Mark Scheme (Results)

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

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Unit 1: Principles of Computer Science

General marking guidance
- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Mark grids should be applied positively. Learners must be rewarded for what they have shown they can do rather than be penalised for omissions.
- Examiners should mark according to the mark grid, not according to their perception of where the grade boundaries may lie.
- All marks on the mark grid should be used appropriately.
- All the marks on the mark grid are designed to be awarded. Examiners should always award full marks if deserved. Examiners should also be prepared to award zero marks, if the learner's response is not rewardable according to the mark grid.
- Where judgement is required, a mark grid will provide the principles by which marks will be awarded.
- When examiners are in doubt regarding the application of the mark grid to a learner's response, a senior examiner should be consulted.

Specific marking guidance

The mark grids have been designed to assess learners' work holistically.

Rows in the grids identify the assessment focus/outcome being targeted. When using a mark grid, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches the learner's response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer in response to the assessment focus/outcome and will be modified according to how securely all bullet points are displayed at that band.

- Marks will be awarded towards the top or bottom of that band depending on how they have evidenced each of the descriptor bullet points.

Question Number	Answer	Mark
1a	Award 1 mark for each correct reason up to a maximum of 3. Constants (1) Key processes (1) Repeated processes / subroutines / functions (1) Inputs (1) Outputs (1) **Additional Guidance** Accept 'processes' on its own once only if 'key processes' and 'Repeated processes' are not mentioned specifically	3

Question Number	Answer	Mark
1b	Award 1 mark for each correct reason up to a maximum of 3 marks. • The customer bill is not output (1) • No choice of service type (1) • No discount calculation (1) • No 'service' variable declared but is used later in the algorithm (1) • No service costs used (1) • Only yes is accepted for inputs (1) • Total bill is set to "yes" rather than a numerical value (1) • Service & MOT cost need to be added together (1) • No condition to check if both service and MOT have been carried out	3

Question Number	Answer	Mark
1c	Award 1 mark for each correct reason up to a maximum of 2 marks. • It saves development time / more efficient (1) • General functions are already written (1) • Will be error free (1) • Code will have already been tested (1) • Code is more readable / easier to maintain (1) **Accept any other appropriate responses.**	2

Question Number	Answer	Mark
1d	Award one mark for identification of a validation check and an additional mark for appropriate linked expansion, up to a maximum of 4 marks. Type check (1) to ensure only text is entered (1) Length check (1) as only 'yes' or 'no' is being used this could ensure nothing greater than 3 characters is entered (1) Presence check (1) to ensure something is entered for MOT and service (1) Constraints Check (1) to check that only specific values are entered (e.g. 'yes' or 'no') (1)	4

Question Number	Answer	Mark
1e	Sample solution 	8

Level	Mark	Descriptor
Level 0	0	No rewardable material.
1	1-3	Structure of the flowchart uses some appropriate hierarchies/subdivision but clarity and/or readability is limited. Variable/object/process names are inappropriate and/or inconsistent Logical operations and sequence/structure of processes used with limited accuracy. There is limited use of accepted conventions A limited or highly inefficient solution.
2	4-6	Structure of the flowchart uses mostly appropriate hierarchies/subdivision to provide some clarity and readability.

		Variable/object/process names are mostly appropriate but there is some inconsistency
		Logical operations and sequences/structure of processes used with some accuracy.
		Accepted conventions have been applied but there are some inconsistencies.
		A solution that meets most of the requirements with some inefficiencies.
3	7-8	Structure of the flowchart uses appropriate and consistent hierarchies/subdivision providing clarity and readability.
		Variable/object/process names are appropriate and used consistently
		Logical operations and sequences/structures of processes are mostly accurate.
		Accepted conventions have been used consistently.
		A solution that meets the requirements with minor inaccuracies/inefficiencies.

Question Number	Answer	Mark
2a	Award one mark for identification of a benefit and one mark for an appropriate linked explanation of the benefit up to a maximum of four marks. Easier to see the statements and conditions attached to them (1) because iteration/selection are grouped together (1) It is easier/quicker to debug/maintain (1) because it is easier to find/identify the code that needs updating/altering (1) Reduced timeframe in making changes (1) as programmer will be able to easily identify functions/procedures (1) Aids teamworking/code reviews (1) because code is more clearly organised / because it is easier to understand (1) (1) Accept any other valid response.	4

