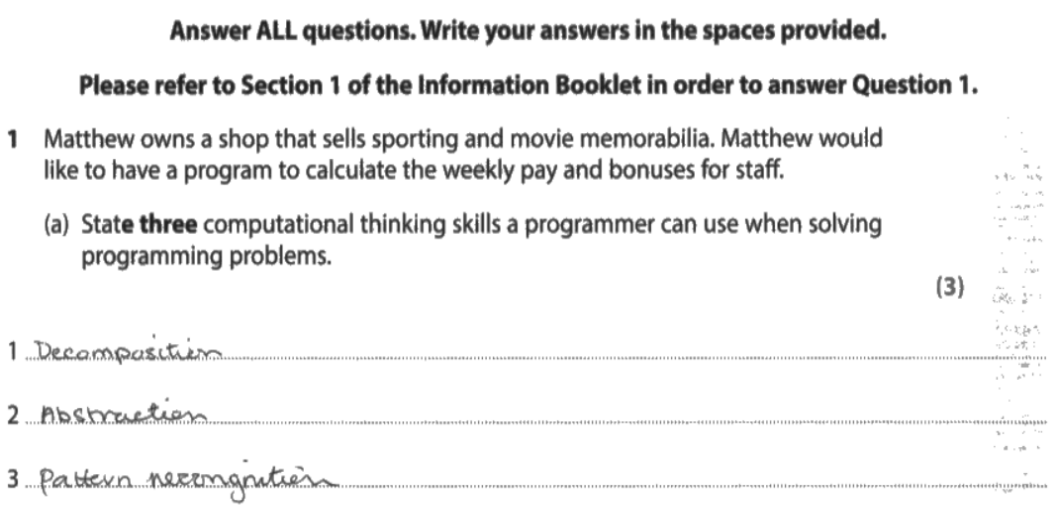
It is expected that learners will apply their knowledge to each scenario and respond with answers that are related to each scenario. However, to apply their knowledge, learners must be confident with the basic understanding of programming principles. It was also evident in many questions, which required learners to discuss, analyse or evaluate, that most learners were not able to meet the demands of these higher order command verbs. This had resulted in many learners achieving lower marks.

It is worth noting that the recommended Guided Learning Hours (GLH) for this unit is 120. It is recommended that centres ensure that this amount of time is used to ensure that learners are equipped with the knowledge to allow them to answer a range of different questions covering the whole specification.

Individual Questions

Question 1a

Most learners gained at least 2 marks for this question. Most learners were able to state the two or three computational thinking skills.



Answer ALL questions. Write your answers in the spaces provided.

Please refer to Section 1 of the Information Booklet in order to answer Question 1.

1 Matthew owns a shop that sells sporting and movie memorabilia. Matthew would like to have a program to calculate the weekly pay and bonuses for staff.

(a) State **three** computational thinking skills a programmer can use when solving programming problems.

(3)

1 Decomposition

2 Abstraction

3 Pattern recognition

3 marks awarded.

Question 1b

Most learners were able to achieve at least 2 marks for this question. Learners were able to identify at least one variable and one constant that Matthew could use for his program.

(b) Matthew wants to use variables and constants when producing the code for his program.

Identify **two** variables and **one** constant Matthew can use for his program code.

(3)

Variable 1

~~total_customers~~ customers_served

Variable 2

total_weekly_sales

Constant

base_pay

3 marks awarded.

Question 1c

Some learners gained the full 4 marks for this question but most only gained 2 marks for identifying an integer is a whole number and Boolean is true/false/

(c) Describe how the data types Integer and Boolean could be used in Matthew's program.

(4)

Integer

An integer is a number with no decimals. It can be used to represent how many ~~movie products are sold per week.~~ Customers have been served by a staff member.

Boolean

A boolean is a decision with only two choices. It can be used for if a staff member has been present or not in a day of the week.

4 marks awarded.

(c) Describe how the data types Integer and Boolean could be used in Matthew's program.

(4)

Integer

~~The integer can be used to~~ the pay can be ~~h t~~ ~~stored a~~ an integer.

Boolean

to determine if bonus pay should be added. ~~and~~

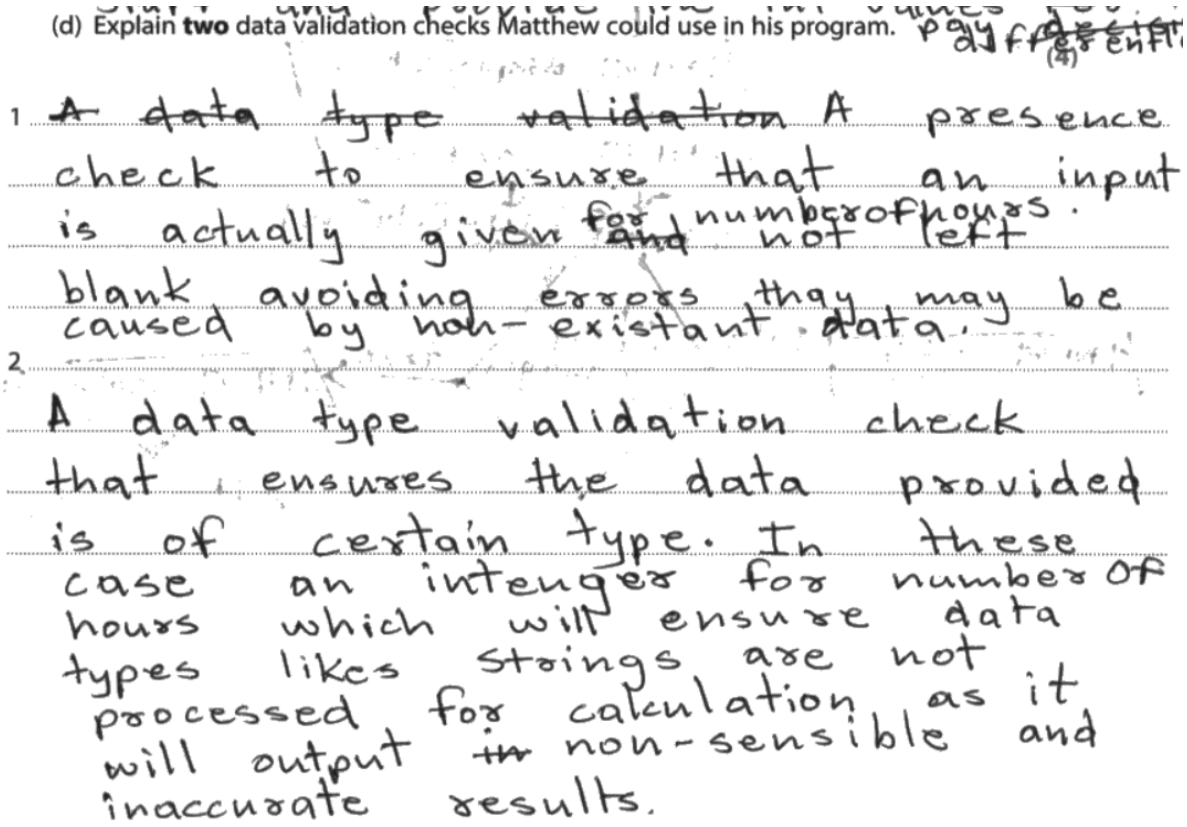
2 marks awarded.

