

## **Cambridge IGCSE**<sup>™</sup>

CANDIDATE NAME					
CENTRE NUMBER			CANDIDATE NUMBER		



**COMPUTER SCIENCE** 

0478/23

Paper 2 Problem-solving and Programming

May/June 2022

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

#### **INSTRUCTIONS**

- Answer all questions.
- Do not attempt Tasks 1, 2 and 3 in the copy of the pre-release material on page 2; these are for information only.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do not write on any bar codes.
- Calculators must not be used in this paper.

### **INFORMATION**

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

#### Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the following tasks before the examination to answer Question 1.

#### Pre-release material

Seaview Castle Visitor Centre is open seven days a week. It offers a range of facilities and activities including meeting rooms, a permanent fossil exhibition, supervised walks along the cliff tops and an old stone quarry.

There are three meeting rooms, which can each be booked separately. There is one large room that can be used for a variety of activities such as showing films, holding presentations, displaying exhibitions or wedding receptions. There are also two smaller meeting rooms. Each room can be booked by the day according to the following tariff:

Room	Cost per day
large	\$295
small 1	\$175
small 2	\$150

Write and test a program or programs to arrange meeting room bookings:

- Your program or programs must include appropriate prompts for the entry of data. Data must be validated on entry.
- All outputs, including error messages, need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these three tasks. Each task must be fully tested.

Task 1 – setting up a booking system structure for the meeting rooms

Set up suitable data structures for each of the three meeting rooms to store:

- when it is booked during a fixed eight-week period
- the client's name (the person making the booking)
- a unique booking code
- the cost of the booking.

#### **Task 2** – booking a meeting room

Extend the program in **Task 1** to enable bookings to be made so that the client enters their name, the meeting room required and the day of the booking. After the data has been entered, the program should check if the requested day is available for the required meeting room and if **not**, the client should be allowed to enter an alternative day or exit the program.

If the requested day is available, the booking details and cost of the booking should be output for the client to confirm. Once confirmed, a unique booking code should be generated and stored in both the appropriate meeting room data structure and the unique booking code data structure. The client's name and cost of the booking should be stored in the appropriate data structures set up in **Task 1**.

Bookings of more than one day must be entered as separate single day bookings.

#### Task 3 – using the booking data

Extend the program in Task 1 and Task 2 to make use of the data that is available, to:

- select a meeting room and output the days when it is free
- total and output the amount of money currently taken for all three meeting rooms
- check the bookings for a specific client.

1

,	All ۱	variables, constants and other identifiers must have meaningful names.
	(a)	Identify one variable and one array you could have used for Task 1 or Task 2.
		Give the use for the variable and array.
		Variable
		Use
		Array
		Use
		[4]
	(b)	Describe how you could test if the validation of the input to choose a meeting room works (Task 2).
		[2]
	(c)	Explain how your program in <b>Task 2</b> could be altered to allow a 30% discount on bookings for the same meeting room of two to six days, inclusive.
		[4]

- (d) Write an algorithm to show how your program completes the following parts of **Task 2**:
  - output the booking details and cost of the booking
  - take confirmation from the client
  - generate a unique booking code
  - store the booking details.

Assume that Task 1 and the first part of Task 2 have been completed.

Assume that the booking is for a single day and that the requested booking day is available.
Use pseudocode, programming statements or a flowchart.

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		101

(e)	Explain how your program selects a meeting room, finds and then outputs the days when it is available (part of <b>Task 3</b> ). Any programming statements used in your answer must be fully explained.
	[4]

### Section B

2 Tick (✓) one or more boxes in each row to match the type(s) of test data to each description.

	Types of test data					
Description	Boundary	Erroneous/ Abnormal	Extreme	Normal		
test data that is always on the limit of acceptability						
test data that is either on the limit of acceptability or test data that is just outside the limit of acceptability						
test data that will always be rejected						
test data that is within the limits of acceptability						

[4]

3	Describe what is meant by the terms variable and constant and give an example of each in you answer.	ır
	Variable	
	Constant	
		 4]