Question Number	Answer	Mark
2b	Award 1 mark for each correct value up to a maximum of 5.<table><tr><td>val</td><td>left</td><td>right</td><td>mid</td><td>arr[mid]</td></tr><tr><td>**48**</td><td>**0**</td><td>**6**</td><td>**3**</td><td>**48**</td></tr></table>**Additional Guidance** Allow the value 6 for 'left': Left initially set to 0 at line 3 but would change to 6 at line 8	5

Question Number	Answer	Mark
2c	An explanation such as: The numbers are not in order/sorted (1) so the boundaries will be set incorrectly / incorrect values will be discarded (1) causing an error/incorrect output (1) The array needs an odd number of elements (1) or an error will occur (1) because the code uses integer division (1) Award any other valid response.	3

Question Number	Answer	Mark
2d	Award one mark for identification of a reason and an additional mark for appropriate linked expansion, up to a maximum of 4 marks. Changes do not affect the rest of the program (1) making it easier to fix/amend/test (1) It allows the code to be reused (1) which reduces development time / just have to call it (when needed) (1) Uses less memory / more efficient (1) because there are fewer lines of code (1) It can be used to sort any numbers in the array / different lengths of array (1) allowing for flexibility in the program (1) Award any other valid response.	4

Question Number	Answer	Mark

2e	Award 1 mark for each of:
	
	• using IF statement to check condition (1)
	• Complete if/else structure (1)
	• the correct condition (e.g. arr[mid]) (1)
	• suitable output messages (1)
	
	An example answer is:
	
	IF val = arr[mid] THEN
	       Output "value has been found"
	ELSE
	       Output "Value has not been found"
	ENDIF
	
	Award any other valid response.
		4

Question Number	Answer	Mark

3a	Sample answer:
	
	INPUT surname
	INPUT distance
	WHILE distance ≤ 0
	       OUTPUT error message
	       INPUT distance
	ENDWHILE
	
	INPUT passengers
	WHILE passengers <1 OR >10
	       OUTPUT error message
	       INPUT passengers
	ENDWHILE
	
	fare = 5 * passengers
	fare = fare + (2.5 * distance)
	
	IF distance >20 THEN
	       fare = fare +30
	END IF
	
	OUTPUT surname
	OUTPUT passengers
	OUTPUT distance
	OUTPUT fare
	
	Accept any other valid response.
		8

Level	Mark	Descriptor
Level 0	0	No rewardable material.
1	1-3	Structure of the algorithm uses some appropriate hierarchies/subdivision but clarity and/or readability is limited. Variable/object/process names are inappropriate and/or inconsistent Logical operations and sequence/structure of processes used with limited accuracy. There is limited use of accepted conventions A limited or highly inefficient solution.
2	4-6	Structure of the algorithm uses mostly appropriate hierarchies/subdivision to provide some clarity and readability. Variable/object/process names are mostly appropriate but there is some inconsistency Logical operations and sequences/structure of processes used with some accuracy. Accepted conventions have been applied but there are some inconsistencies. A solution that meets most of the requirements with some inefficiencies.
3	7-8	Structure of the algorithm uses appropriate and consistent hierarchies/subdivision providing clarity and readability. Variable/object/process names are appropriate and used consistently Logical operations and sequences/structures of processes are mostly accurate. Accepted conventions have been used consistently. A solution that meets the requirements with minor inaccuracies/inefficiencies.

Question Number	Indicative Content	Mark
3b	Parameter/argument allows a value to be sent to a sub-program Global variables can be accessed throughout the scope of the program Local variables can only be accessed within the scope of the sub-program it's defined within a parameter/argument becomes a local variable in the function Global variables are good to use for constants as it is easier to follow these throughout the program Programmers generally only prefer local variables/parameters/arguments as they can be removed from the memory after they have been used to stop them being accessed by other parts/functions of the code. The global variable can be accessed by the entire code which therefore increases the chances of integrity issues and the accuracy can be compromised. If the program expands in the future it can get very complicated trying to follow global variables throughout the code. Global would require altering the algorithm as the value would be over-ridden on each call Global would mean that memory space is kept throughout the running of the program, not just the sub-program Parameter/argument enables memory to be reallocated. **General / Conclusion:** The decision to use global variables decreases data integrity as the values within the programming code can be changed by other functions therefore decreasing the accuracy of the calculations. Debugging is made harder when using global variables as it is a lot harder to follow them through the entire program.	8

