Mark Scheme (Results)

Summer 2022

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

BTEC Qualifications from Pearson

BTEC qualifications from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.btec.co.uk for our BTEC qualifications.

Pearson: helping people progress, everywhere

Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

June 2022
Publications Code 31768H_2206_MS

General Marking Guidance

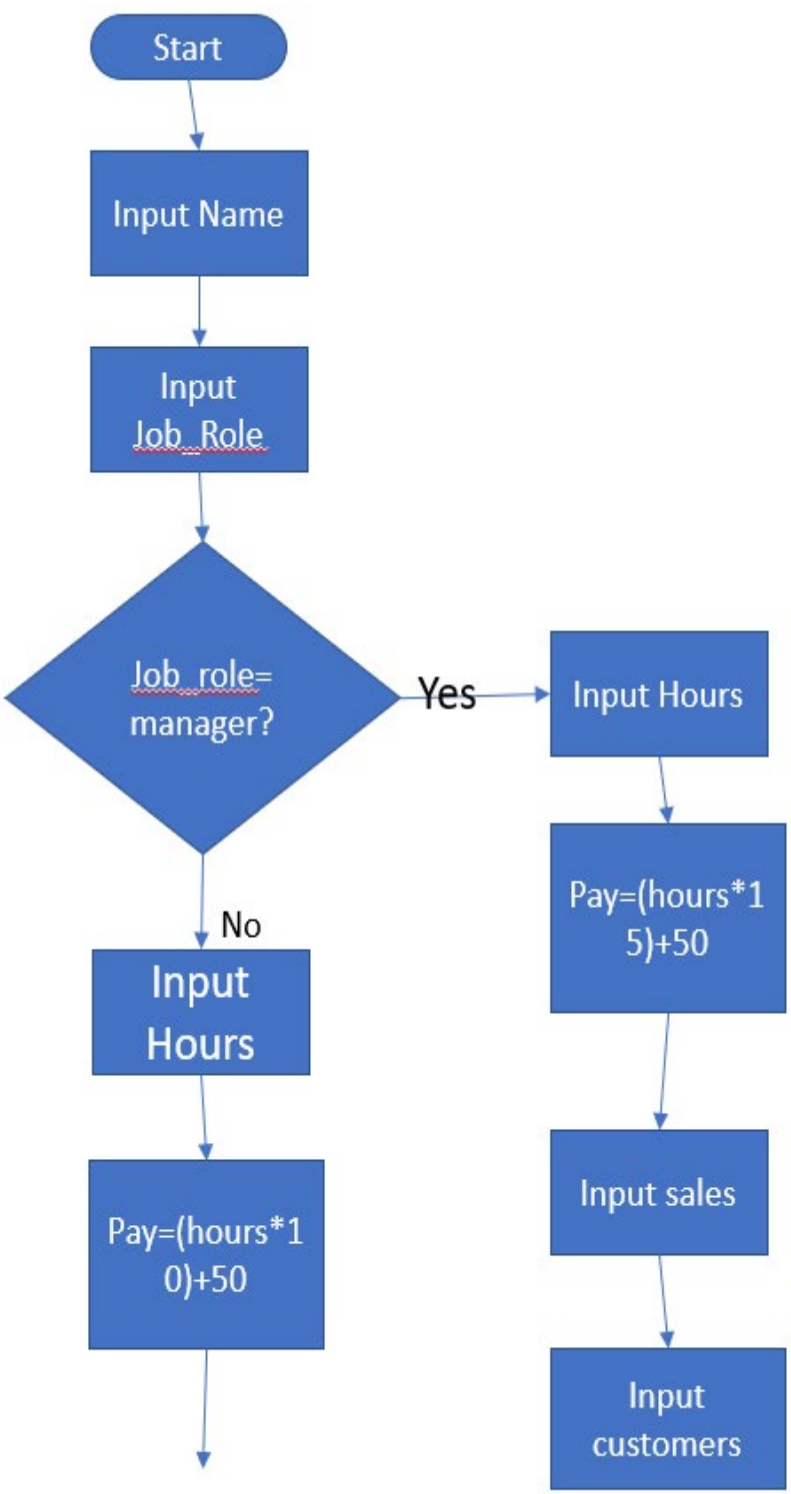
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- All marks on the mark scheme should be used appropriately.
- All marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if a candidate's response is not worthy of credit according to the mark scheme.
- Where some judgment is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt about applying the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed-out work should be marked UNLESS the candidate has replaced it with an alternative response.
- Phonetic spelling should be accepted.

