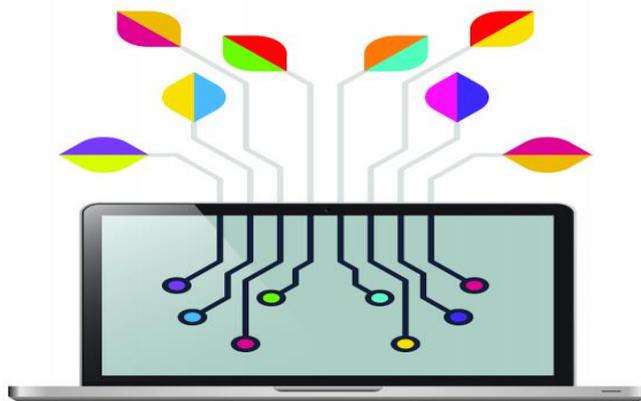Mark Scheme (Results)

January 2018

BTEC Level 3 National in Computing
Unit 1: Principles of Computer Science
(31768H)

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Unit 1: Principle 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.
- Marking 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 marking grid, not according to their perception of where the grade boundaries may lie.
- All marks on the marking grid should be used appropriately.
- All the marks on the marking 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 marking grid.
- Where judgement is required, a marking grid will provide the principles by which marks will be awarded.
- When examiners are in doubt regarding the application of the marking grid to a learner's response, a senior examiner should be consulted.

Specific marking guidance

The marking grids have been designed to assess learner work holistically. Rows in the grids identify the assessment focus/outcome being targeted. When using a marking 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.
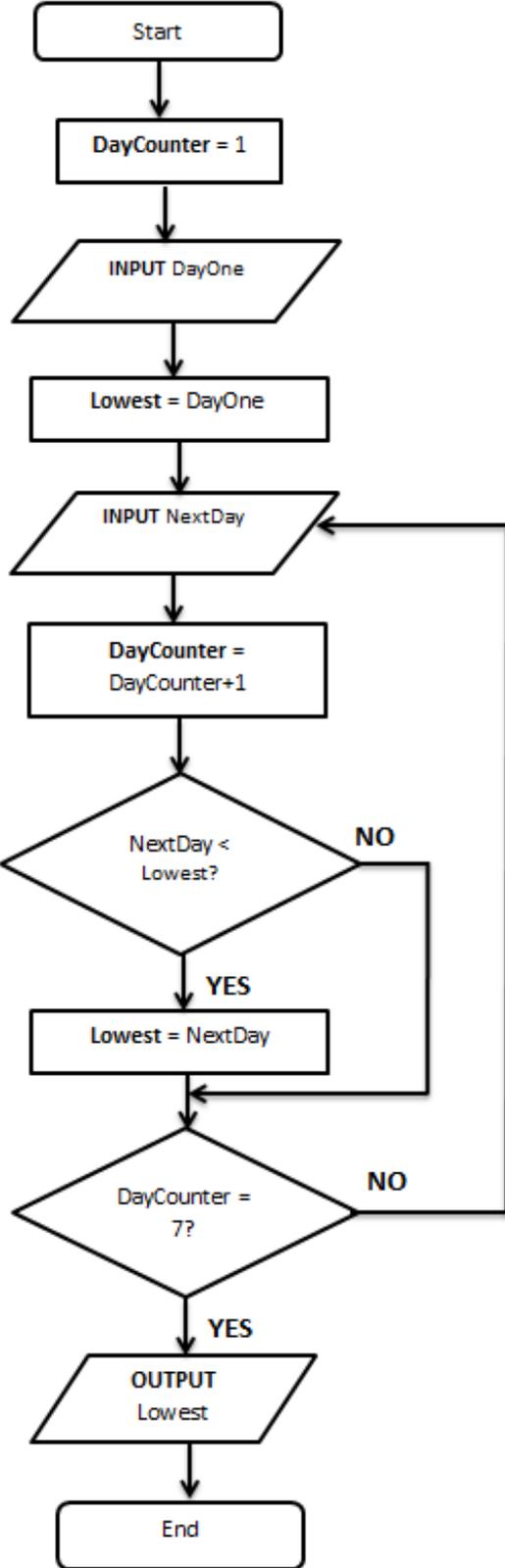
Question Number	Answer	Mark
1a	Award **1** mark for each of the following up to **four** marks: • Algorithm does not subtract the discount (£2) • Standard electric daily charge is not included (7*0.50). • ElectricBill variable is output instead of TotalBill variable / does not output GasBill variable • ElectricNightUsed is not entered/declared	4

