



Examiners' Report Lead Examiner Feedback

January 2021

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

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Introduction

This was the seventh examination season for Level 3 BTEC Computing Unit 1: Principles of Computer Science.

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 will be given an information booklet. They will be instructed to look at individual parts / sections of this during the examination to answer 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 code to interpret, analyse or evaluate.

All sections of the examination paper provide differentiation at all attainment levels and the paper is designed to be ramped in difficulty so that a larger percentage of higher-grade marks are allocated to the later stages of the paper.

Introduction to the Overall Performance of the Unit

The overall performance of learners is like the last examination series for this unit. The average mark per candidate has risen slightly which shows that centres are better preparing learners for the rigor of this exam. However, there is still evidence to suggest that there are still a lot of learners who are not fully prepared to take this examination.

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.

While learners did not perform well on some of the extended questions, overall, the performance on the shorter response questions appears to have improved with many learners picking up marks. Learners still do not fully understand the demands of the higher order command words such as discuss, analyse, and evaluate. Learners were not able to meet the demands of these higher order command verbs which resulted in many learners achieving lower marks on the extended questions.

Individual Questions

Question 1a

This was an accessible question and most learners got 3 marks.

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 Fred has been employed to develop a program for a car repair business. The business provides MOTs and servicing for customers' cars. The business owner would like a program to calculate customers' bills.

(a) Fred will use pattern generalisation and abstraction to identify the variables to be used in the program.

Give **three other** parts of a programming problem that will be identified using pattern generalisation and abstraction.

(3)

1 Subroutines Subroutines

2 Inputs

3 Outputs

3 marks awarded.

Subroutines - 1 mark

Inputs - 1 mark

Outputs - 1 mark

Question 1b

This was another very accessible question and majority of learners achieved 2 or 3 marks out of the 3 marks available.

- (b) Fred has written an algorithm using pseudocode to calculate and output customers' bills.

He has used the information in **Figure 1** in the Information Booklet and would like some feedback on his algorithm.

```
BEGIN
MotCost = 79.99
TotalBill = 0
OUTPUT (Has the customer's car had an MOT?)
INPUT Mot
IF Mot = "yes" THEN
    TotalBill = MotCost
END IF
OUTPUT (Has the customer's car had a service?)
INPUT Service
IF Service = "yes" THEN
    TotalBill = Service
END IF
```

Identify **three** reasons why the algorithm will not work as expected.

(3)

Reason 1

The IF loops contain only 1 valid input; if a user enters 'no', the program would crash.

Reason 2

The TotalBill variable only accounts for Service; both MotCost and Service should be added together.

Reason 3

No discounts have been applied, nor does the program output the bill.

3 marks awarded.

Reason 1 - a mark can be awarded for the 6th point on MS 'Only yes is accepted for inputs' - 1 mark.

Reason 2 - Mark can be awarded for implying that service and mot need to be added together for total bill - 1 mark.

Reason 3 - No discount applied - 1 mark – 'nor does the program output the bill' - This is a valid response, but 3 marks has already been awarded.

Question 1c

This question followed on from previous series' whereby the learners struggled with the technical programming terminology and majority achieved 0 or 1 out of the 2 marks available.

(c) Fred is going to use built-in functions when producing the code for his program.

State **two** benefits of using built-in functions when creating program code. (2)

Benefit 1

in Build-in function, you won't error, ~~whereas~~ ^{whereas} when you do it on your own you will find errors.

Benefit 2

The build-in functions is much more efficient and most of the code is already there.

2 marks awarded.

Benefit 1 - A mark can be awarded for implying there are less errors- 1 mark.

Benefit 2 - Mark can be awarded for more efficient- 1 mark.

Question 1d

This question was answered well, learners have extensive knowledge of data validation techniques.

(d) Fred will use validation checks for the MOT and service inputs within his program.

Explain **two** types of validation checks that would be suitable for these inputs.

(4)

1 Data type check, he should check that they inserted the right datatype. In this case a string. Or else the code won't work.

2 Presence check. To make sure something has actually been entered. Or else might run into problems

4 marks awarded.

Data type check - 1 mark

'he could check that they inserted the right data type, in this case a string' - 1 mark.