Integer
"The pay can be an integer" (1 mark).

Boolean
"to determine if bonus pay should be added"- (just enough to award 1 mark).

Question 1d

This question was not answered very well, it seems that learners are not being fully taught about validation methods. There were just a handful of responses which had achieved full marks.



(d) Explain **two** data validation checks Matthew could use in his program. (4)

1 ~~A data type validation~~ A presence check to ensure that an input is actually given ~~for~~ and number of hours not left blank avoiding errors thay may be caused by non-existant data.

2 A data type validation check that ensures the data provided is of certain type. In these case an integer for number of hours which will ensure data types likes strings are not processed for calculation as it will output ~~th~~ non-sensible and inaccurate results.

4 marks awarded.

Presence check - 1 mark.
check to ensure that an input is actually given for number of hours - 1 mark.

A data type validation check - 1 mark.
Ensures the data entered is of a certain type... integer for number of hours - 1 mark.

Question 1e

This question, involving a flowchart, should have been relatively straightforward to answer, but many learners did not understand the logic required for a full solution. Majority of responses seen were in band one of the mark scheme, where these solutions were awarded 2 marks.

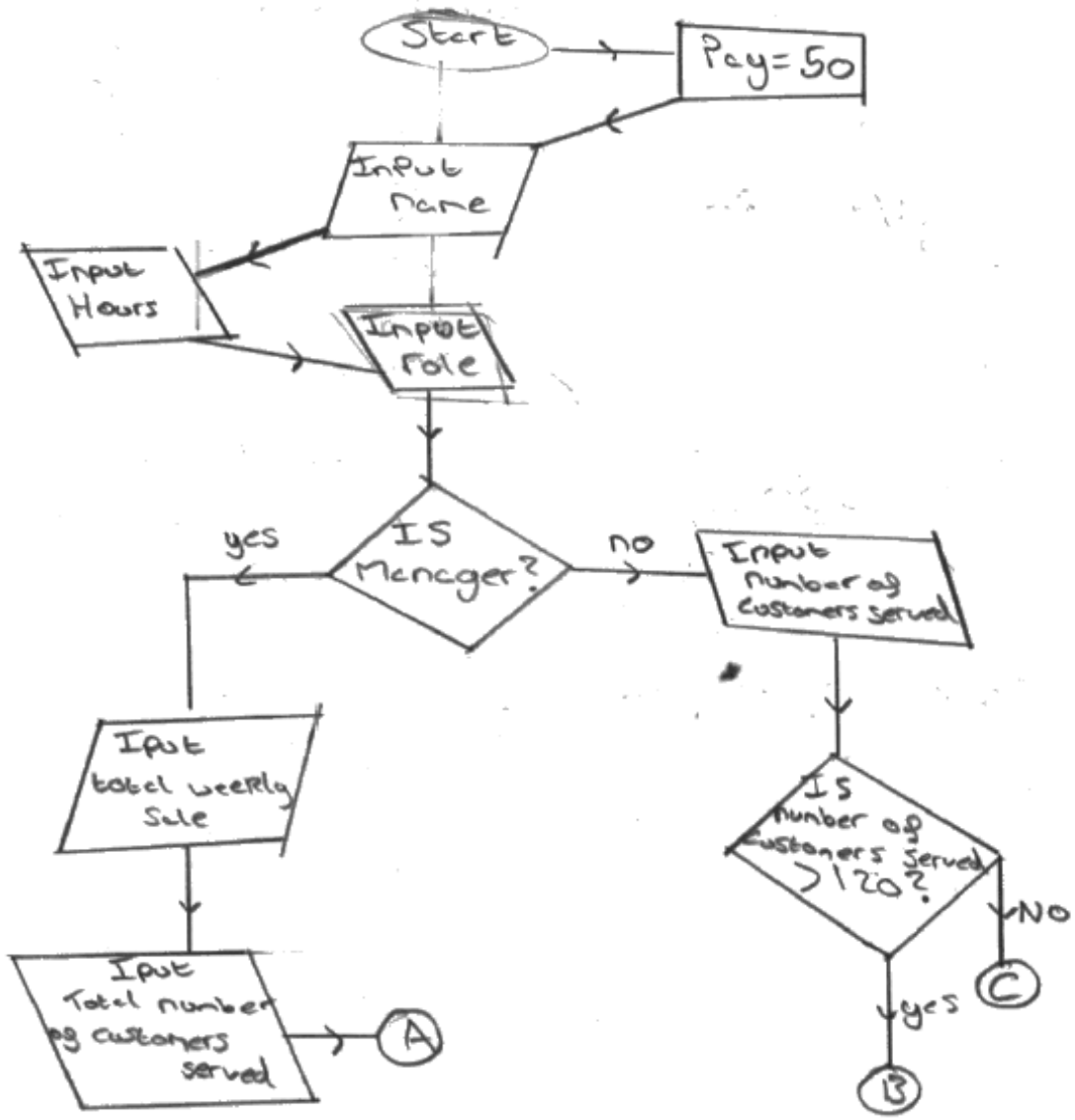
(e) Matthew needs to calculate the weekly pay and bonuses for staff.