Question Number	Answer	Mark
1b	Explanation to include any **three** from: • The algorithm is calculating currency/ money (1) • Therefore the variable value requires a decimal point / integers only store whole numbers (1) • An integer would remove/truncate the value after the decimal point (1) • Which can lead to inaccurate results being outputted (1) **Additional guidance:** Do NOT accept 'The variable is rounded up/down if stored as an integer'	3

Question Number	Answer	Mark
1c	Control structure: Sequential/Linear (1) Description to include any **two** from:	3

- all lines of code are executed (1)

- in order from the first line to the last line (1)

- without the use any selection / iteration (1)

Additional guidance

For mark point 2, accept 'line by line'.

Question Number	Answer	Mark
1d	A linked explanation to contain any **three** from: • the program will not continue (1) • until/only numerical values are input (1) • so calculations can take place (1) • to reduce (runtime/calculation) errors (1) • to ensure the total is more reliable/sensible (1) **Additional guidance** Allow 'comparisons' for calculations in mark point 2.	3

Question Number	Answer	Mark
1e	**EXAMPLE SOLUTION:**	7

EXAMPLE SOLUTION:

Start

DayCounter = 1

INPUT DayOne

Lowest = DayOne

INPUT NextDay

DayCounter = DayCounter+1

NextDay < Lowest?
- NO
- YES → Lowest = NextDay

DayCounter = 7?
- NO → (back to INPUT NextDay)
- YES → OUTPUT Lowest

End

Mark scheme (award up to 7 marks)		
Level	Mark	Descriptor
Level 0	0	No rewardable material.
1	1-2	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.** Use of logical operations and sequence/structure of processes demonstrate **limited accuracy.** There is **limited use** of accepted conventions. A **partial** and/or highly inefficient solution has been achieved.
2	3-5	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.** Use of logical operations and sequences/structure are **mostly accurate** with only minor errors. Accepted conventions have been applied but there are **some inconsistencies.** An **almost complete/inefficient** solution has been achieved.
3	6-7	Structure of the algorithm uses appropriate and consistent hierarchies/subdivision **providing clarity and readability**. Variable/object/process names are appropriate and **used consistently.** Use of logical operations and sequences/structures are **accurate throughout.** Accepted conventions have been used **consistently.** A **full and efficient** solution been achieved.

Question Number	Answer	Mark

2a	Explanation to include:
	
	• a (single) line of code (1)
	
	• that provides instructions/tasks/ actions (for the computer/program) (1)
	
	• such as to assign values to variables (1)
	
	Additional guidance:
	Allow all other variations of uses of statements for marking point 3 such as:
	    • carryout calculations
	
	    • create conditions
	
	    • IF statements
	
	    • create loops
	
	Allow 1 mark maximum for an example use of a statement.
		3

Question Number	Answer	Mark
2b	Explanation can contain any **three** from: • The code will only generate one set of numbers (1) • That are stored under a single identifier (1) • More efficient than individual variables (1) • Because all of them are of the same type (1) • Easy to check the numbers used/created (1) • Makes use of indexes to identify each position in the array (1) • There are a fixed number of values (1) • The values are replaced each time the code is run (1)	3

Question Number	Answer	Mark
2c	Award 1 mark for correctly identifying the line of code and one mark for **one** additional mark for appropriate expansion up to **four** marks. **Line of Code:** Line 3 / Line 7 (1) **Explanation:** • the array is specified at 80 elements (1) • the code will create 90 numbers (1) • therefore creating too many numbers for the size of the array (1) **Additional Guidance:** Allow for students writing out the correct line of code with an error instead of a stating the line number.	4

