Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6568118850

COMPUTER SCIENCE **0478/22**

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.

This document has **12** pages.

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

A program is needed to allow a Wildlife Park to sell tickets. A booking consists of one or more tickets for the same day(s) and can be made up to a week in advance. A booking can be made for a visit of one day or two consecutive days. A booking can have extra attractions included. A booking will be valid for the day(s) chosen only.

Ticket type	Cost for one day	Cost for two days
one adult	$20.00	$30.00
one child (an adult may bring up to two children)	$12.00	$18.00
one senior	$16.00	$24.00
family ticket (up to two adults or seniors, and three children)	$60.00	$90.00
groups of six people or more, price per person	$15.00	$22.50

Extra attraction	Cost per person
lion feeding	$2.50
penguin feeding	$2.00
evening barbecue (two-day tickets only)	$5.00

Write and test a program or programs for the Wildlife Park:

- 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 – displaying the ticket options and the extra attractions available
Set up your program to:

- display the options, attractions and prices for one-day tickets
- display the options, attractions and prices for two-day tickets
- show the days available for booking; assume that there are tickets available for any valid day.

Task 2 – process a booking
Extend your program for **Task 1** to:

- input the tickets and extra attractions required, then calculate the total cost of the booking
- allocate a unique booking number
- display the booking details, including the total cost and the unique booking number
- repeat as required.

Task 3 – ensuring each booking is the best value
Check that the total for each booking gives the best value and offer an alternative if this is **not** the case. For example, buying two family tickets is better than a group ticket for a group of 10 that includes four adults and six children.

1 All variables, constants and other identifiers must have meaningful names.

(a) **(i)** Identify **one** constant that you could have used for **Task 1**.
Give the value and use of the constant.

Constant ....

Value ....

Use ....

.... [3]

(ii) Identify **one** variable that you could have used for **Task 2**.
Give the data type and use of the variable.

Variable ....

Data type ....

Use ....

.... [3]

(b) Explain how your program showed the days available for booking in **Task 1**.

....

....

....

....

....

.... [3]

(c) Explain how your program made sure that each booking number allocated in **Task 2** was unique.

....

....

....

.... [2]

(d) Write an algorithm for the part of **Task 2** that inputs the tickets and extra attractions required then calculates the total cost of the booking.

Assume that the booking is for a single day.

Use pseudocode, programming statements or a flowchart.

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[6]

(e) Explain how your program decides when a family ticket is better value in **Task 3**.

Any programming statements that you include in your answer must be fully explained.

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....

.... [3]

Section B starts on page 8

Section B

2 An algorithm allows a user to input their password and checks that there are at least eight characters in the password. Then, the user is asked to re-input the password to check that both inputs are the same. The user is allowed three attempts at inputting a password of the correct length and a matching pair of passwords. The pre-defined function `LEN(X)` returns the number of characters in the string, `X`

```
Attempt ⟵ 0
REPEAT
  PassCheck ⟵ TRUE
  OUTPUT "Please enter your password "
  INPUT Password
  IF LEN(Password) < 8
    THEN
      PassCheck ⟵ TRUE
    ELSE
      OUTPUT "Please re-enter your password "
      INPUT Password2
      IF Password <> Password
         THEN
         PassCheck ⟵ FALSE
      ENDIF
  ENDIF
  Attempt ⟵ Attempt + 1
UNTIL PassCheck OR Attempt <> 3
IF PassCheck
  THEN
   OUTPUT "Password success"
  ELSE
    OUTPUT "Password fail"
ENDIF
```

(a) Identify the **three** errors in the pseudocode and suggest a correction to remove each error.

Error 1 ....

Correction ....

Error 2 ....

Correction ....

Error 3 ....

Correction ....

[3]

(b) The algorithm includes **two** types of check on the data input.
Identify and describe each type of check.

Type of check 1 ....

Description ....

....

Type of check 2 ....

Description ....

....
[4]

(c) Give **two** sets of test data for this algorithm and a reason for choosing each set.

Each set of test data and its reason must be different.

Set 1 ....

Reason ....

....

Set 2 ....

Reason ....

....
[4]

3 **(a)** Describe a one-dimensional array. Include an example of an array declaration.

....

....

....

....

....

.... [3]

(b) Explain how indexing could be used to search for a value stored in a one-dimensional array.