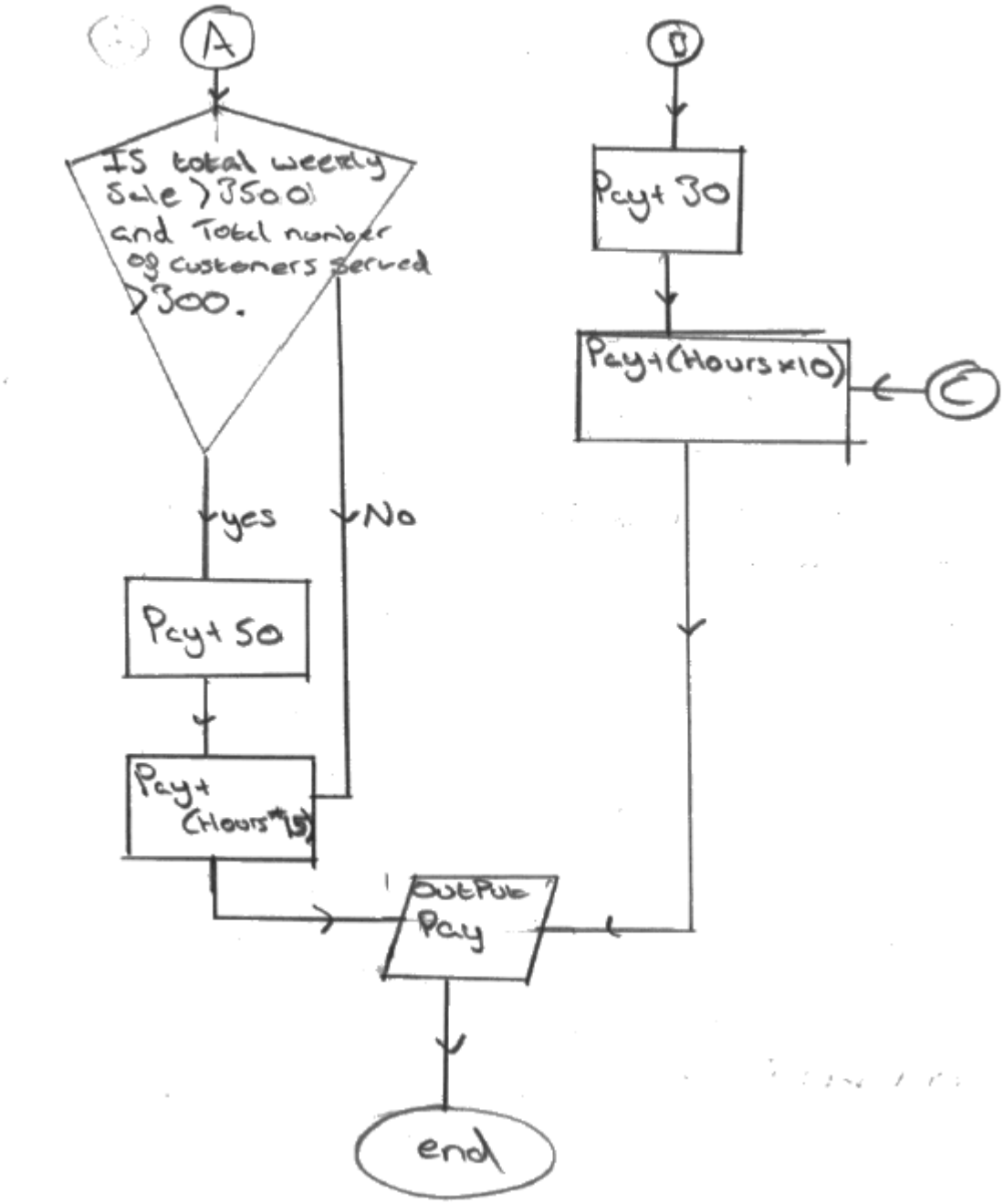
The requirements of the program are:

- allow users to input:
  - employee name
  - job role (manager or other)
- calculate and output employees' pay (including bonus).

Draw a flowchart that meets the program requirements.

(6)