Question Number	Answer	Mark
2d	Explanation to include any two from: • it is defining a (for) loop / ensuring code repeats (1) • to (execute/iterate) 90 times / until the loop reaches 89 (1) • to ensure all (90) numbers can be generated/added (1) **Additional guidance:** Do NOT accept 'repeats code 89 times / generate 89 numbers'	2

Question Number	Answer	Mark
2e	Description to include any two from: • this will check each position in the array (1) • to check if the random number has already been generated (1) • if so it will go back to the start (of the loop) (1) • in order to so generate another number (1)	2

Question Number	Answer	Mark
2f	Explanation to include any **six** from: • the numbers are added in a random order / not sorted (1) • the search will only work on a sorted list (1) • so (upper, lower, mid) boundaries will be set incorrectly (1) • causing half of the array with 70 to be discarded / the number 70 cannot be found (1) • which therefore creates an error (1) • not ideal for a small list (1) • therefore a linear search would be more appropriate (1)	6

Question Number	Answer	Mark
3a	Award **one** mark for identification and **one** additional mark for appropriate expansion up to **three** marks. • (When the submit button is pressed) a timer will be set / current time is logged (1) • And the time is then monitored (1) • To **automate** the status updates / call a function (1) • After set time limits (1) • So that the user/operator does not need to monitor the status (1) • Which reduces human error (1) Additional guidance Allow examples that show understanding of time monitoring/automation. Allow 'program will be automated'.	3

Question Number	Answer	Mark
3b	Award **one** mark for identification and **one** additional mark for appropriate expansion up to **three** marks. • First In First Out /FIFO (1) • Therefore customers earlier in the queue will be prioritised (1) • As bookings are stored/executed in the booking order (1)	3

Question Number	Answer	Mark
3c	**Indicative Content:** **Variable Type:** • Siad has used local variables and a global variable. • Programmers generally only prefer local variables as they can be removed from the memory after they have been used to stop them being accessed by other parts/functions	10

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.

- The program has various functions and therefore a global variable could be altered in many different places within the code.

- If the program expands again in the future it can get very complicated trying to follow global variables throughout the code.

Variable Names:
- Naming conventions have not been used effectively.

- While they start with a word and use underscores, the variable names are not sensible and do not reflect their purpose so that the programmer will not know what they are actually used for.

- This will therefore increase the chances of errors / the amount of debugging as it means that the programmer may make mistakes when attempting to pass the correct variables from one part of the code to another.

Choice of Data Types:
- The choice of data types is poor. The programmer has chosen to only use a string data type and this is not appropriate for all variables.

- These could therefore stop the code from being able to make comparisons/calculations that are needed to make decisions within the code (e.g. comparing the current time to the time the booking was placed).

General / Conclusion:
- The decision to use global variables decrease data integrity as the values within the programming code can be changed by other functions therefore decreasing the accuracy of the calculations.

- The decisions around the variables names could increase the number of errors in the

<table>
<tr><td></td><td colspan="2">programming code. If these are used consistency within the code then this would not cause any errors however the programmer may use/pass incorrect variables which may increase the amount of debugging required.

• The decisions around the choice of data types could impact on the accuracy of the calculations. These variables will be used with constants in the programming code and therefore storing variables as strings make calculations more problematic.</td><td></td></tr>
</table>

Mark scheme (award up to 10 marks)			
Level	Mark	Descriptor	
Level 0	0	No rewardable material.	
1	1-3	Technical vocabulary is used but is **not used appropriately** to support arguments in relation to the issues of the question. Issues are identified but **chains of reasoning are not made** leading to a superficial understanding of the relative importance of issues to the scenario. Does **not link arguments to the given scenario.**	
2	4-7	Accurate technical vocabulary is used to **support arguments** but **not all are relevant** to the issues of the question. A consideration of **relevant issues** using **logical chains of reasoning** but **does not** reflect upon their relative importance to the given scenario. Considers the various elements of the question and but **does not always link arguments** to the given scenario.	
3	8-10	**Fluent and accurate** technical vocabulary is used to **support arguments** that are **relevant** to the issues of the question. A **balanced consideration** of relevant issues using **coherent and logical chains of reasoning** that shows a **full awareness** of their relative importance to the given scenario. **Carefully considers** the various elements of the question and **Links arguments** to the given scenario.	