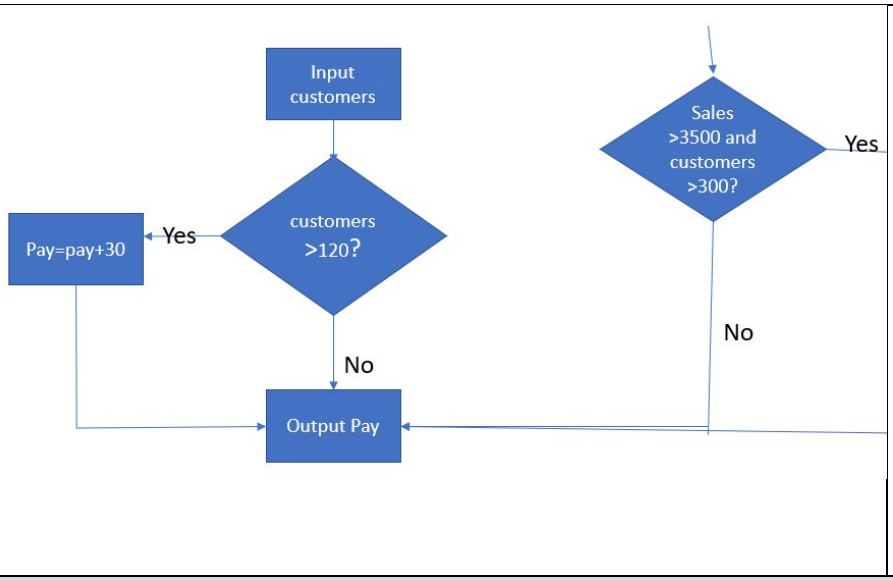
Question Number	Answer	Mark
1a	Any three from: Decomposition (1) Abstraction (1) Pattern recognition (1) Algorithm design (1)	3

Question Number	Answer	Mark
1b	Award 2 marks for identification of two variables to be used and 1 mark for identification of a constant that can be used. **Variable:** • Hours worked • Customers served • Job role • Total sales • Total pay • Bonuses paid **Constant:** • Base rate / Base pay • Manager pay rate • Staff pay rate • Staff bonus • Manager bonus **Additional Guidance** Ignore case, underscores etc in variable names Accept any appropriate recognisable names	3

Question Number	Answer	Mark
1c	Description of use of Integer and Boolean such as: **Integer** This stores whole numbers (1) and can be used to accept number of customers served (1) **Boolean** Used to accept True or False (1) such as bonus paid (1) **Additional Guidance** For expansion mark accept descriptions of uses that would be appropriate in a payroll program.	4

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. Format check (1) for example employee ID/postcode/NI Number/DOB(1) Length check (1) for example employee ID/phone number (1) Presence check (1) to ensure something is entered for hours worked (1) Range check (1) to check hours worked >0 and <60 (1) Type check (1) to ensure numerical data only entered in hours worked (1) **Additional Guidance** Expansion must relate to scenario. Accept other appropriate expansions that are suitable for the given scenario i.e. payroll program	4

Question Number	Answer	Mark
1e	Sample solution 	6



Level	Descriptor
0 0 marks	No rewardable material
1 1-2 marks	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 3-4 marks	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 5-6 marks	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 line number and one mark for correct pseudocode, up to a maximum of **six** marks. Line 1 (1) FOR count 1 To 10000 (1) Line 3 (1) IF house_value > 250000 (1) Line 13 (1) OUTPUT taxband (1)	6

Question Number	Answer	Mark
2b	Award one mark for identification of why it is used, one mark for an appropriate linked explanation and one mark for an appropriate extended explanation, up to a maximum of three marks. 'Taxband' is not used in calculations (1) it is just a code (1) and is only used to determine the tax band of each house (1) Taxband is only used for output (1) it will not be used in calculations (1) so no need to declare as an integer/float (1). **Accept any other valid response**.	3

Question Number	Answer	Mark
2c	Award one mark for identification of why it is used and one mark for an appropriate linked explanation, up to a maximum of two marks. The local council knows there are 10000 houses (1) so a For loop is used as the number of iterations is **known** (1) A While loop would contain an (early) exit condition (1) which is only needed if the number of iterations is **unknown** (1) **Accept any other valid response.**	2

Question Number	Answer	Mark
2d	Award one mark for identification of use and one mark for an appropriate linked explanation, up to a maximum of two marks. A record can store more than one data type (1) so all data can be held in same data structure (1) Can search/locate data easily (1) because each data item can be assigned a unique identifier (1)	2

Question Number	Answer	Mark
2e	Description of use of Blocks and Procedures such as: **Blocks** Can be used to treat a group of statements as one whole unit (1) for example a block to declare variables (1) **Procedures** When the statements have been setup (1) the procedures can then be used to carry out specific actions/calculations /tasks (1) Can be (repeatedly) called throughout the program (1) without needing to re-write code (1)	4

Question Number	Answer	Mark
2f	**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 JavaScript 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 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. Residents could access and use the program, using any internet-enabled device in school or at home. The use of a web platform should reduce the development time, as different versions would not need to be produced for different operating	6

	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 program running on the web, for example wider audience, loss of connection etc..	

