Cambridge Assessment International Education

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1306263972

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/51**

Paper 5 Investigation (Core) **May/June 2022**

1 hour 10 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- 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.
- You should use a graphic display calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly, including sketches, to gain full marks for correct methods.
- In this paper you will be awarded marks for providing full reasons, examples and steps in your working to communicate your mathematics clearly and precisely.

INFORMATION

- The total mark for this paper is 36.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **8** pages.

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Answer **all** the questions.

INVESTIGATION **STORAGE BINS**

This investigation looks at different methods to store items in storage bins.

Amara wants to use the smallest number of storage bins possible.
Each bin can hold a maximum total mass.

1 Amara uses this method.

Method 1 Put each item in the first bin that can hold its mass.

Example

These are the masses, in kg, of four items.

6 7 4 2

The maximum total mass that each bin can hold is **10 kg**.
The tables show how Amara puts these items into bins.

Amara puts the first item in bin 1.
4 kg of storage is unused in this bin.

Bin	Mass of items in bin	Unused mass in bin			
1	6	4			
2					
3					

The second item will not go in bin 1
because it is more than 4 kg.
Amara puts the second item in bin 2.

Bin	Mass of items in bin	Unused mass in bin			
1	6	4			
2	7	3			
3					

The third item is 4 kg.
Amara puts this in bin 1.
Bin 1 is now full.

The fourth item will go in bin 2.
Bin 3 is not used.

Bin	Mass of items in bin	Unused mass in bin			
1	6, 4	4	0		
2	7, 2	3	1		
3					

Amara needs two bins which can hold a total of 20 kg.
1 kg out of the total of 20 kg of storage is unused.

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(a) These are the masses, in kg, of ten items.

38 6 21 50 32 7 15 9 27 25

The maximum total mass that each bin can hold is **60 kg**.
Amara uses Method 1 to put these ten items into bins.
The table shows how she puts the first 6 items into bins.

Bin	Mass of items in bin	Unused mass in bin				
1	38, 6, 7	22	16	9		
2	21, 32	39	7			
3	50	10				
4						
5						

(i) Complete Amara's table to show that she needs 5 bins. [4]

(ii) Work out the total unused mass in the 5 bins.

..... [2]

(b) These are the masses, in kg, of six items.

8 16 13 10 5 3

The maximum total mass that each bin can hold is **20 kg**.

Bin	Mass of items in bin	Unused mass in bin				
1	8	12				
2						
3						
4						
5						

Use Method 1 to complete the table for all six items.
The first item has been put in for you.
You may not need all the bins. [2]

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2 Amara wants to see if she can use fewer bins.
She puts her items in order of mass before she puts them in bins.
She uses this method.

Method 2 Put the masses in order, largest first.
Then use **Method 1**.

These are the masses, in kg, of the ten items from **Question 1(a)**.

38 6 21 50 32 7 15 9 27 25

(a) Write these ten masses in order, largest first.

..... , ... , ... , ... , ... , ... , ... , ... , ... , ... [1]

(b) The maximum total mass that each bin can hold is **60 kg**.

Complete the table using Method 2.

Bin	Mass of items in bin	Unused mass in bin				
1						
2						
3						
4						
5						

[3]

(c) Work out the difference in the total unused mass when using Method 1 and Method 2.
Use your answers from **Question 1(a)(ii)** and **Question 2(b)**.

..... [2]

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3 A *best solution* uses the smallest possible number of bins.

(a) (i) A set of items with a total mass of 270 kg is put into 4 bins.
The maximum total mass that each bin can hold is 80 kg.

Show that this is a best solution.

[2]

(ii) Show that the solution in **Question 1(b)** is a best solution.

[2]

(b) Amara knows that for a particular set of items a best solution is 6 bins.
The maximum total mass that each bin can hold is 5 kg.
The total mass of the items is 27.5 kg.

Work out the amount of unused storage for a best solution for these items.

..... [2]

4 Amara tries another way to improve Method 1.

Method 3 Look for items that combine to make as many full bins as possible and place these first. For the remaining items, use **Method 2**.

(a) These are the masses, in kg, of eight items.

21 10 30 19 13 7 28 4

The maximum total mass that each bin can hold is **40 kg**.

Does Method 3 give a best solution for these items?
Show how you decide.

Bin	Mass of items in bin	Unused mass in bin				
1						
2						
3						
4						
5						

[6]

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(b) Amara puts nine items into bins using Method 3.
The maximum total mass that each bin can hold is **40 kg**.

Bin	Mass of items in bin	Unused mass in bin				
1	18, 22	0				
2	32, 5, 3	0				
3	32	8				
4	19, 15	21	6			
5	12	28				

Amara only wants to use 4 bins.
She removes the last item she packed and divides it into two smaller items with the same total mass.
She puts each of these two items into a bin that can hold its mass.

Work out how much the percentage of unused storage changes when Amara uses 4 bins instead of 5 bins.

..... [5]

Question 5 is printed on the next page.

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[Turn over

5 These are the masses, in kg, of eight items.

31 10 39 20 29 47 50 12

The maximum total mass that each bin can hold is **60 kg**.
Each bin Amara uses costs $13.50 .

Use Method 2 or Method 3 to put these items into bins to give a best solution.
Find the cost of this solution.

Bin	Mass of items in bin	Unused mass in bin				
1						
2						
3						
4						
5						

$ ..... [5]

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