Presence check - 1 mark

'to make sure something has actually been entered' - 1 mark.

Question 1e

Responses to extended answer questions are marked using levels-based mark schemes, with the quality of the response determining the level. There are four levels; level 0 where there is no rewardable material presented and then levels 1, 2 and 3; the higher the level the better the quality of response.

Compared to previous exam series this flow chart question was answered very well.

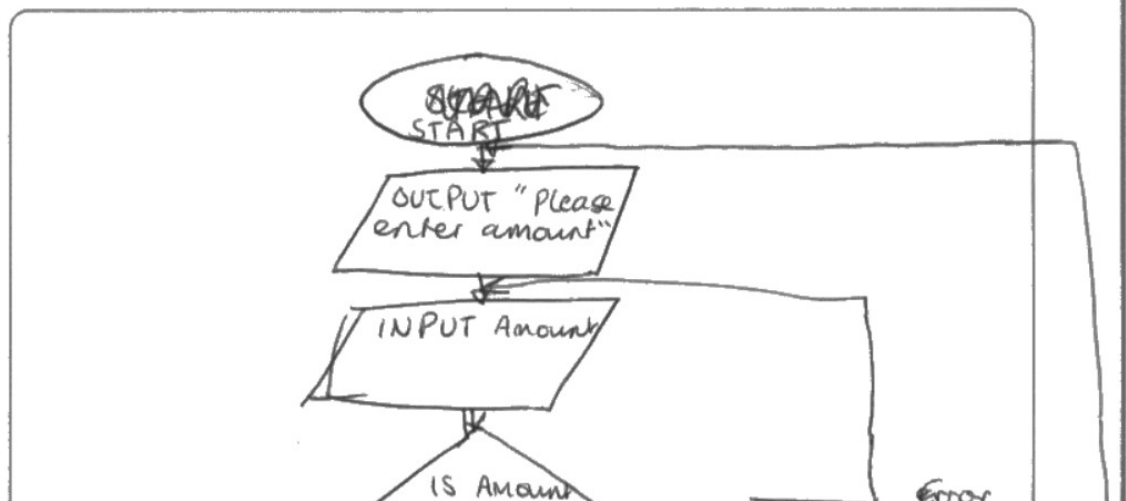
Marks are given for structure of the flowchart, appropriate variable names, logical operations and meeting the requirements.

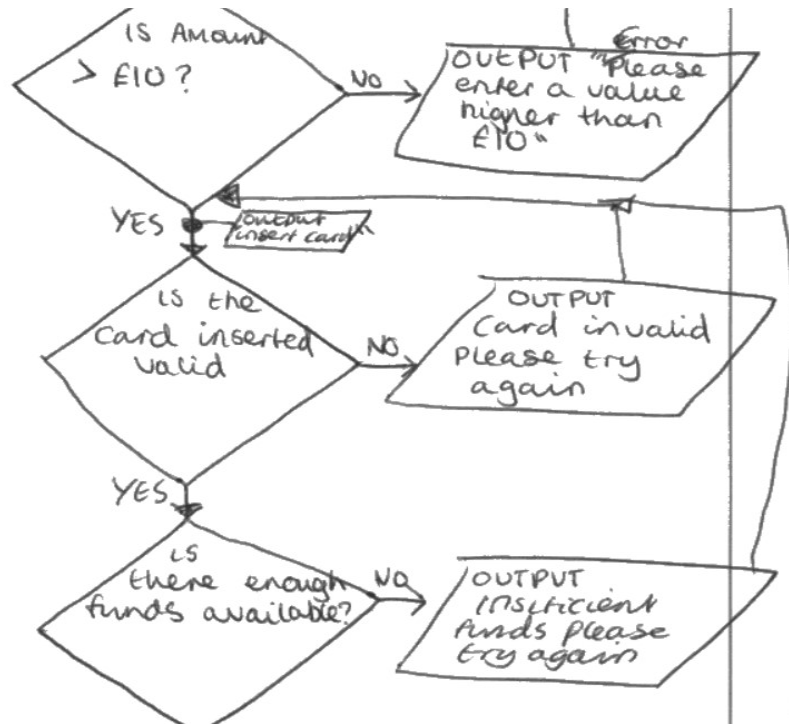
(e) The business uses a set of rules to follow when processing card payments.