4 The pseudocode represents an algorithm.

The pre-defined function DIV gives the value of the result of integer division. For example, Y = 11 DIV 4 gives the value Y = 2

```
Count \leftarrow 0
INPUT Limit
FOR In \leftarrow 1 TO Limit
  Logic ← TRUE
  Test \leftarrow 2
  INPUT Number
    IF Number / Test = Number DIV Test
       THEN
         Logic \leftarrow FALSE
       ELSE
         Test \leftarrow Test + 1
    ENDIF
  UNTIL NOT Logic OR Test >= Number DIV 2
  IF Logic
    THEN
       Store[Count] ← Number
       Count \leftarrow Count + 1
  ENDIF
NEXT In
FOR Out \leftarrow 0 TO Count - 1
  OUTPUT Store[Out]
NEXT Out
```

(a) Complete the trace table for the algorithm using this input data: 5, 9, 5, 8, 10, 7

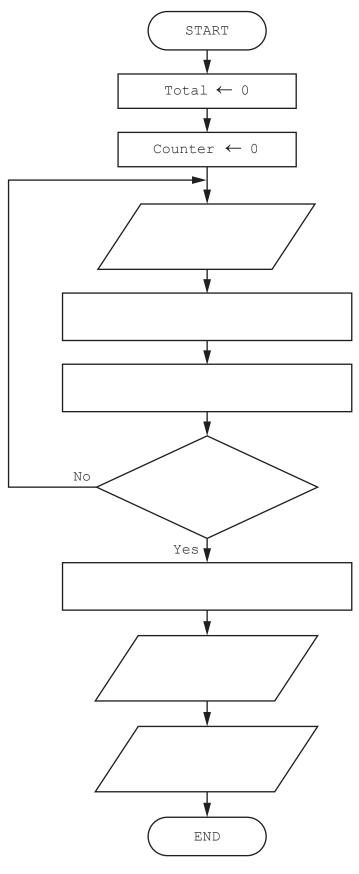
In	Logic	Test	Number	Store [Count]	Count	Limit	Out	ОИТРИТ

[7]

(b)	State the purpose of this algorithm.
	[2]
(c)	This algorithm only works for numbers that are 3 or greater.
	Describe how you could change this algorithm to make sure that only numbers that are 3 or greater are entered. Any pseudocode statements used in your answer must be fully described.
	[3]

- 5 The flowchart shows an algorithm that should:
  - allow 100 numbers to be entered into the variable Number
  - total the numbers as they are entered
  - output the total and average of the numbers after they have all been entered.

### Complete this flowchart:



Data about planets in the solar system is stored in a database table called PLANETS. The fields used in the table are shown.

Name of field	Contents of field
PlanetName	the name of the planet
PlanetMass the planet's mass in kilograms	
Larger	whether or <b>not</b> the planet has a greater mass than Earth
MaxDistance	the maximum distance the planet is from Earth in kilometres
MinDistance	the minimum distance the planet is from Earth in kilometres
YearLength	the length of time it takes for the planet to orbit the Sun in Earth days

(a) S	) State the name of the field that could contain Boolean data.								
	[1]								
(	) Complete the query-by-example grid to output the planets with a longer year length and greater mass than Earth. Assume Earth's year length is 365 days.Display only the name of the planets sorted in alphabetical order.								
Field:									
Table:									
Sort:									
Show:									
Criteria:									
or:	or:								
	[3]								

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## Cambridge IGCSE™

COMPUTER SCIENCE 0478/23

Paper 2 Problem Solving and Programming MARK SCHEME

May/June 2022

Maximum Mark: 50

#### **Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

### Cambridge IGCSE – Mark Scheme

#### PUBLISHED

#### **Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

#### GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

#### **GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always whole marks (not half marks, or other fractions).

#### **GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

#### GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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### **GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

### **GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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### Please note the following further points:

The words in **bold** in the mark scheme are important text that needs to be present, or some notion of it needs to be present. It does not have to be the exact word, but something close to the meaning.

If a word is underlined, this **exact** word must be present.

A single forward slash means this is an alternative word. A double forward slash means that this is an alternative mark point.

Ellipsis (...) on the end of one-mark point and the start of the next means that the candidate **cannot** get the second mark point without being awarded the first one. If a mark point has an ellipsis at the beginning, but there is no ellipsis on the mark point before it, then this is just a follow-on sentence and **can** be awarded **without** the previous mark point.