Question Number	Answer	Mark
3d	**Possible Answers:** **General:** • A quick sort is generally the fastest sorting technique however it is dependent on choosing a pivot that is not close to the lowest or largest elements in the list. • The most efficient pivot will be a value somewhere in the middle of the list (e.g. 54). The least efficient pivot will be the lowest or highest value in the list (e.g. 25). **Use The Leftmost/Rightmost Element:** • This means choosing the first element in the list. For example, 25 is actually the lowest element in this list this could create the 'worst case' for a quick sort O (n^2). • Choosing 25 as the pivot would create two sublists of 0 elements and 8 elements (n-1) which therefore increases the amount of time it takes to sort the data into order as it takes more recursive calls to sort the data. • This therefore increases the amount of memory that would be used in order to sort the numbers. As the list of numbers is almost sorted this would then be repeated for almost all of the pivots in this sort which will therefore increasing the running time. • This would also be the same if the last / rightmost element had been selected. **Median of Three Approach:** • He could use a 'median' / 'median of three' approach. Therefore he could take any three random values and then order them into first, middle and last value and then take the middle value as the pivot. • This would reduce the change of 'worst case' performance for a quick sort O (n log n) because you know that the pivot will not be the first or last element. • Using the middle value would create two more balanced sublists and so therefore less	8

recursions are needed which will therefore decrease the amount of time needed to sort the data. This would also decrease the amount of memory needed.

Mark scheme (award up to 8 marks)

Level	Mark	Descriptor
0	0	No rewardable material
1	1-3	Technical vocabulary is used but are **not used appropriately** to support arguments in relation to the issues of the question. Issues are identified but **chains of reasoning are not made** leading to **a superficial understanding** of the relative importance of issues to the scenario.
2	4-6	**Accurate technical vocabulary** is used to **support arguments** but **not all are relevant** to the issues of the question. A **consideration of relevant issues** using **logical chains of reasoning** but **does not reflect** upon their relative importance to the given scenario.
3	7-8	**Fluent and accurate** technical vocabulary is used to **support arguments** that are **relevant** to the issues of the question. A **balanced and wide ranging** consideration of **relevant** issues using **coherent and logical chains** of reasoning that shows a **full awareness** of their relative importance to the given scenario.

Question Number	Answer	Mark
4a	An explanation to contain any four from: • most up-to-date list (1) • work together in real time (1) • reduce duplication (1) • don't need specific software (1) • Paul can manage the process more effectively (1) • reduces the processing load on the user's computer (1) **Additional guidance** Allow different example uses of Paul managing the process – mark point 5. E.g. closing the playlist after a certain amount of time.	4

Question Number	Answer	Mark

4b	**EXAMPLE SOLUTION:**
	
	BEGIN
	
	PlayListArray = []
	
	INPUT Duration
	PlaylistTime = Duration – (Duration/ 100 * 25)
	
	Put LastSelected into descending order
	
	Allocation=PlaylistTime*(45/100)
	RequiredPopularity = 5
	Run **FUNCTION** AddSongs
	
	Allocation =PlaylistTime *(30/100)
	RequiredPopularity = 4
	Run **FUNCTION** AddSongs
	
	Allocation =PlaylistTime *(25/100)
	RequiredPopularity = 3
	Run **FUNCTION** AddSongs
	
	FUNCTION AddSongs:
	
	WHILE Allocation > 0:
	      FOR each line in file:
	         IF Popularity = RequiredPopularity **THEN**
	           Add songID to PlaylistArray
	           Allocation = Allocation – SongLength
	           LastSelected = 0
	         ENDIF
	       ENDFOR
	ENDWHILE
	
	END
		10

Mark scheme (award up to 10 marks)		
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 Use of logical operations and sequence/structure of processes demonstrate limited accuracy. There is limited use of accepted conventions