Level	Mark	Descriptor
Level 0	0	No rewardable material.
Level 1	1-2	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
Level 2	3-4	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
Level 3	5-6	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
3a	A description of branching and iteration such as: **Branching** Can be used to **select/decide** which group a pupil goes into (1) depending on the month number input (1) **Iteration** Repeat/loop the process/decision (for each pupil) (1) until all (100) pupils have had their details entered (1) **Accept any other valid response.**	4

Question Number	Answer	Mark
3b	Award one mark for identification of how each can be used and one mark for an appropriate linked explanation, up to a maximum of four marks. **Boolean operators** These can be used to connect different options (e.g. birth months) (1) such as a range between 1 **and** 4 (1) **Relational operators** Compares two arithmetic expressions/values (1) to set the boundaries for each group (e.g. >= 1) (1)	4

Question Number	Answer	Mark
3c	Award one mark for identification of a benefit and one mark for an appropriate linked explanation, up to a maximum of four marks. • Increases program readability of the larger program (1) as code will be grouped together (1) • Reduces the chances of error (1) as the number of lines of code is reduced (1) • Aids debugging / errors are easier to find (1) as errors are localised to the function (1) • Code would still be easy to modify (1) as variables would only be used in the function and not the rest of the program (1) • Could reduce development time (1) as sections of code only need to be written once (and called later) (1)	4

Question Number	Answer	Mark

3d	**Sample Pseudocode**
	
	R = 0
	G = 0
	W = 0
	
	FOR x = 1 to 100
	
	INPUT birthnum
	
	IF birthnum >= 1 AND birthnum <= 4 THEN
	OUTPUT "Red group"
	R = R + 1
	
	ELSE IF birthnum >= 5 AND birthnum <= 8 THEN
	OUTPUT "Green group"
	G = G +1
	
	ELSE IF birthnum >= 9 AND birthnum <= 12 THEN
	OUTPUT "White group"
	W = W + 1
	END IF
	END FOR
	OUTPUT R, G, W
		8

Level	Descriptor
0 0 marks	No rewardable material
1 1-3 marks	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 marks	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 marks	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	Answer	Mark
4a	Award one mark for identification and one mark for an appropriate linked explanation up to a maximum of two marks. Array indexing is counted from 0 (1) so the final item in the array would be 11 / index 12 is an **out of range** error (1)	2

Question Number	Indicative Content	Mark
4b	A description to contain **three** from: Initialised to **False** at the start of the algorithm (1) If pairs of numbers are swapped, set to **True** (1) When all numbers have been compared, check swaps (1), if swaps is **True**, repeat algorithm / process again (1) if no swaps take place the swaps variable will be **False** and the algorithm will end (1)	3

Question Number	Indicative Content	Mark
4c	Bubble sort is commonly used by beginners because it is logically easier to understand. Bubble sort is as fast for small data sets because Quick Sort has extra overhead from the recursive function calls. Bubble sort is more stable than Quick sort and requires less memory. Average case of bubble sort is generally the best case for quick sort, however for short arrays (under 1,000 elements), the benefits of Quick Sort are minimal, and might be outweighed by its complexity, if the goal is readability. Bubble sorts will sort the data just as fast as a quick sort as the number of items to be sorted is small. If the number was larger, a quick sort would be more efficient. Bubble sorts are easy to create programming code for. Although the numbers could increase it will not reach an amount that will affect the performance of a bubble sort. The bubble sort is better than quick sort in practice for small set of data, but as size of input data increases, the performance of bubble sort suddenly drop down and the exact opposite behaviour is found with quick sort.	10

	Bubble sorts take up less memory whereas quick sorts rely on more memory as more code will be running.	

Mark scheme (award up to 10 marks)		
Level	Mark	Descriptor
0	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
4d	**Linear Search** Each item is compared against the item being searching for. Worst case scenario, 500,000 comparisons / all values checked. The search criteria will be entered before the search begins. The search then starts with the first item and compares each item in turn until either a match is found, or it reaches the end of the data with no match. ***Benefits*** Will perform fast searches of small to medium lists. With today's powerful computers, small to medium arrays can be searched relatively quickly. Slow searching of large lists. The list does not need to sorted. Unlike a binary search, linear searching does not require an ordered list. Not affected by insertions and deletions. As the linear search does not require the list to be sorted, additional elements can be added and deleted. As other searching algorithms may have to reorder the list after insertions or deletions, this may sometimes mean a linear search will be more efficient. ***Drawback*** Slow searching of large lists. **Binary Search** The list must be in order for a binary search to work. Binary search splits size of list in half each time / uses divide and conquer. Worst case scenario, many fewer comparisons. ***Benefits*** Binary search is more efficient / linear search is less efficient. For large lists of data, it works significantly better than linear search.	12

	Much quicker than a linear search because the data that needs to be searched halves with each step. ***Drawbacks*** It employs recursive approach which requires more stack space. Programming binary search algorithm is error prone and difficult. ***Conclusion*** Although a binary search is a little harder to program, it is far more efficient than a linear search. *When should you use a binary search?* If the list is large and changing often, with items constantly being added or deleted, then the time it takes to constantly re-order the list to allow for a binary search might be longer than a simple serial search in the first place. If the list is large and static, then a binary search is very fast compared to a linear search. If the list is small, then it might be simpler to use a linear search.	

Mark scheme (award up to 12 marks)		
Level	Mark	Descriptor
0	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 conclusion (if 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.