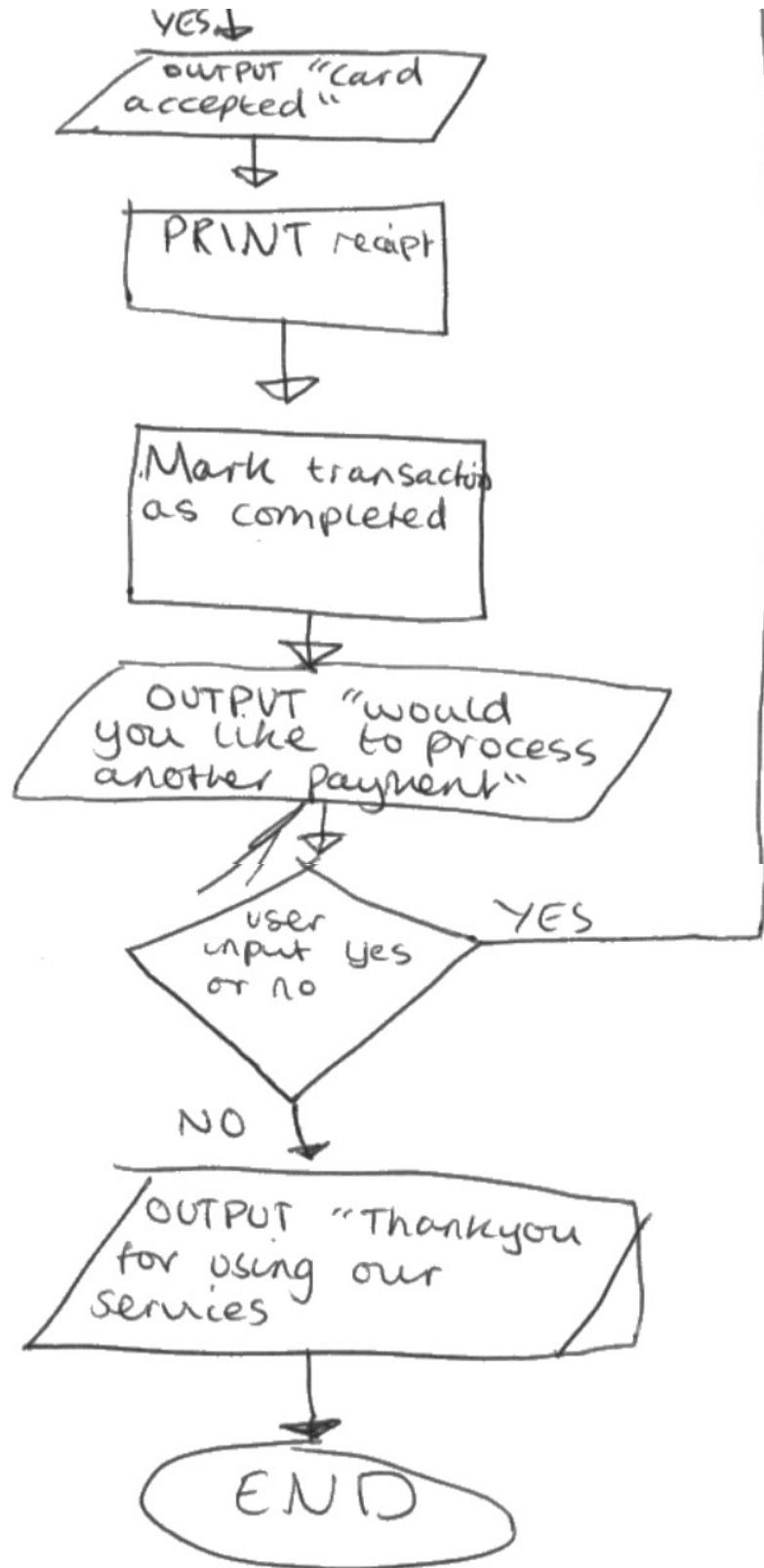
- Payments have to be above £10. ◇
- The card must be checked with the appropriate bank to make sure that: ◇
 - it is valid
 - enough funds are available.
- Receipt must be printed. □
- Transaction must be marked as completed. □
- There must be an option to process another payment. ◇

Draw a flowchart that meets the rules when processing card payments.

