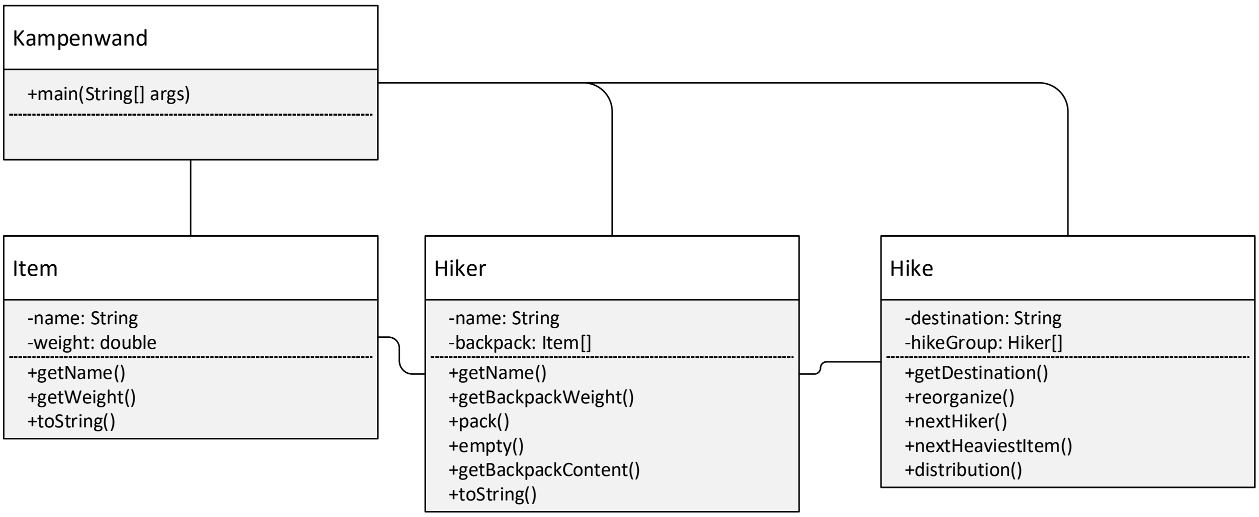
Exercise 10 – Object-oriented programming

You are planning a hiking trip to Kampenwand with friends. You agree that everyone should bring something, and that the weight should be fairly allocated before you start the climb.

- Peter brings 5 bottles of water (1.5kg each), ham sandwiches (500g) and his jacket (1.5kg)
- Max brings cheese sandwiches (700g), chocolate (300g) and his jacket (1kg)
- Sabine brings apples (500g), a blanket (2kg) and her jacket (1kg)
- Gerda brings bananas (500g), a frisbee (200g) and her jacket (700g)
- At the last minute, a lazybones signs up to come along, but doesn't bring anything (except for an empty rucksack).

The redistribution of luggage items means that each participant first empties their rucksack, and then in turn, the next-heaviest item is put in the next-lightest rucksack. Write a programme that outputs the luggage allocation among the hikers before the redistribution, then redistributes the luggage fairly, and finally outputs the new luggage allocation.

The following class diagram reflects the classes and their relationships:



Task 1: Work out the substantive task for the respective methods.

Task 2: Describe the algorithm for the redistribution. The basic idea is based on a greedy algorithm.

Task 3: Implement the classes: Item, Hiker, Hike and Kampenwand with the attributes and methods given in the class diagram, along with the redistribution algorithm developed.

Task 4: Create the example output listed below.

Notes:

- In principle, you are already familiar with the search for the next-lightest (next-heaviest) rucksack (luggage item); what's new here is that you need to add or remove elements in an array. To do so, revisit the sections on *Fields* and *Non-primitive (reference) data types*.
- If a hiker should pack a luggage item, but the rucksack is implemented as an array, you must first create a new array, which is bigger than the old one, copy all the old elements into the new array, and then add the new element at the end.

Example output

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Luggage allocation for the hike to Kampenwand:
Peter: water, water, water, water, water, ham sandwiches, jacket (9.5 kg)
Max: cheese sandwiches, jacket, chocolate (2.0 kg)
Sabine: apples, jacket, blanket (3.5 kg)
Gerda: bananas, jacket, frisbee (1.4 kg)
Lazybones: no luggage

Allocated total load of 16.4 kg across 5 hikers
Peter takes the blanket (2.0 kg)
Max takes water (1.5 kg)
Sabine takes water (1.5 kg)
Gerda takes water (1.5 kg)
Lazybones takes water (1.5 kg)
Max takes water (1.5 kg)
Sabine takes a jacket (1.5 kg)
Gerda takes a jacket (1.0 kg)
Lazybones takes a jacket (1.0 kg)
Peter takes the cheese sandwiches (0.7 kg)
Gerda takes a jacket (0.7 kg)
Lazybones takes the ham sandwiches (0.5 kg)
Peter takes the apples (0.5 kg)
Max takes the bananas (0.5 kg)
Sabine takes the chocolate (0.3 kg)
Lazybones takes the frisbee (0.2 kg)

Luggage allocation for the hike to Kampenwand:
Peter: blanket, cheese sandwiches, apples (3.2 kg)
Max: water, water, bananas (3.5 kg)
Sabine: water, jacket, chocolate (3.3 kg)
Gerda: water, jacket, jacket (3.2 kg)
Lazybones: water, jacket, ham sandwiches, frisbee (3.2 kg)
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