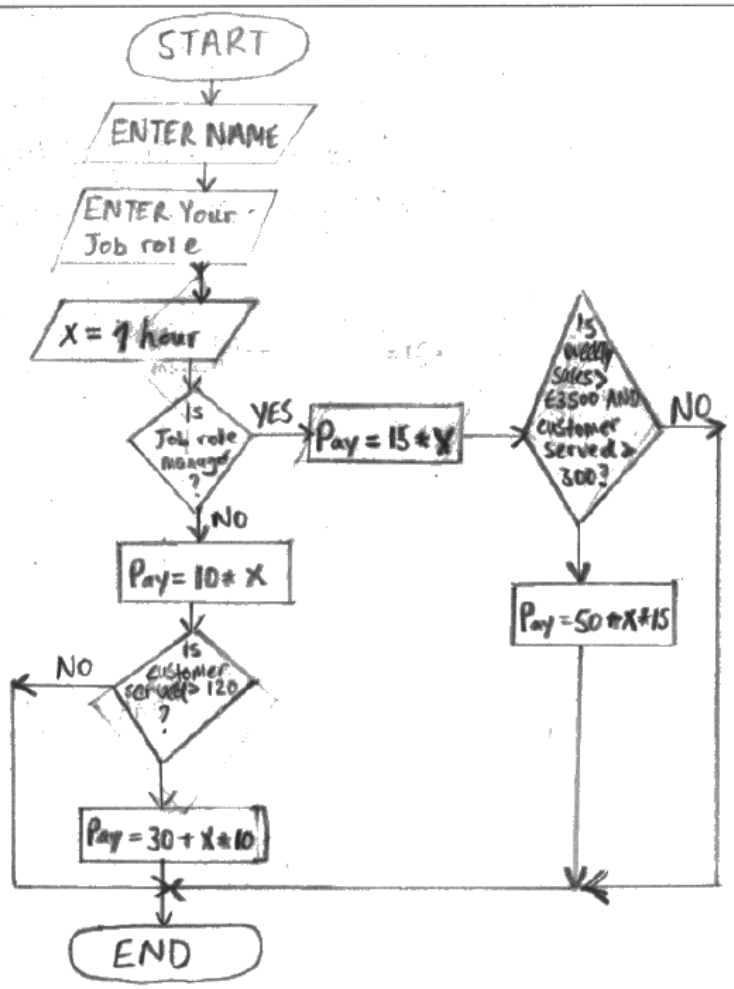


6 marks awarded.

Correct flowchart symbols used and good structure throughout. Appropriate variable names used consistently, and the flowchart meets all of the requirements. Full marks have been awarded.

Draw a flowchart that meets the program requirements.

(6)



2 marks awarded.

This response has an input for name and job role, but lacks input for hours.

Calculations are incorrect which would lead to a highly inefficient solution.
This response only meets the descriptors for level 1.

Question 2a

Most learners managed to pick up marks on this question. There were some 6-mark answers which was pleasing to see.

2 A local council wants to develop a program to calculate the council tax band each house will be in.

Figure 2 shows part of the pseudocode for this program.

(a) The pseudocode contains three errors. Because of the errors the algorithm does not meet requirements of the program.

Identify the line number of each error and write the correct pseudocode for each line.

(6)

Line number

line 3

Correct pseudocode

IF house_value > 250000 THEN

Line number

Line 1

Correct pseudocode

~~ELSEIF house_value~~ FOR count 1 to 10000

Line number

Line 13

Correct pseudocode

Output ~~tax_band~~ taxband

6 marks awarded.

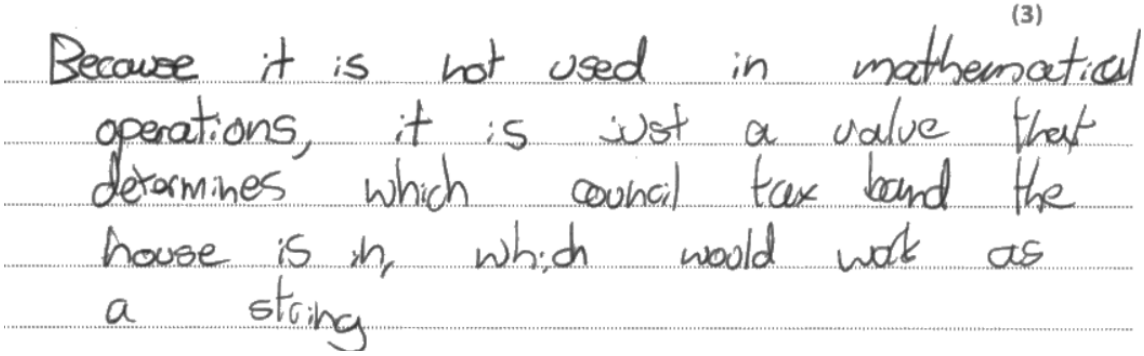
Line 3 - 1 mark.
If house_value >250,000 then - 1 mark.
Line 1 - 1 mark.
For count 1 to 10000 - 1 mark.
Line 13 - 1 mark.
Output taxband - 1 mark.

Question 2b

There were a variety of marks awarded for this question. Most learners simply commented on the use of letters being used for 'taxband' which is not relevant, but there were some responses that achieved the full 2 marks.

(b) Explain why the variable 'taxband' should be declared as a string.

(3)



2 marks awarded.

'it is not used in mathematical operations' - 1 mark awarded for mark scheme point 'taxband is not used in calculations'.

'it is just a value that determines which council tax band the house is in' - 1 mark awarded for mark scheme point 'it is only used to determine the tax band of each house'.

Question 2c

It was pleasing to see that many learners were able to identify the differences between these loops, where the majority of responses achieved full marks for this question.

(c) Explain **one** reason why a 'FOR' loop has been used instead of a 'WHILE' loop.

(2)

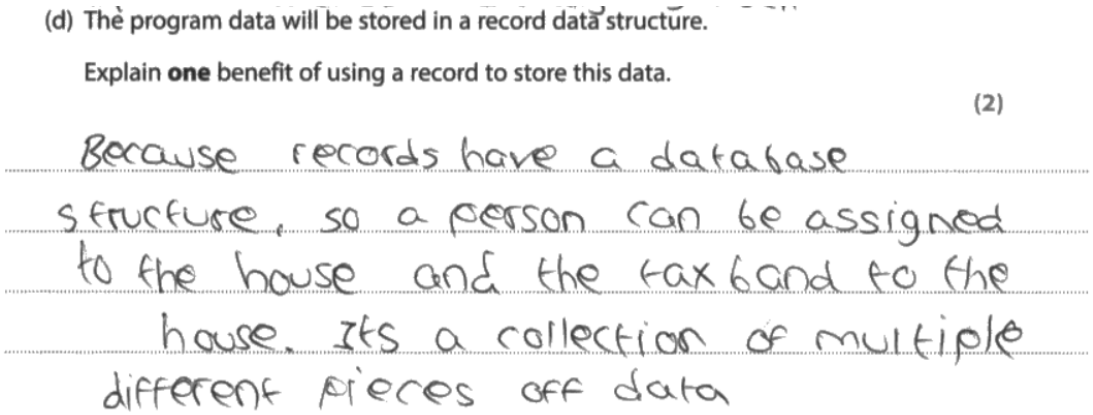
It is a specified amount of houses (10 thousand) and in order to do 'WHILE', there must be a condition set. The house won't know when to stop if a condition is set ~~as there is no~~ meaning that the program ~~terminates~~, in otherwords, it would never stop running.