(8)







8 marks awarded.

Structure of the flowchart uses appropriate and consistent hierarchies as well as appropriate variable names. Logical operations and sequences are accurate, and this solution meets the requirements with some possible minor inaccuracies.

Question 2a

This question performed well with most learners achieving at least 2/3 marks out of the 4 marks available.

2 A programmer is developing code that will include a binary search.

(a) Explain **two** benefits of producing code with good readability.

(4)

Benefit 1

If the code is readable, then other programmers will be able to work ~~out~~ out what you are coding and understand / comprehend it.

Benefit 2

~~If you stop spending time on~~ If you make it clear and readable, you may find some errors or ways to make the code more efficient.

3 marks awarded.

'other programmers (1 mark) will be able to work out what you are coding and understand it' (1 mark)

'if you make it clear and readable, you may find some errors or ways to make the code more efficient - 1 mark for easier to debug/maintain

Question 2b

This question performed well with most learners achieving full marks. It demonstrates that learners are able to trace variable values through pseudocode.

(b) Complete the table for the values used in the algorithm in **Figure 2** in the Information Booklet.

(5)

val	left	right	mid	arr[mid]
48	0	6	3	48

5 marks awarded.

val=48 - 1 mark

left=0 - 1 mark

right=6 - 1 mark

mid=3 - 1 mark

arr[mid]=48 - 1 mark

Question 2c

This question performed consistently with previous 3 mark explain questions, whereby most learners achieved 2 marks out of the available 3.

(c) Explain why the binary search algorithm shown in **Figure 2** in the Information Booklet would not work when [48, 1, 26, 56, 15, 6] is in the array (arr).

(3)

A binary search algorithm only works on sorted lists as ~~it~~ due to when choosing a value it discards the values that are smaller/bigger than the current value. If the value chosen is 48 then it will experience a run-time error as it ~~right values the array's right~~ the values to 48's right contain both larger and smaller values.

3 marks awarded.

'works on a sorted list' - 1 mark

'when choosing a value it discards the values that are smaller/bigger than the current value' - 1 mark awarded for boundaries will be set incorrectly

'experience a run time error' - 1 mark

Question 2d

This question again highlighted the issues learners are having with programming terminology. Most of the learners only achieved 1 or 2 marks.

(d) The programmer implementing the algorithm in **Figure 2** in the Information Booklet wants to create it as a subroutine with 'arr' as a parameter.

Explain **two** reasons why the programmer might implement the algorithm as a subroutine.

(4)

Reason 1

so that the code can be used again later in the program without having to write it out again - will save time when writing program and help to eliminate syntax errors.

Reason 2

code can be used with a different array in order to make the program more versatile - can be used with different lengths of arrays as well as values within the array.

4 marks awarded.

'so that code can be used again' - 1 mark

Will save time - 1 mark

Make the program more versatile - 1 mark

'different lengths of arrays' - 1 mark

Question 2e

This question had a consistent approach from the learners with most achieving full marks. The answer was based around and IF..THEN..ELSE structure which the learners seemed very familiar with.

(e) The algorithm in **Figure 2** in the Information Booklet is not fully complete.

Write some pseudocode that will continue after line 14 and display a suitable message when a value is found or not found.

(4)

```
IF val = arr[mid] THEN
    OUTPUT "value found at index " + arr[mid]
ELSE
    OUTPUT "Value not found."
```

4 marks awarded.

IF statement used to check condition - 1 mark

Complete if/else structure - 1 mark

Correct condition - 1 mark

Suitable output messages - 1 mark

Question 3a

Responses to extended answer questions are marked using levels-based mark schemes, with the quality of the response determining the level. There are four levels; level 0 where there is no rewardable material presented and then levels 1, 2 and 3; the higher the level the better the quality of response.

This question performed better than the pseudocode questions in previous papers. Most learners managed to achieve marks from the top mark band which gave them 7 or 8 marks.

Please refer to Section 3 of the Information Booklet in order to answer Question 3.

Gerrard owns a limousine hire company. He wants to create a program that will calculate the hire cost of limousines.