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Question	Answer	Marks					
	Section A	•					
1(a)	Many correct answers, the names used must be meaningful. The names given are examples only.  One mark per mark point, max four						
	Variable ClientName						
	Use Storing the name of the person making the booking						
	Array BookingsLarge[]     Use Storing the bookings for the large meeting room						
	<ul> <li>Task 1 – setting up a booking system structure for the meeting rooms</li> <li>Set up suitable data structures for each of the three meeting rooms to store:</li> <li>when it is booked during a fixed eight-week period</li> <li>the client's name (the person making the booking)</li> <li>a unique booking code</li> <li>the cost of the booking.</li> </ul> Task 2 – booking a meeting room Extend the program in Task 1 to enable bookings to be made so that the client enters their name, the meeting room						
	required and the day of the booking. After the data has been entered, the program should check if the requested day is available for the required meeting room and if <b>not</b> , the client should be allowed to enter an alternative day or exit the program.						
	If the requested day is available, the booking details and cost of the booking should be output for the client to confirm. Once confirmed, a unique booking code should be generated and stored in both the appropriate meeting room data structure and the unique booking code data structure. The client's name and cost of the booking should be stored in the appropriate data structures set up in <b>Task 1</b> .						
	Bookings of more than one day must be entered as separate single day bookings.						

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Answer						
One mark per mark point, max two						
<ul> <li>input a piece of normal test data that should be accepted // use Large, Small1 or Small2 to check that these data are accepted // use a menu and check the input matches the available options</li> <li>Input a piece of erroneous test data that should be rejected // entry of anything that is not Large, Small1 or Small2 should be rejected // anything not on the menu should be rejected</li> </ul>						
Explanation Task 2						
One mark per mark point, max four						
MP1 introduce a (new) variable/array for the number of days for the booking // introduce a (new) variable/array for the number of days for booking the same room // identify the number of days the same room has been booked by the same client						
MP2 use a conditional/IF statement to check if the length of the booking is 2 to 6 inclusive / 2, 3, 4, 5, or 6 //Use a CASE statement						
MP3 if it is, get the daily rate for the room booking						
MP4 multiply the number of days for the booking by the room rate						
MP5 multiply the total cost of the booking by 70%/.7// reduce the total cost by 30%						
	One mark per mark point, max two  MP1 input a piece of normal test data that should be accepted // use Large, Small1 or Small2 to check that these data are accepted // use a menu and check the input matches the available options  MP2 Input a piece of erroneous test data that should be rejected // entry of anything that is not Large, Small1 or Small2 should be rejected // anything not on the menu should be rejected  Explanation Task 2  One mark per mark point, max four  MP1 introduce a (new) variable/array for the number of days for the booking // introduce a (new) variable/array for the number of days for booking the same room // identify the number of days the same room has been booked by the same client  MP2 use a conditional/IF statement to check if the length of the booking is 2 to 6 inclusive / 2, 3, 4, 5, or 6 //Use a CASE statement  MP3 if it is, get the daily rate for the room booking  MP4 multiply the number of days for the booking by the room rate					

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Question	Answer	Marks						
1(d)	One mark per mark point, max six							
	<ul> <li>MP1 output all relevant input data using suitable variables for client name, meeting room choice, the booking day and the booking cost</li> <li>MP2 attempt to provide appropriate messages to accompany given output input with messages to confirm booking</li> <li>MP4 conditional statement or WHILE to check for a positive confirmation input attempt at generation of booking code</li> <li>MP5 attempt at generation of booking code fully unique booking code generated</li> <li>MP7 identification of meeting room using CASE or IF statements</li> <li>MP8 storage of booking code in both meeting room and booking code arrays/lists</li> <li>MP9 storage of client name and booking cost in appropriate arrays/lists</li> <li>Relevant parts of Task 2 for this question:</li> <li>output the booking details and cost of the booking</li> </ul>							
	<ul> <li>take confirmation from client</li> <li>generate a unique booking code</li> <li>store the booking details.</li> </ul> Assume the booking is for a single day and the requested booking day is available.							
	<pre>Example answer //Assume variables representing the current index position for the client //related arrays, ClientIndex, and index for date related arrays, //DateIndex, have been used OUTPUT "Your name is ", ClientName, Meeting Room ", MeetingRoom,</pre>							
	BookingCode ← BookingCode + 1  CASE OF MeetingRoom  'Lg': MeetingLarge[DayIndex] ← BookingCode  'S1': MeetingSmall1[DayIndex] ← BookingCode  'S2': MeetingSmall2[DayIndex] ← BookingCode							