2 marks awarded.

The learner specified the amount of houses (10 thousand) - 1 mark.
to do 'WHILE', there must be a condition set - 1 mark.

Question 2d

This question clearly demonstrated that most learners did not know what a record data structure was. Most learners were awarded zero marks for this question but there were some that achieved the full 2 marks.



(d) The program data will be stored in a record data structure.

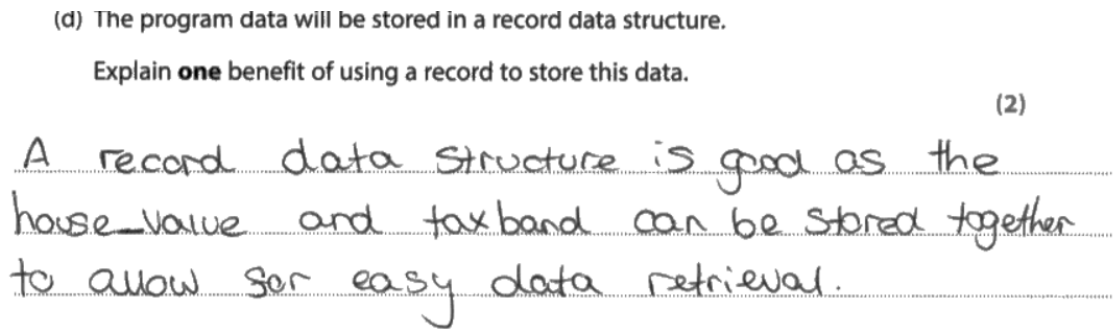
Explain **one** benefit of using a record to store this data.

(2)

Because records have a database structure, so a person can be assigned to the house and the tax band to the house. Its a collection of multiple different pieces off data

0 marks awarded.

"Its a collection of multiple different pieces off data" - not enough to award a mark as it must relate to data type.



(d) The program data will be stored in a record data structure.

Explain **one** benefit of using a record to store this data.

(2)

A record data structure is good as the house_value and taxband can be stored together to allow for easy data retrieval.

2 marks awarded.

“house_value and taxband can be stored together” - 1 mark.
"easy data retrieval" - 1 mark.

Question 2e

This question demonstrated that most learners did not know what a lot about procedural programming. Most learners were awarded zero marks for this question.

(e) The local council has decided to write the program using a procedural language.

Describe how blocks and procedures can be used when writing the code for this program.

(4)

Blocks

Blocks are collection of statements. Programmer can use the block of code to specify where it belongs which makes it easier to understand code by other developes. Increases readability of code.

Procedures

Procedures are used to carry out certain tasks or sub-routine. You can define the procedure once ~~used~~ in the code and then reuse it anywhere ~~it~~ in the code, which reduces the code line and development time. Also increases the efficiency of the code as you do not ~~req~~ repeat the line of code in program.

3 marks awarded.

Blocks - collections of statements (1 mark).
Procedures - Used to carry out certain tasks (1 mark) and then reuse it anywhere in the code (1 mark).

Question 2f

This focus for this question is on coding for the web, but majority of the responses seen were generic web answers such as 'available on different devices'. This topic has appeared on numerous exam papers but is still poorly answered.

(f) The local council wants to offer a version of this program on its website.

Discuss the implications of implementing the program on a web platform.

(6)

They would have to find a server to host the program and would most likely have to store data in the cloud as it would require a lot of storage. Would also need to find a coding language compatible with the platform. Would have to make it accessible on different types of devices are accessible through a wifi connection.

1 mark awarded.

Consideration of making it available on different devices - 1 mark.

Question 3a

This question focuses on applying knowledge of branching and iteration to the rules of a program. Some learners can now describe how branching and iteration can be used but there are still a lot that do not know what these terms are.

3 A school organises pupils into groups for sports day based on the month that they were born.

The school wants to develop a program that will calculate the number of pupils in each group.

Figure 3 in the Information Booklet shows the rules for the program.

(a) Describe how branching and iteration could be used for this program.

(4)

Branching

Branching could be used to determine what group the student goes in. For example if the student is born in January, February, March or April they go in red group

Iteration

Iteration could be used to repeat the program until 100 entries have been made

4 marks awarded.

"Branching could be used to determine what group the student goes in" (1 mark).

"If the student is born in January, February, March or April they go in red group" (1 mark).

"Iteration could be used to repeat the program" (1 mark) ..."until 100 entries have been made" (1 mark).

Question 3b

This question was poorly answered with most learners not achieving any marks. A lot of learners associated Boolean operators with true/false which in this case is wrong.

(b) Explain the role of Boolean and Relational operators when developing the program.

(4)

Boolean operators

This would be used to record the number of pupils in each group from their birth month.

Relational operators

This helps with statements as you can check whether something is over a certain number. For example, > is a greater than symbol and can be used to compare the number of each group for this program.

2 marks awarded.

Boolean - No awardable content.

Relational operators – "check whether something is over a certain number" - 1 mark provided as it implies compare two numbers.

"> is a greater than symbol and can be used to compare the numbers of each group" – 1 mark as it is linked to scenario.

(b) Explain the role of Boolean and Relational operators when developing the program. also be

(4)

Boolean operators

Boolean operators the role would be to return ~~true~~ to false if Pupils ~~are neither~~ an were neither born in Jan → Apr ~~and~~ or May – August meaning that they would be placed in the white group.

Relational operators

Relational operators would be to put a relation between the student and their date of birth to their ~~month~~. month.