3 (a) Develop an algorithm for this program using the rules shown in **Figure 3a** in the Information Booklet.

Write your answer using pseudocode.

BEGIN

Distance = INPUT (integer) journey distance in miles

Npassengers = INPUT (integer) number of passengers

WHILE Npassengers IS LESS THAN 1 OR MORE THAN 10 THEN

== IS EQUAL TO⁽⁸⁾

```

Npassengers = INPUT(integer) number
of passengers
ENDWHILE

Pcost = 5 multiplied by Npassengers
Jcost = 2.50 multiplied by Distance
Extra = 30.00
Totalcost = Pcost + Jcost
IF Distance IS MORE THAN 20 THEN
    Totalcost = Pcost + Jcost + 30.00
ELSE THEN
    Totalcost = Pcost + Jcost
ENDIF
DISPLAY Curname
DISPLAY Npassengers
DISPLAY Distance
DISPLAY Totalcost

END

```

8 marks awarded.

All of the requirements have been met.

3 inputs, calculations, validation for number of passengers, IF statement for extra mileage over 20 and all outputs.

As all of the requirements have been met you can award 8 marks.

Question 3b

Responses to extended answer questions are marked using levels-based mark schemes, with the quality of the response determining the level. There are four levels; level 0 where there is no rewardable material presented and then levels 1, 2 and 3; the higher the level the better the quality of response.

This question again highlighted the issues that learners are having with understanding programming terminology. There were a lot of band 1 answers for this question as learners just do not have the technical knowledge of programming.

(b) **Figure 3b** in the Information Booklet shows the variables Gerrard plans to use when he writes the code for the program.

Discuss the implications of using functions with arguments instead of the global variables defined in **Figure 3b**.

(8)

Using functions with arguments instead of global variables will result in the program being more maintainable. This is because using global variables can often lead to causing errors as they are harder to keep track of. This is because they are in use throughout the entire program, and therefore can be changed accidentally anywhere.

However, using global variables is less complex. It means that you do not have to worry about returning values or putting things in parameters. It also ensures that the variable names for the global variables stay the same. This means less communication is needed between programmers if they are working on the same program. For example, this would be useful for Variable 4 as it ~~is~~ would be used on various occasions in and out of functions in the program.

Another reason why functions with arguments is better is because if different programmers work on different functions, the code will be easier to put together as the end program will be modular.

As a whole, I think functions with arguments has better implications as the code will overall be more maintainable and reduce the chance of errors.

5 marks awarded.

This response focuses on functions with arguments will make the program more maintainable because global variables can often lead to errors as they are harder to keep track of as they are in use throughout the whole program. - This will be sufficient to get into mark band 2, but not all points are relevant. So not enough to access top of mark band 2.

(b) **Figure 3b** in the Information Booklet shows the variables Gerrard plans to use when he writes the code for the program.

Discuss the implications of using functions with arguments instead of the global variables defined in **Figure 3b**.

(8)

Functions with arguments are better to use instead of global variables because they ^{are} ~~are~~ easier to alter and change it will, because global variables are part of the entire program whereas functions with arguments are fixed to a certain piece which makes them much more reliable and easy to use.

1 mark awarded.

There is mention of global variables being part of the entire program, as well as mention of arguments being reliable which is worthy of a mark.

Question 3c

Responses to extended answer questions are marked using levels-based mark schemes, with the quality of the response determining the level. There are four levels; level 0 where there is no rewardable material presented and then levels 1, 2 and 3; the higher the level the better the quality of response.

This question was not answered well by the learners, it is clear they are not being taught any in-depth knowledge of object-oriented programming.

(c) Gerrard is considering developing the program using an object-oriented programming language.

Discuss the benefits and drawbacks of using an object-oriented language to develop this program.

(8)

Object-oriented programming allows the use to solve real world problems by using classes & objects to them.

§

Using object-oriented allows a programmer to ~~be~~ maintain the code better as the program uses encapsulation which blocks off code, allowing nothing to externally change the properties & behaviours within ~~§~~ the encapsulation which

therefore hides data from. ~~It~~ Using encapsulation makes code easier to read.

~~It~~ Another benefit is that using this program allows ~~the~~ it to be used in a range of other devices which makes compatibility of the program very useful.

