Quest 3: The Deepest Fit

Quest 2 Quest 4

Part I

Story section

You are carrying the completed breastplate that you just finished in the forge with the blacksmith. Everyone you pass along the path is drawn to the shiny, finely carved symbols. The knight gets up from the bench and walks over to have a close look at the work as soon as he notices you coming.

- This... is incredible! - he shouts, taking the breastplate in his hands. - How did you achieve this, blacksmith?

The blacksmith smiles with satisfaction but points at you.

- It's not just my success, sir. My friend here has something extraordinary in him. Without his calculating abilities, the drawing on the breastplate would never look so accurate.

The knight shifts his attention to you, his face expressing wonder and interest. You briefly discuss how you got to the blacksmith's and how curious you are about your origins.

- Since you have such an extraordinary talent, maybe you can also help me with one problem? In return for this favour, I will take you with me to the garrison, where I will arrange an escort to Stacktrace Sanctuary. The best place to find answers is in the world's books and scrolls. Ah! Where are my manners! With all this, I forgot to introduce myself. My name is Sir Mandelbrot. Nice to meet you. My family has been using the engraving's pattern for centuries. I am very curious about how much we will be able to uncover regarding its secrets in the future.

You recognise the knight's good intentions, so you agree to help. Also, you have a feeling that these complex numbers could be very useful, but this is something for a completely different story.

The knight came to the village to get supplies for the army. He has a number of horse-drawn wagons that are full of different-sized wooden crates. The carts are already filled with some goods. There are many empty crates still, but it's clear that not all of them will fit on the carts. But the knight has an idea. For as long as possible, he wants to put smaller crates inside bigger ones and bigger crates inside even bigger ones. Therefore, the crates will take up a lot less space since only the biggest one will be left from each set.

The knight gives you a list of numbers (your notes). Each number represents the size of a single crate. If two crates differ in size, the smaller one can be packed within the larger one. A sequence of crates packed one inside another is called a set. The knight is curious about the largest possible set that can be formed, in terms of the total size of all crates forming it.

Example based on the following notes:

`10,5,1,10,3,8,5,2,2`

A few sample sets of crates that can be packed one inside the other are listed below. For example, the notation `10 > 8 > 5` means that inside a crate of size 10, there is a crate of size 8, and inside that, there is a crate of size 5.

```
10 > 8 > 5 > 3 > 2 > 1   the sum of the sizes: 10 + 8 + 5 + 3 + 2 + 1 = 29
10 > 8 > 5 > 2 > 1       the sum of the sizes: 10 + 8 + 5 + 2 + 1 = 26
10 > 5 > 3 > 2           the sum of the sizes: 10 + 5 + 3 + 2 = 20
10 > 5 > 2               the sum of the sizes: 10 + 5 + 2 = 17
```

There are many ways to pack crates; however, out of all the packing options, the largest possible set of crates is `29`.

What is the largest possible set of crates that can be formed from a given list?

Your notes for this part:

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Part 1 solved with answer: 2546

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Part II

The knight nods, confirming your answer. It seems that it was just a small test of your skills. You are receiving another list with the sizes of the crates (your notes). The packing rules remain the same as before.

One of the purchased items is a special mushroom used for brewing potions, which will fit in any crate from the received list, but it cannot be packed with anything else and needs a bit of air to survive the journey. That's why it needs to be packed into the smallest possible set of exactly `20` crates. This will allow the larger crates remain continuously available.

Example based on the following notes:

```
4,51,13,64,57,51,82,57,16,88,89,48,32,49,49,2,84,65,49,43,9,13,2,3,75,72,63,48,61,14,40,77
```

To pack the mushroom into exactly 20 crates according to the rules, the following sizes should be used:

```
75 > 72 > 65 > 64 > 63 > 61 > 57 > 51 > 49 > 48 > 43 > 40 > 32 > 16 > 14 > 13 > 9 > 4 > 3 > 2
```

The total size of this set is 781, and it is the smallest possible set of 20 crates for this list of crates.

Pack the mushroom into exactly `20` crates. What is the smallest possible set of the crates that can be used for this purpose?

Your notes for this part:

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Part 2 solved with answer: 269

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Part III

The mushroom and other goods are loaded onto the carts. The only task left is to pack the empty crates (your notes).

Your final task is to pack these crates as efficiently as possible. The rules for packing remain unchanged. There is also no limit on the number of crates that can be packed into one set. The goal is to pack everything into as few sets as possible.

Example based on the following notes:

```
4,51,13,64,57,51,82,57,16,88,89,48,32,49,49,2,84,65,49,43,9,13,2,3,75,72,63,48,61,14,40,77
```

The given list can be packed into `3` sets.

Here is an example of such packaging:

```
88 > 82 > 64 > 57 > 51 > 49 > 16 > 13 > 4 > 2
89 > 84 > 65 > 61 > 57 > 51 > 49 > 48 > 43 > 32 > 2
77 > 75 > 72 > 63 > 49 > 48 > 40 > 14 > 13 > 9 > 3
```

Pack the given list as efficiently as possible. How many sets do you need for this?

Your notes for this part:

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Part 3 solved with answer: 2905

Check your progress

Puzzle solved! Don't stop now!

Post your solution, compare ideas, and help others grow on Reddit