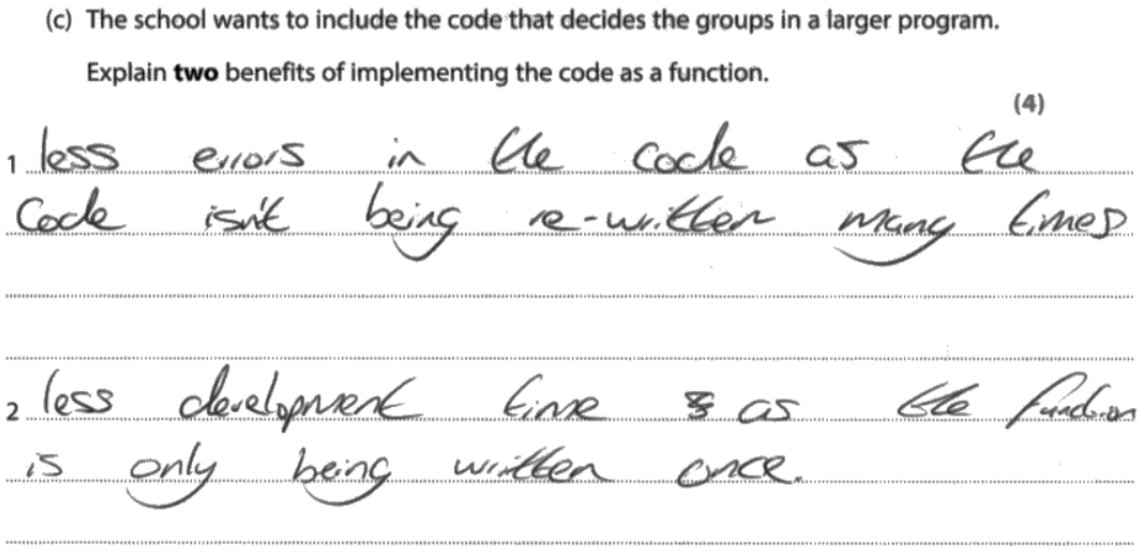
0 marks awarded.

Boolean - No awardable content. We are looking for "AND OR NOT". True or False not to be awarded a mark as this is not a Boolean operator.

Relational - No awardable content.

Question 3c

This question was answered better than in previous exam papers with most learners achieving marks.



(c) The school wants to include the code that decides the groups in a larger program.

Explain **two** benefits of implementing the code as a function.

(4)

1 less errors in the code as the code isn't being re-written many times

2 less development time as the function is only being written once.

4 marks awarded.

1 - less errors in the code (1 mark) as the code isn't being re-written many times (1 mark). The expansion implies less lines of code, so we can award the mark.

2 - less development time (1 mark) as the function is only being written once (1 mark).

Question 3d

This question was answered better than in previous exam papers with most learners achieving marks. Learners understanding of pseudocode is getting better and there were a number of responses that achieved full marks.

(d) Write the pseudocode for a program that meets the rules shown in **Figure 3**. (8)

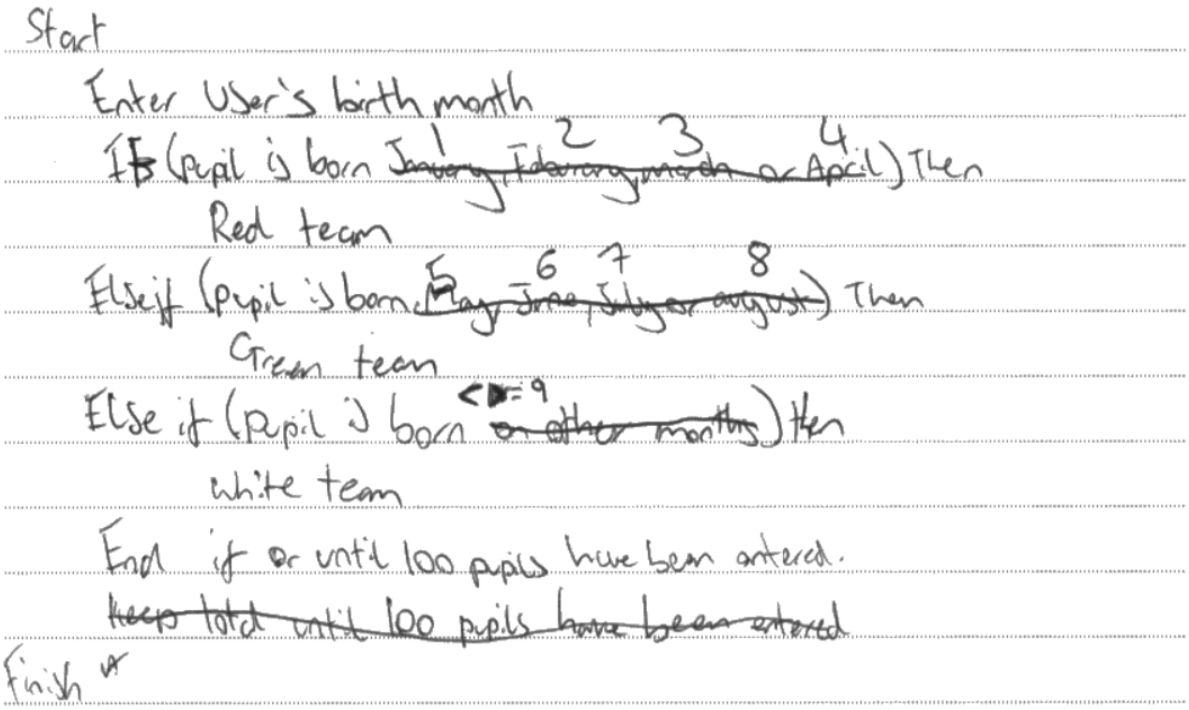
```
for Count 1 to 100
def BirthMonth():
    green=0
    Month = Input("Enter a number 1-12 for your Birth Month")
    If month == '1' OR '2' OR '3' OR '4':
        red = red+1
        group="red"
    elif month == '5' OR '6' OR '7' OR '8':
        green = green+1
        group="green"
    elif month == '9' OR '10' OR '11' OR '12':
        white = white+1
        group="white"
    End if
End
OutPut red
OuTPut green
Out Put White
```

8 marks awarded.