However the program size ~~is~~ for object-oriented is very large therefore there would be a higher need in storage capacity ~~which makes an~~

Another drawback of this is that the instruction base of the program is very large so it will take time to develop an understanding of the program's ~~code~~ instructions.

6 marks awarded.

This response mentions using classes and objects to solve real world problems (entities). Encapsulation is mentioned as another benefit and then it focuses on storage capacity and it being a complex language to learn.

Some accurate knowledge is demonstrated, some of the points are relevant to the scenario and a partially developed discussion is evident.

(c) Gerrard is considering developing the program using an object-oriented programming language.

Discuss the benefits and drawbacks of using an object-oriented language to develop this program.

(8)

Object orientated programming would allow Gerrard to quickly add more customers through the use of ~~polymorphism~~ polymorphism. it'd make it so there is always an input data quickly into ~~variables~~ variables that have been encapsulated, inheritance would make it that ~~easy~~

~~But~~ However Object orientated programming can be hard to set up and time consuming to set up, it also main use is when theres many objects that inherit and change variables functions, which makes it useful for very complex and long codes not a simple one like Gerrard will need.

2 marks awarded.

This response identifies some features of OOP but does not offer any explanations. Although it does mention that OOP can be complex to set up and very time consuming which puts this in mark band 1.

Question 4a

This question was answered well, most learners achieved between 2 and 4 marks out of the total 4 marks.

4 Amy is a games developer. She has come up with an idea for a new game aimed at children.

Figure 4 in the Information Booklet shows information about the new game.

(a) Explain why Amy would use decomposition and abstraction to help the development of the game.

(4)

Decomposition

decomposition is breaking down a large problem into smaller, more manageable tasks. This allows developers to focus on key processes and solutions. And to ensure nothing is missed / overlooked.

Abstraction

is removing any unnecessary detail from a problem and focusing on the key points. This would help development as it would make goals easier to identify and then work towards, ensuring they can deliver the important parts of the program.

4 marks awarded.

2 marks for breaking down a large problem into smaller, more manageable tasks. This allows developers to focus on key processes and solutions.

2 marks for removing any unnecessary data and help development as it would make goals easier.

Question 4b

Responses to extended answer questions are marked using levels-based mark schemes, with the quality of the response determining the level. There are four levels; level 0 where there is no rewardable material presented and then levels 1, 2 and 3; the higher the level the better the quality of response.

This question uses the command verb analyse. This requires learners to examine a topic in detail, breaking it down into its component parts and explaining how each part contributes to the other, and in this instance how Event driven programming could be used to meet the requirements of the game.

This question was not well answered by the learners. A lot of the responses referred to general programming terms such as IF statements, loops etc.

(b) Analyse how Amy could use the features of event-driven languages to meet the requirements shown in **Figure 4** in the Information Booklet.

(10)

Amy's could use many features of event driven programming. Event Driven programming is coding waiting for an event to occur to trigger a response. It says that happiness decreases 5% There are many events in this code.

Feeding the alien could be done by pressing on the feed button. There could be an event called feed and it will keep waiting until the button is clicked. This will trigger a piece of code executed by the callback function to feed the alien. After that it will the main loop

~~This same principle could be used to play games with it or teaching it tricks.~~ This piece of code will increase happiness by 40% and reduce hunger to 0. After that the main loop will keep looping ~~to~~ until an event is triggered. Similarly this button click could be used for playing games and teaching it tricks also running the appropriate code.

Time driven could be used for this. This means that this piece of code is affected by the time. So for every tick an event will be triggered to bring happiness down by 5%. This could also be used for the hunger and boredom increasing 1% each tick.

Event driven programming could also be used to ^{start} ~~end the~~ game and end the game. To start you could use your mouse to select a colour this will trigger an event to change the colour of the alien. Same for the name. To end it the game will have to reach happiness or intelligence 0 or boredom or hunger reach 100. This will trigger an event to end the game.

10 marks awarded.

This response refers to events, time driven and triggers. There is a detailed analysis of how these can be used for the program which is why the marks awarded are within mark band 3. Points made are relevant to the context of the question. Meets all the traits for the descriptor of mark band 3, therefore full marks are awarded.