Mark scheme (award up to 10 marks)		
Level	Mark	
	0	No rewardable material
1	1-3	Demonstrates isolated elements of knowledge and understanding, there will be major gaps or omissions Few of the points made will be relevant to the context in the question Limited discussion which contains generic assertions rather than considering different aspects and the relationship between them
2	4-6	Demonstrates some accurate knowledge and understanding, with only minor gaps or omissions Some of the points made will be relevant to the context in the question, but the link will not always be clear Displays a partially developed discussion which considers some different aspects and some consideration of how they interrelate, but not always in a sustained way
3	7-8	Demonstrates mostly accurate and detailed knowledge and understanding Most of the points made will be relevant to the context in the question, and there will be clear links Displays a well-developed and logical discussion which clearly considers a range of different aspects and considers how they interrelate, in a sustained way

Question Number	Indicative Content	Mark
3c	Benefits **Real Word Entities –** In OOP real world entities are used. Classes and objects can be made of the things that are real and exist in the world. **Code Reusability –** Code reusability is one of the characteristics of object-oriented programming. The feature that explains this point is inheritance. In inheritance, the class and subclasses or parent and child classes can be derived, and its data member and member functions can be used as such. This feature saves times and the user do not need to code again and again, if similar features or functionality is required. Long programs can be cut short and the lot of time can be saved. **Easy Management –** code management becomes very easy in the object-oriented programming. As all the code is divided into several elements it becomes easy to manage. For instance, the whole program can be termed as a class and even if it contains several functions are written or coded in it, their objects can be made. **Maintenance –** Maintenance of code also becomes easy in object-oriented programming. Because of easy management of the code maintenance also becomes easy. If the code is to be used by another programmer, still it will not create any ambiguity of correct guiding of coding is used. **Abstraction –** In abstraction, only the useful data is visible to the user and not the things that they are not required to see. **Polymorphism –** It is another feature of the object-oriented programming. Polymorphism simply means that a function has many forms. Drawbacks **Complex Design –** Designing and proper implementation of Object-Oriented Programming (OOP) concepts is complex. A programmer required many skills for a better programming. Different skills like programming skills, designing skills, logical thinking and problem-solving skills are needed. If a programmer does not have an extreme knowledge about programming, then it becomes difficult for them to code and manage.	8

| | | **Large size & Many Instructions –** Programs of object-oriented programming are of larger size in comparison with the traditional procedural programming. Due to the larger size of the program, many instructions are needed to execute the program. This makes the code complex and lengthy.

Slow Speed – Due to large size of the programs its execution speed becomes slow. Even many coding instructions make the execution of the program slower and effects its efficiency. | |

Mark scheme (award up to 8 marks)

Level	Mark	
	0	No rewardable material
1	1-3	Demonstrates isolated elements of knowledge and understanding, there will be major gaps or omissions Few of the points made will be relevant to the context in the question Limited discussion which contains generic assertions rather than considering different aspects and the relationship between them
2	4-6	Demonstrates some accurate knowledge and understanding, with only minor gaps or omissions Some of the points made will be relevant to the context in the question, but the link will not always be clear Displays a partially developed discussion which considers some different aspects and some consideration of how they interrelate, but not always in a sustained way
3	7-8	Demonstrates mostly accurate and detailed knowledge and understanding Most of the points made will be relevant to the context in the question, and there will be clear links Displays a well-developed and logical discussion which clearly considers a range of different aspects and considers how they interrelate, in a sustained way

Question Number	Answer	Mark
4a	An explanation such as: Decomposition can be used to break a problem down into smaller parts (1) making it easier to solve / manage each problem (1) Abstraction is used to simplify pieces of code / processes (1) this will save time / speed up the program. (1) Abstraction is to remove unnecessary data (1) making it easier to develop the game (1) Award any other valid response.	4

Question Number	Indicative Content	Mark
4b	Features of event driven languages: **Events** The program responds to individual user actions, such as the entry of data, user pressing a button, etc. As actions can be assigned to events, they are suitable for tasks where the computer only needs to respond to user inputs. Good for use with data processing programs. The assignment of events makes them suitable for creating graphical user interfaces and buttons that can be clicked, to action regularly performed tasks. The development of a GUI (Graphical User Interface) based solution may be overly complicated for a simple data handling application. The development and design of the GUI is likely to extend the development time of a program. **Event handlers** The event handler is a section of code that denotes the action that will be carried out when an event occurs. Each event will be written as a separate function/subroutine. The modular nature of the code makes debugging and testing easier, as code can be tested in separate chunks. As events do not affect another if a section of code is not tested correctly, an error may not be	10

noticed. The program may appear to work until incorrect code is run.

Event loops
Used to monitor the events the program must respond to. Constantly runs, waiting for the predefined event to be triggered.

Constant running uses some CPU processing time even when the program is not actively being used.