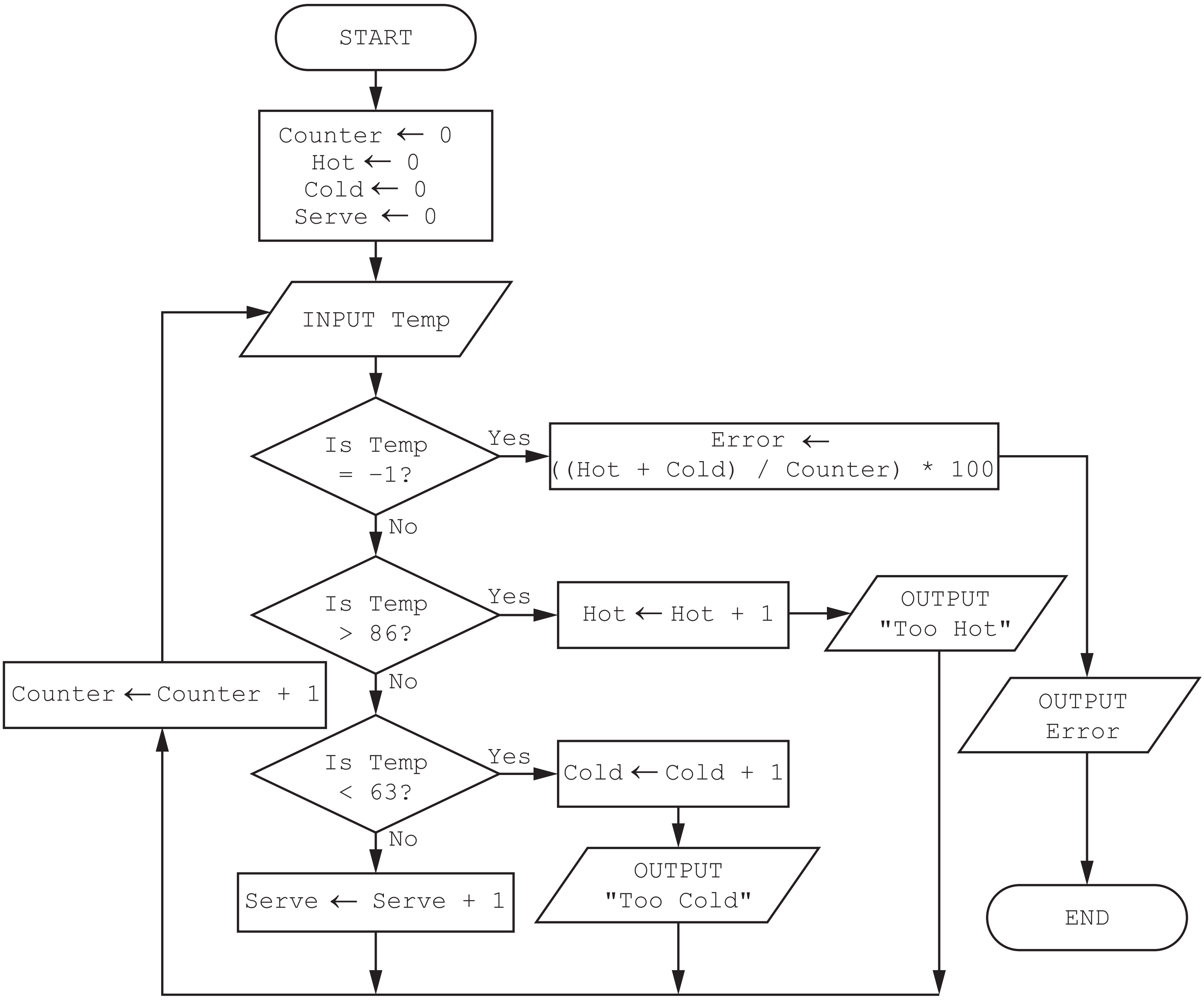
....

....

....

.... [2]

4 This algorithm checks the temperature of hot food being served to customers.



(a) Complete the trace table for the algorithm using this input data:

75, 78, 84, 87, 91, 80, 75, 70, 65, 62, –1, 20

Counter	Hot	Cold	Serve	Temp	Error	OUTPUT

[7]

(b) State how the final output from the algorithm could be improved.

....

.... [1]

(c) Identify the process in the algorithm that is **not** required.

....

.... [1]

5 A database table, NURSE, is used to keep a record of disposable items worn by veterinary nurses.

This is part of the table:

ItemNumber	Description	SingleUse	Uses	StockLevel	ReorderLevel
DIG1	Glove (pair)	Y	1	500	800
DIA1	Apron	Y	1	700	800
DIM5	Hair net	Y	1	650	500
DIA2	Apron	N	5	25	100
DIS4	Suit	N	3	70	50
DIV9	Shoe cover (pair)	Y	1	400	250

(a) Complete this query-by-example grid to display only the item number and the description of single use items, where the stock level is below the reorder level.

Field:					
Table:					
Sort:					
Show:	□	□	□	□	□
Criteria:					
or:					

[4]

(b) Give a reason why the field SingleUse is **not** required in the table NURSE.

....

.... [1]

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COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **May/June 2022**

MARK SCHEME

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.

This document consists of **12** printed pages.