The solution meets all of the requirements and is logically correct.

(d) Write the pseudocode for a program that meets the rules shown in **Figure 3**.

(8)



1 mark awarded.

Highly inefficient solution developed. No loop in the pseudocode, so it will only iterate once, and it is not clear what the IF statements are doing. This response partially meets the descriptor for level 1.

Question 4a

This question was answered quite well by majority of learners, which is pleasing to see. It is evident that learners are clearly being taught about arrays.

4 A programmer is writing a program to process reward points for an online retailer.

The reward points earned by a customer on their last 12 orders are stored in the array points.

0	1	2	3	4	5	6	7	8	9	10	11
14	7	2	12	5	23	36	15	11	8	4	19

(a) Explain why OUTPUT points[12] would return an error.

(2)

This is because although there are 12 elements in a the list, a computer program starts counting from 0, meaning we must index knowing the order index will be one less.

2 marks awarded.

“Program starts counting from 0” - 1 mark.

“We must index knowing the order index will be one less” - 1 mark.

Question 4b

This focus for this question was how the 'swaps' variable could be used. However, most learners simply described what it could do and did not achieve any marks.

The programmer sorts the points array using a bubble sort algorithm.

(b) When writing the bubble sort algorithm, the programmer uses a Boolean variable called 'swaps'.

Describe how the 'swaps' variable would be used in the bubble sort algorithm.

(3)

A bubble sort algorithm swaps values from one index to another whether the value in that index is greater or less than. A boolean variable can indicate whether any swaps were done in each pass. If no swaps the the the list is sorted and algorithm can be terminated.

0 marks awarded.

This response is more of an explanation of what the swaps variable could do, the question focus is on how it would be used.

Question 4c

This focus for this question was the differences between a quick/bubble sort and why the programmer would have chosen one over the other. Most learners simply explained how a bubble sort works and were only achieving marks within the level 1 band.

(c) Analyse why the programmer has chosen a bubble sort to sort the data in the points array rather than a quick sort.

(10)

A quick sort algorithm is faster than a bubble sort algorithm, but there aspects to bubble sort that make it much more appealing to a programmer.

A bubble sort is much easier to implement and far less complicated in terms of the structure of the code. This makes it appealing to a programmer, as they will apply less time and effort in order to implement bubble sort rather than quicksort.

A quick sort algorithm can sort a large data set much quicker than bubble. However, when it comes to smaller data sets such as the one the programmer is using, in this scenario, a bubble sort can be significantly more quicker and efficient.

A bubble sort algorithm can bee a lot easier to work with compared to quick sort algorithm, due its much simpl more simple instruction set, which is a useful thing when it comes to debugging our program.

In conclusion, our programmers choice of a bubble sort rather than quick sort for the points will merit the % debugging, speed and overall implementation complexity for our programmer.

7 marks awarded.

Points made are relevant to the questions and some accurate knowledge has been demonstrated. A partially developed analysis has been displayed which considers some links between the two sorts.

The response is prevented from achieving level 3 as the response does not provide detailed explanation of the points they make. For example, why is one faster than the other.

This response fully meets the descriptors for level 2.

Question 4d

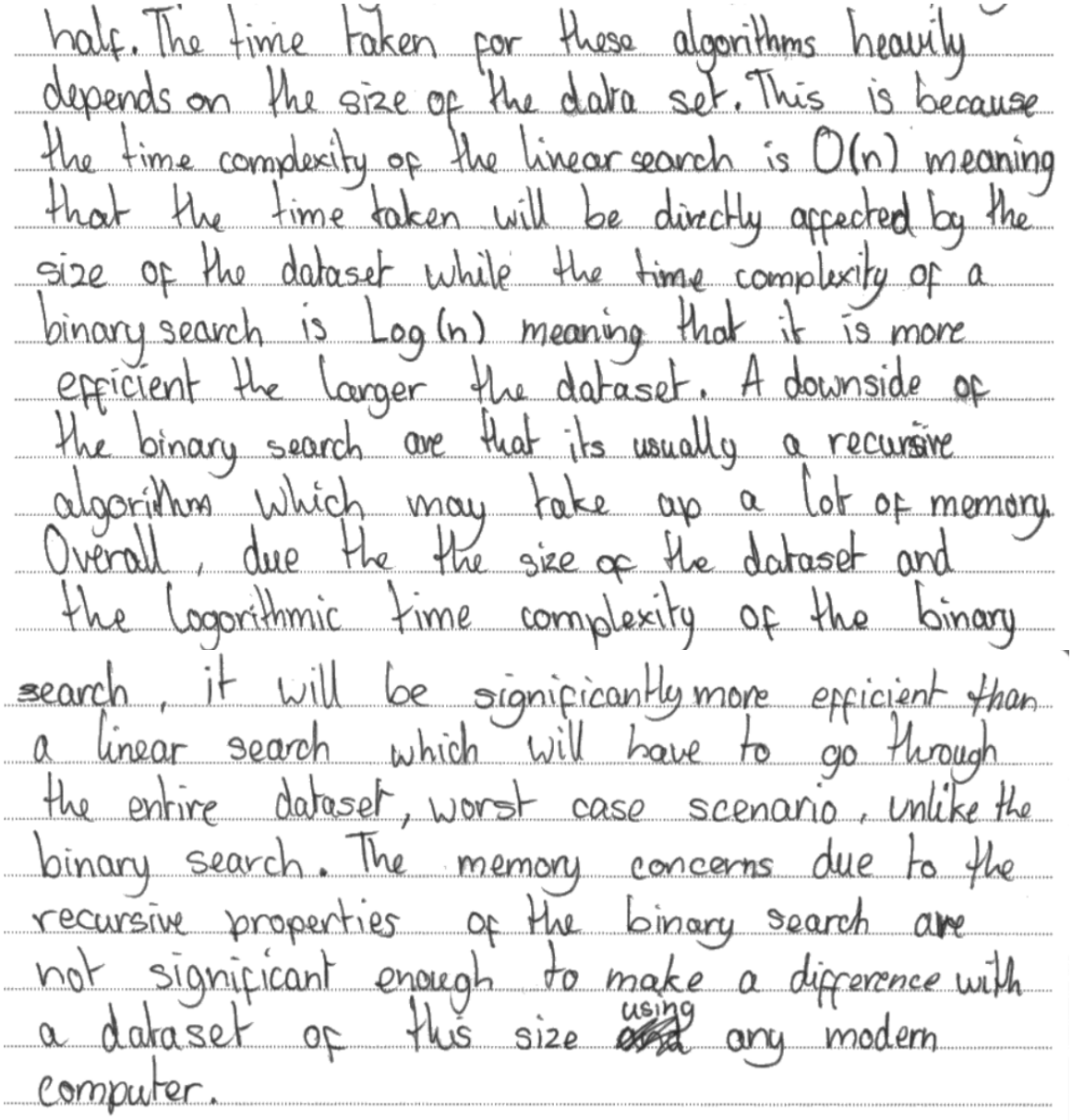
This focus for this question was the differences between a linear/binary search and how efficient each would be for the specified dataset. Many learners simply explained how linear or binary search works and were only achieving marks within the level 1 band. There were only a few responses which managed to access the full range of marks for this question.