Service orientated processing
Allows execution of code to be linked to a service that may run in the background.

Allows programs to be linked to a service that it may use, giving the event driven programs greater flexibility in the way they are used.

The drawback of linking a program to a service, is that the program will always run in the background using up system processing time and memory.

Time driven
Allows functions in a program to be scheduled, to activate at times or at intervals.

Allows the programmer to add functions that do not need to be monitored/activated by the user, or tasks that are best scheduled when the system will not be in use by the user.

Trigger functions
Trigger functions are designed to assign a event with an action.

Mark scheme (award up to 10 marks)		
Level	Mark	Descriptor
	0	No rewardable material
1	1-4	Demonstrates isolated knowledge and understanding, there will be major gaps or omissions Breaks the situation down into component parts and a few of the points made will be relevant to the context in the question Limited analysis which contains generic assertions rather than interrelationships or linkages
2	5-7	Demonstrates some accurate knowledge and understanding, with few minor omissions/any gaps or omissions are minor Breaks the situation down into component parts and some of the points made will be relevant to the context in the question Displays a partially developed analysis which considers some interrelationships or linkages but not always sustained.
3	8-10	Demonstrates mostly accurate and thorough/detailed knowledge and understanding Breaks the situation down into component parts and most of the points made will be relevant to the context in the question Displays a well-developed and logical analysis which clearly considers interrelationships or linkages in a sustained manner

Question Number	Indicative Content	Mark
4c	**Power** Use of a language such as HTML/HTML5 would give only limited functionality/computational power, owing to it being a mark-up language rather than a true programming language. To successfully implement the package as a web-based product, may need to incorporate different web development language such as Java Script and other support, such as API usage in HTML5 to execute multimedia functionality and additional features. **Performance** Consider the language/scripting used and how this is implemented. Using server-side processing means many of the tasks in the web program would be executed by the server. May cause issues in relation to the speed at which a program appears to respond to user interaction. Could make use of scripting to split certain tasks between the client and server, to improve	12

performance (although performance may be more dependent on the power of the client machine). Executing too many tasks on the server could overload it, especially if a large volume of traffic is expected.

Use of additional client programs, installed locally on the client machine, which interact with the server via the web interface, is one way of splitting the load between the server and client. Using this approach requires competence in a range of different programming and scripting languages. This may increase the development time required. Users may be unwilling to install untested/unknown software.

Use of additional clients may also increase the scope of testing needed, such as additional compatibility and functionally factors that will need testing.

Platform independence
Using a web-based solution would remove many compatibility issues. Due to the independent nature of many web languages, the operating system that the user has installed should have no impact on being able to access the program.

The use of a web platform should reduce the development time, as different versions would not need to be produced for different operating systems. However, the program would need to be tested in different browsers, especially if using plug-ins/extensions.

Security
Security of the data held on the system consideration, especially if any user data is stored on the remote server.

If program held and executed on a remote server then, adequate protection of the data being held (such as usernames, passwords, etc.) would need to be in place, to avoid threats (viruses, hackers, etc.).

The use of an encrypted connection (https instead of http) would also need to be established in order to protect sensitive data.

Protocols
Setting up sophisticated security protocols may require additional programmers and data security experts" involvement. Impacts on development time and costs.

| | Webpages use a standard protocol (http) to communicate between systems, allowing for a platform independent solution. Additional webpage functionality may need to make use of other protocols that enable the use of some web services. Impacts on development time and cost of adding extra services.

The use of web services that may use fewer common protocols, may impact on the end user as they may need to install additional software, in order to use the product. Users with limited computing capability may find accessing the product difficult, so the product is less likely to reach its intended audience.

Additional guidance
Allow the implications of the game running on the web, for example wider audience, loss of connection etc.. | |

Mark scheme (award up to 12 marks)

Level	Mark	Descriptor
	0	No rewardable material
1	1-4	Technical vocabulary is used but is not used appropriately to support arguments in relation to the issues of the question. Few of the points made will be relevant to the context in the question. Limited evaluation which contains generic assertions leading to a con present) that is superficial or unsupported
2	5-8	Accurate technical vocabulary is used to support arguments but not all are relevant to the issues of the question Some of the points made will be relevant to the context in the question, but the link will not always be clear. Displays a partially developed evaluation which considers some different competing points, although not always in detail, leading to a conclusion which is partially supported.
3	9-12	Fluent and accurate technical vocabulary is used to support arguments that are relevant to the issues of the question Most of the points made will be relevant to the context in the question, and there will be clear links 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.