		A partial and/or highly inefficient solution has been achieved.
2	4-7	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
		Use of logical operations and sequences/structure are mostly accurate with only minor errors.
		Accepted conventions have been applied but there are some inconsistencies.
		An almost complete/inefficient solution has been achieved.
3	8-10	Structure of the algorithm uses appropriate and consistent hierarchies/subdivision providing clarity and readability.
		Variable/object/process names are appropriate and used consistently
		Use of logical operations and sequences/structures are accurate throughout.
		Accepted conventions have been used consistently
		A full and efficient solution been achieved.

Question Number	Answer	Mark
4c	**Indicative Content:** **STORAGE CONSIDERATIONS:** • He could make use of a front end web server and a backend database server to keep his website and data separated. • He could configure a firewall to ensure that the backend will only communicate with the front end to reduce attacks such as SQL injections. • He could store personal data into different areas/tables. For example he could store bank card details in one table, log-on credentials in another table and other personal details in another table. • Therefore if an attacker accesses a table then they are unlikely to access all of the data within the database. • He could also encrypt the data that is stored to ensure that if this was accessed by an attacker then they would not be able to read /	12

make sure of the data.

SSL CERTIFICATES:
- If he is handling the payment transaction himself he will need to setup a Secure Socket Layer (SSL) certificate. In order to obtain this he is going to have to prove this identify. This can include sending him a letter to his address to prove that his address exists or asking him to put some code into his website to prove that he owns the domain.

- When he has obtained an SSL certificate this will allow him to make use of encryption which will encrypt all payment transaction data while it is being transferred from one location to another. This will allow show his customers that his site is a legitimate site so they will feel more confident entering their payment details.

- He cannot handle the payment process completely on his own as he is going to need to have contact with an external source at some point (e.g. bank account etc) to transfer the money. Using this method he may be required to store more data (including the card details) and so therefore he is going to need to setup security on the location where the data is stored.

- As his company is likely to be relatively small, it is probably not going to be worth his while setting up the code to take payments securely when he could use payment gateways to handle the small amount of transactions for him.

Payment Gateways:
- The payment can be handled by an external source via a payment gateway such as an API. They can handle part of the transaction or all of the transaction depending on his preferences. External providers will often specialise in payment transactions and so therefore they will have strict security procedures already setup. This will then reduce his workload allowing him to focus on the functionality of his site rather than creating code to handle payments securely from customers. However there is usually a

fee involved with using these services.

- **RESTFUL API** - He could make use of a RESTful API which would partly handle the payment details. When this is setup, the external provider will wait for credit/debit card details to be entered by his customers and then the API will send back a notification that the card details are correct. They will then send the payment to his bank account. By doing this, it means that he will never see or need to store customer bank card details. Instead he would store less sensitive data such as the transaction date and transaction ref/ID. This would then often direct the customer back to his site and so he could setup other automated features linked to a successful payment.

- **HANDLE ALL API** - Another alternative is that he could make sure of an API which handles all of the transaction. The company will probably give him HTML code to copy into his website that will direct customers to their website. They will then deal with the payment entirely and then let him know that the transaction has been carried out successfully. However he would not be able to make use of additional automated services as this would often take the user away from his site.

Mark scheme (award up to 12 marks)

Level	Mark	Descriptor
Level 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. Issues are identified but chains of reasoning are not made leading to a superficial understanding of the relative importance of issues to the scenario Does not link arguments to the given scenario
2	5-8	Accurate technical vocabulary is used to support arguments but not all are relevant to the issues of the question A consideration of relevant issues using logical chains of reasoning but does not reflect upon their relative importance to the given scenario Considers the various elements of the question and but does not always link arguments to the given scenario
3	9-12	Fluent and accurate technical vocabulary is used to support

| | | arguments that are relevant to the issues of the question

A balanced consideration of relevant issues using coherent and logical chains of reasoning that shows a full awareness of their relative importance to the given scenario

Carefully considers the various elements of the question and Links arguments to the given scenario |
|---|---|---|