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.

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.

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.

Question	Answer	Marks
	Section A	
1(a)(i)	Many correct answers, the name used must be meaningful. The name given is an example only**.** **One** mark per mark point, max **three** Constant `AdultCostOneDay` Value `20.00` Use Storing the cost of an adult ticket for one day	**3**
1(a)(ii)	Many correct answers, the name used must be meaningful. The name given is an example only. **One** mark per mark point, max **three** Variable `NumberOfTickets // NumberOfAdultTickets` Data type Integer Use Inputting the number of tickets purchased // Inputting the number of adult tickets purchased	**3**
1(b)	**One** mark per mark point, max **three** MP1 using an array or variables // lookup // input **today**'s date MP2 use a loop / `FOR` / `REPEAT` / `WHILE` statement MP3 … to output / display **today**'s date / **today** using a suitable message MP4 … and the 6/7 following dates/days // loop 6/7 times or MP5 using an array or variables // lookup // input **today**'s date MP6 array/ variables contains all the days of the week / the next seven days or dates MP7 attempt to output / display available days using a suitable message(s)	**3**
1(c)	**One** mark per mark point, max **two** MP1 method used to allocate a new number, e.g. initialise a variable or counter // select a random number MP2 how it ensured uniqueness, e.g. every booking number is one larger than the previous number // check existing bookings to ensure it hasn't been used before	**2**

Question	Answer	Marks
1(d)	**One** mark per mark point, max **six** MP1 initialise a running total for the cost of the booking MP2 input (with prompt) the number of tickets MP3 … attempt to identify type of ticket MP4 … add the cost of tickets to the running total MP5 ability to book several types of ticket MP6 attempt to check that the number of children booked is less than or equal to twice the number of adults MP7 attempt to identify type of attraction MP8 input **with prompt** the number of selected attractions required MP9 … check that this number is not greater than the total number of tickets booked MP10 … add the cost of the attractions to the (running) total	**6**

Example answer

```
TotalCost ← 0
TotalPeople ← 0
OUTPUT "Do you want single tickets? Y/N"
INPUT Single
IF Single = "Y"
  THEN
  FOR Type ← 1 TO 3  // adults, children and seniors
    REPEAT
      Flag ← True
      OUTPUT "How many ",TicketDecription[Type], " tickets"
      INPUT NumberOfTickets[Type]
      IF Type = 2
        THEN
          IF NumberOfTickets[2] > 2 * NumberOfTickets[1]
            THEN
              Flag ← FALSE
              OUTPUT "Too many children"
              ENDIF
      ENDIF
    UNTIL NumberOfTickets[Type] >= 0 AND Flag
    TotalCost ← TotalCost + TicketPrice[Type] * NumberOfTickets[Type]
```

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(d)</td><td>

```
    TotalPeople ← TotalPeople + NumberOfTickets[Type]
  NEXT Type
ENDIF
OUTPUT "Do you want a family ticket? Y/N"
INPUT Family
IF Family = "Y"
  THEN
    OUTPUT "How many?"
    INPUT NumberOfTickets[4]
    TotalCost ← TotalCost + TicketPrice[4] * NumberOfTickets[4]
    TotalPeople ← TotalPeople + NumberOfTickets[4] * 5
ENDIF

OUTPUT "Do you want a group ticket? Y/N"
INPUT Group
IF Group = "Y"
  THEN
    OUTPUT "How many people in the group?"
    INPUT NumberOfTickets[5]
    TotalCost ← TotalCost + TicketPrice[5] * NumberOfTickets[5]
    TotalPeople ← TotalPeople + NumberOfTickets[5]
ENDIF

REPEAT
  OUTPUT "How many people would like to see the lion feeding?"
  INPUT LionFeedingNumber
  IF TotalPeople >= LionFeedingNumber
    THEN TotalCost ← TotalCost + LionFeedingNumber * LionfeedingPrice
  ENDIF
  OUTUT "How many people would like to see the penguin feeding?"
  INPUT PenguinFeedingNumber
   IF TotalPeople >= PenguinFeedingNumber
    THEN TotalCost ← TotalCost + PenguinFeedingNumber * PenguinfeedingPrice
  ENDIF
UNTIL TotalPeople >= PenguinFeedingNumber AND TotalPeople >= LionFeedingNumber
```

</td><td></td></tr>
</table>

Question	Answer	Marks
1(e)	Explanation **One** mark per mark point, max **three** MP1 use of selection (or any other method) to identify bookings with 2 or more adults and/or seniors and 2 (allow 3) or more children MP2 calculating new price including family ticket(s) for booking / tickets sold MP3 … use of condition to compare price of family ticket(s) to price of ordinary tickets / group ticket(s) … MP4 … identifying best value / lowest cost	**3**