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Question	Answer	Marks			
1(d)	<pre>ENDCASE BookingCode[ClientIndex] ← BookingCode ClientName[ClientIndex] ← ClientName BookingCost[ClientIndex] ← BookingCost //No ELSE clause is specified in the task or the question //so, ignore it if one is given ENDIF</pre>				
1(e)	One mark per mark point, max four  MP1 select the room whose records are to be searched // input the room whose records are to be searched MP2 use a suitable loop (to search through the array that stores the bookings data for that room)  MP3 use an IF statement/conditional statement to check if the current array element has a booking if not, use the array index to output the day represented Check each element in the array until all array elements have been checked	4			
	<ul> <li>Task 3 – using the booking data</li> <li>Extend the program in Task 1 and Task 2 to make use of the data that is available, to:</li> <li>select a meeting room and output the days when it is free</li> <li>total and output the amount of money currently taken for all three meeting rooms</li> <li>check the bookings for a specific client.</li> </ul>				

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Question	n Answer									
	1		Section B							
2	One mark per row, max four									
			Types of	Types of test data						
		Description	Boundary	Erroneous / Abnormal	Extreme	Normal				
		test data that is always on the limit of acceptability			✓					
		test data that is either on the limit of acceptability or test data that is just outside the limit of acceptability	<b>√</b>							
		test data that will always be rejected		✓						
		test data that is within the limits of acceptability			✓	<b>✓</b>				

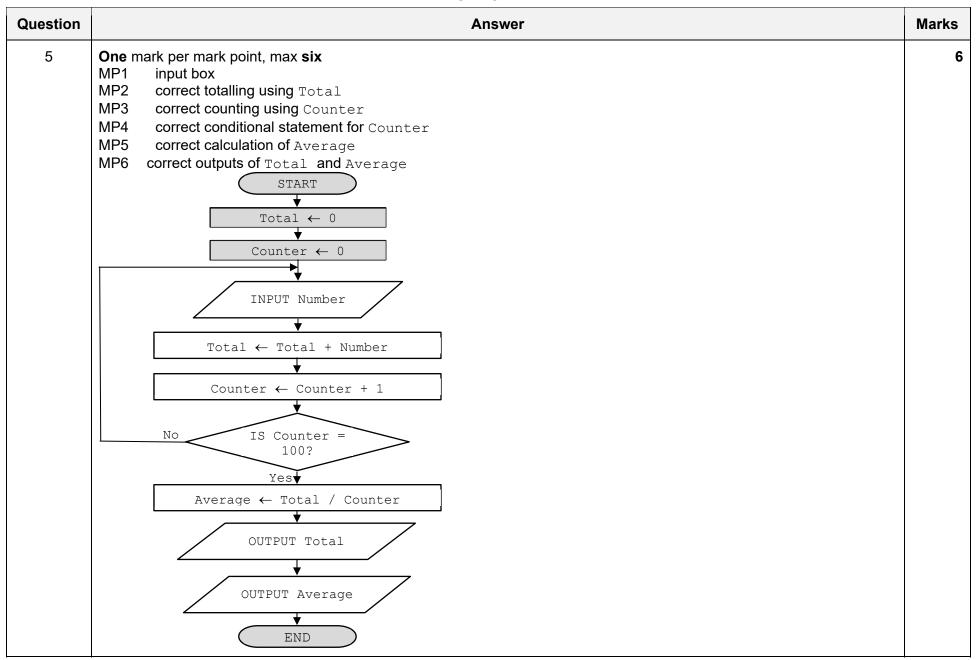
Question	Answer					
3	One mark per mark point, max four	4				
	<ul> <li>variables are used to represent values that can change during the execution of a program // variables can be used to store the results of calculations / counting / totalling // can store values entered by the user</li> <li>variable example – any data that is input into a program such as a date</li> <li>constants represent values that must stay the same throughout the execution of a program</li> <li>constant example – any value that does not change, such as Pi in mathematical formulae</li> </ul>					