(b) Analyse how Amy could use the features of event-driven languages to meet the requirements shown in **Figure 4** in the Information Booklet.

(10)

An event-driven language will allow the alien to lose percentage of happiness, ~~hunger~~, ~~boredom~~ and intelligence.*
An event-driven language will allow these four statistics to change value over time.

* And gain hunger and boredom over time.

You can use IF statements with an event-driven programming language. This is useful as ~~the~~ you can use a feature where the game ends when the alien reaches 100 hunger or boredom.

With an event-driven language Amy can be specific with the amount of happiness or intelligence lost. She can use both percentages and decimals in her case she used percentages to indicate the alien's happiness, intelligence, boredom and hunger.

With an event-driven language Amy can make buttons or options where if the player clicks on a button/option a certain event occurs. In Amy's game, there's an option where if the ~~at~~ player chooses the 'feed' option, the hunger is reduced to 0 and happiness is increased by 40%.

1 mark awarded.

This response refers to general programming terminology such as IF statements which is not awardable content for this question. 1 mark has been awarded for reference to buttons and events in the last paragraph.

Question 4c

Responses to extended answer questions are marked using levels-based mark schemes, with the quality of the response determining the level. There are four levels; level 0 where there is no rewardable material presented and then levels 1, 2 and 3; the higher the level the better the quality of response.

This question uses the command verb evaluate. This requires learners to display 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 question was not well answered by the learners. A lot of the responses referred to general web benefits and drawbacks which is not what this question was targeted at. The focus for this question was web programming but it is clear from the responses that learners knew very little about this topic area.

(c) Amy has decided to create the game as a web application.

Evaluate the implications of Amy's decision to implement the game as a web application.

You should use examples appropriate to the scenario to support your evaluation.

(12)

Amy will have to consider if she wants to use client side processing or server side processing for her game. Client side processing is where the code for the game/application is processed on the client's computer. This is good, however it forces the clients to have to have Javascript installed and have it up to date, this may seem like not much of an issue however people may choose not to have Javascript installed for privacy reasons. Client side processing also gives the user access to the HTML code, in which they may edit, which

will affect functionality of the game. A positive is client side processing however is that it lowers data traffic on the web server. In my opinion Amy should ~~use~~ implement the game as a web application because of this so it can run smoothly.

Amy will need to know how to program in HTML to implement the game as a web application. This can be bad as ~~amy~~ Amy may not know how to program in HTML so this will make her unable to implement the game as a web application. However if she knows how to program in HTML5,

this allows her to add lots of features to her application, so I would recommend she implements her game as a web application if she can do this.

Amy would also choose if she wants to make her game as open source or proprietary. If she chooses open ~~source~~ source this can allow for others to edit the HTML code to ~~her own~~ their own needs, however proprietary source allows for ~~people's~~ support with the web management, although it usually costs a fee. So - ~~Amy~~ proprietary source also allows for updates if ~~any~~ Amy wants to update her code so I would advise her to use that.

overall I believe she should ~~not~~ upload her game
(Total for Question 4 = 26 marks)

to the web only if she can **TOTAL FOR PAPER = 90 MARKS**
code in HTML5 due to how beneficial this will
be to her

6 marks awarded.

This response focuses on client side and server-side processing but also mentions that HTML 5 will be needed to add lots of features which pushes it into mark band 2.

This next response is consistent with the majority of responses seen during this exam series.

(c) Amy has decided to create the game as a web application.

Evaluate the implications of Amy's decision to implement the game as a web application.

You should use examples appropriate to the scenario to support your evaluation.

(12)

① Unless you use Web Assembly (which is somewhat experimental and not all browsers support it), you will have to transpile to Javascript or use Javascript.

② Accessible. Everything has a browser these days. By ~~can~~ developing a web app, you can be sure most platforms will be able to use it.

③ Simplicity. Her game seems simple, not ~~graphically~~ graphically heavy nor memory heavy. A web browser should be able to support her game without any problems.

I sincerely see no issues with developing it for browsers. However, if she wants to later publish her game to consoles, it might be a problem. Fortunately, there are several engines / libraries that do the work for you and make it easy

1 mark awarded.

The response has only mentioned web browsers which is related to developing code for the web. We can award a mark for this but nothing else is worthy of a 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.



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