Question	Answer	Marks
Section B		
2(a)	**One** mark per mark point, max **three** • line 8 / `PassCheck ← TRUE` correction `PassCheck ← FALSE` • line 12 / `IF Password <> Password` correction `IF Password2 <> Password` // `IF Password <> Password2` • line 18 / `UNTIL PassCheck OR Attempt <> 3` correction `UNTIL PassCheck OR Attempt = 3 / UNTIL PassCheck OR Attempt >= 3`	3
2(b)	**One** mark check, **one** mark matching description, max **four** Check: validation // length check Description length check // checks number of characters in **password** Check: **verification** // **double entry** Description double entry // comparison that two inputs are the same	4
2(c)	**One** mark per set, **one** mark matching reason, max **four** Set 1 – any appropriate example e.g. "small" Reason must follow through from the password given e.g. abnormal data will be rejected Set 2 – any different appropriate example e.g. "password" and "password" Reason must be different and follow through from the password given e.g. normal data will be accepted	4

Question	Answer	Marks
3(a)	**One** mark per mark point, max **two** • a list / one column of items • … of the same data type • … stored under a **single** identifier • … with a single index to identify each element **One** mark for an example of a declaration • example e.g. `DECLARE MyArray[1:10] OF INTEGER`	3

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(b)</td><td><b>One</b> mark per mark point, max <b>two</b>
• using a counter to index the array
• so that the same code can be repeatedly used to check every element // every element can be checked in a loop</td><td><b>2</b></td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)</td><td><b>One</b> mark for each correct column
<table>
<tr><th>Counter</th><th>Hot</th><th>Cold</th><th>Serve</th><th>Temp</th><th>Error</th><th>OUTPUT</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td></td><td></td></tr>
<tr><td>1</td><td></td><td></td><td>1</td><td>75</td><td></td><td></td></tr>
<tr><td>2</td><td></td><td></td><td>2</td><td>78</td><td></td><td></td></tr>
<tr><td>3</td><td></td><td></td><td>3</td><td>84</td><td></td><td></td></tr>
<tr><td>4</td><td>1</td><td></td><td></td><td>87</td><td></td><td>Too Hot</td></tr>
<tr><td>5</td><td>2</td><td></td><td></td><td>91</td><td></td><td>Too Hot</td></tr>
<tr><td>6</td><td></td><td></td><td>4</td><td>80</td><td></td><td></td></tr>
<tr><td>7</td><td></td><td></td><td>5</td><td>75</td><td></td><td></td></tr>
<tr><td>8</td><td></td><td></td><td>6</td><td>70</td><td></td><td></td></tr>
<tr><td>9</td><td></td><td></td><td>7</td><td>65</td><td></td><td></td></tr>
<tr><td>10</td><td></td><td>1</td><td></td><td>62</td><td></td><td>Too Cold</td></tr>
<tr><td></td><td></td><td></td><td></td><td>-1</td><td>30</td><td>30</td></tr>
</table>
</td><td><b>7</b></td></tr>
</table>

Question	Answer	Marks
4(b)	• include a message to explain the value output / e. g. "The percentage of meals not served" // outputting `Hot`, `Cold` and `Serve`	**1**
4(c)	• updating the `Serve` variable // `Serve ← Serve + 1`	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>

One mark per mark point, max **four**

- correct rows Field and Table
- correct row Show
- correct Criteria for SingleUse **or/and** Uses
- correct Criteria for StockLevel less than ReorderLevel

<table>
<tr><td>Field:</td><td>ItemNumber</td><td>Description</td><td>SingleUse</td><td>StockLevel</td></tr>
<tr><td>Table:</td><td>NURSE</td><td>NURSE</td><td>NURSE</td><td>NURSE</td></tr>
<tr><td>Sort:</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Show:</td><td>☑</td><td>☑</td><td>□</td><td>□</td></tr>
<tr><td>Criteria:</td><td></td><td></td><td>True</td><td><[ReorderLevel]</td></tr>
<tr><td>or:</td><td></td><td></td><td></td><td></td></tr>
</table>

Or

<table>
<tr><td>Field:</td><td>ItemNumber</td><td>Description</td><td>Uses</td><td>StockLevel</td></tr>
<tr><td>Table:</td><td>NURSE</td><td>NURSE</td><td>NURSE</td><td>NURSE</td></tr>
<tr><td>Sort:</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Show:</td><td>☑</td><td>☑</td><td>□</td><td>□</td></tr>
<tr><td>Criteria:</td><td></td><td></td><td>= 1</td><td><[ReorderLevel]</td></tr>
<tr><td>or:</td><td></td><td></td><td></td><td></td></tr>
</table>

</td><td>4</td></tr>
<tr><td>5(b)</td><td>the field Uses already shows this information // duplication of data // redundant data</td><td>1</td></tr>
</table>