The programmer has been given a database of 500 000 customers and needs to create an algorithm to search through it to find a specific customer.

(d) Evaluate the efficiency of **both** linear and binary searching algorithms for a dataset of this size.

(12)

A linear search is a simple search algorithm which iterates from the start of a data structure till the end until it finds the target it is searching for, this is a really simple algorithm which is also easy to implement. A binary search works differently as it divides a sorted a data structure and checks its middle element, if the target is smaller than the middle element it will repeat the algorithm with the left half of the datastructu but if its larger, it will do it with the right



half. The time taken for these algorithms heavily depends on the size of the data set. This is because the time complexity of the linear search is O(n) meaning that the time taken will be directly affected by the size of the dataset while the time complexity of a binary search is Log (n) meaning that it is more efficient the larger the dataset. A downside of the binary search are that its usually a recursive algorithm which may take up a lot of memory. Overall, due the the size of the dataset and the logarithmic time complexity of the binary search, it will be significantly more efficient than a linear search which will have to go through the entire dataset, worst case scenario, unlike the binary search. The memory concerns due to the recursive properties of the binary search are not significant enough to make a difference with a dataset of this size using any modern computer.

12 marks awarded.

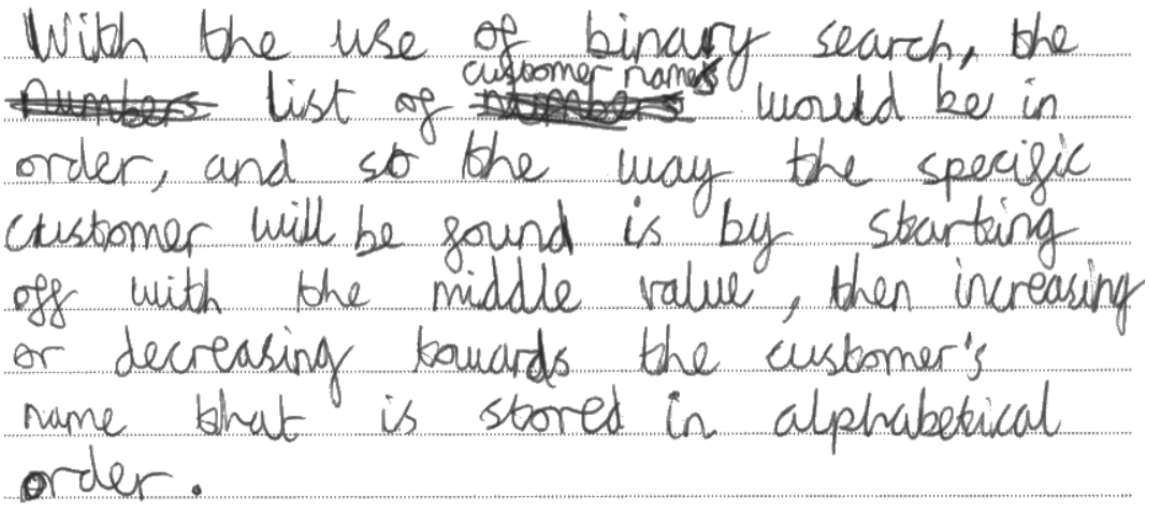
This response is a balanced explanation of both sides of the argument using accurate technical vocabulary. The answer displays a well-developed and logical evaluation which clearly considers different aspects and competing points in detail, leading to a conclusion that is fully supported.

This had placed the response at the top of the mark band, in the mark scheme.

The programmer has been given a database of 500 000 customers and needs to create an algorithm to search through it to find a specific customer.

(d) Evaluate the efficiency of **both** linear and binary searching algorithms for a dataset of this size.

(12)



1 mark awarded.

This response reflects more of a description of how a binary search works, but there is some technical knowledge, so we can award 1 mark.

Summary

Based on performance in this examination series, learners are offered the following advice:

- Ensure that learners make full use of the information booklet when answering the exam questions. When candidates are referred to the information booklet, they should make sure that their answer is specific to the information / program code / rules or other stimulus given.

- For shorter response questions (5 marks or less), learners should be encouraged to note the number of marks available as this will help them identify the number of points they need to make. For example, in a 4 mark 'Explain one…' style question, learners would need to make at least four linked points that expand/exemplify understating of a single point.

- When producing extended writing responses (6 marks or more) learners should ensure that they consider a range of points, each of which should be expanded or supported with examples and applied to the given context.

- Learners need to focus on the key verbs within the questions in order to fully address what is being asked.

- More work is needed in class so learners can successfully apply their knowledge to the given scenarios.