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	ark per ma									
MP2 MP3 MP4 MP5 MP6 MP7	MP3 correct Test column MP4 correct Number column MP5 correct Store[Count] column MP6 correct Count and Limit columns									
	In	Logic	Test	Number	Store [Count]	Count	Limit	Out	ОИТРИТ	
						0	5			
	1	TRUE	2	9						
			3							
		FALSE								
	2	TRUE	2	5						
			3		5	1				
	3	TRUE	2	8						
		FALSE								
	4	TRUE	2	10						
	5	TRUE		7						
			3		7	2				
								1	7	
	MP4 MP5 MP6	MP4 correct N MP5 correct S MP6 correct C MP7 correct C  In  2  3	MP4 correct Number columnmP5 correct Store [Count and Logic In Logic In FALSE In The FALSE IN	MP4 correct Number column MP5 correct Store[Count] column MP6 correct Count and Limit colum MP7 correct Out and OUTPUT colum  In Logic Test  1 TRUE 2  3 FALSE 2 TRUE 2  FALSE 4 TRUE 2  FALSE	MP4         correct Number column           MP5         correct Store[Count] column           MP6         correct Count and Limit columns           MP7         Logic         Test         Number           1         TRUE         2         9           3         FALSE         2         TRUE         2         5           3         TRUE         2         8         FALSE         4         TRUE         2         10         FALSE         5         TRUE         2         7 <td< td=""><td>MP4         correct Number column           MP5         correct Store [Count] column           MP6         correct Count and Limit columns           MP7         Logic         Test         Number         Store [Count]           1         TRUE         2         9           3         FALSE        </td><td>MP4 correct Number column           MP5 correct Store [Count] column           MP6 correct Count and Limit columns           MP7 correct Out and OUTPUT columns           In         Logic         Test         Number [Count]         Count           1         TRUE         2         9           1         TRUE         2         9           FALSE        </td><td>MP4 correct Number column           MP5 correct Store [Count] column           MP6 correct Count and Limit columns           MP7 correct Out and OUTPUT columns           In         Logic         Test         Number         Store [Count]         Count         Limit           1         TRUE         2         9</td><td>MP4 correct Number column           MP5 correct Store [Count] column           MP6 correct Count and Limit columns           MP7 correct Out and OUTPUT columns           In         Logic         Test         Number         Store [Count]         Count         Limit         Out           1         TRUE         2         9</td><td>MP4 correct Number column           MP5 correct Store[Count] column           MP6 correct Count and Limit columns           MP7 correct Out and OUTPUT columns           In         Logic         Test         Number         Store [Count]         Count         Limit         Out         OUTPUT           1         TRUE         2         9</td></td<>	MP4         correct Number column           MP5         correct Store [Count] column           MP6         correct Count and Limit columns           MP7         Logic         Test         Number         Store [Count]           1         TRUE         2         9           3         FALSE	MP4 correct Number column           MP5 correct Store [Count] column           MP6 correct Count and Limit columns           MP7 correct Out and OUTPUT columns           In         Logic         Test         Number [Count]         Count           1         TRUE         2         9           1         TRUE         2         9           FALSE	MP4 correct Number column           MP5 correct Store [Count] column           MP6 correct Count and Limit columns           MP7 correct Out and OUTPUT columns           In         Logic         Test         Number         Store [Count]         Count         Limit           1         TRUE         2         9	MP4 correct Number column           MP5 correct Store [Count] column           MP6 correct Count and Limit columns           MP7 correct Out and OUTPUT columns           In         Logic         Test         Number         Store [Count]         Count         Limit         Out           1         TRUE         2         9	MP4 correct Number column           MP5 correct Store[Count] column           MP6 correct Count and Limit columns           MP7 correct Out and OUTPUT columns           In         Logic         Test         Number         Store [Count]         Count         Limit         Out         OUTPUT           1         TRUE         2         9

Question	Answer	Marks				
4(b)	One mark per mark point, max two to find / output prime numbers store prime numbers in an array					
4(c)	One mark per mark point, max three					
	insert a WHILE loop // pre-condition loop  MP2 after Input Number  MP3 with a condition to enter the loop Number < 3  MP4 an error message included within the loop to ask for a re-entry of Number  MP5 with another input prompt for Number  MP6 ENDWHILE closes the loop and the program carries on from REPEAT in the original algorithm  OR					
	One mark per mark point, max three					
	MP1 insert a REPEAT loop // post-condition loop MP2 before Input Number MP3 a conditional statement should be placed after Input Number MP4 to check if Number < 3 MP5 if the number entered is <3, an error message included within the loop to ask for a re-entry of Number MP6 UNTIL Number >= 3 closes the loop and the program carries on from REPEAT in the original algorithm					

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Question				Answer				Marks		
6(a)	Larger									
6(b)	One mark per mark point, max three  correct fields correctly named and table names correct sort and show box rows correct search criteria									
	Field:	PlanetName	Larger	YearLength						
	Table: PLANETS PLANETS									
	Sort:	Ascending								
	Show:	Ø								
	Criteria:		Yes	>365						
	or:									

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