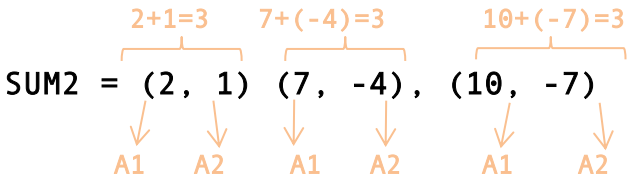
Problem Definition

Given two unsorted arrays `A1` and `A2`, and an integer x, find the set `SUM2` consisting of all pairs of values (`a1`, `a1`), where `a1` ∈ `A1` and `a2` ∈ `A2`, such that `a1+a2=`x.

EXAMPLE

`A1=[4,5,2,7,8,10]` `A2=[1,9,-4,12,-7,-6]` x=3



EXERCISES

1. Find `SUM2` for the following inputs:
   x=6 `A1=[4,5,2,7,8,10]` `A2=[1,9,-4,12,-7,-6]`
2. Find `SUM2` for the following inputs:
   x=0 `A1=[4,5,2,7,8,10]` `A2=[1,9,-4,12,-7,-6]`
3. Find `SUM2` for the following inputs:
   x=7 `A1=[4,5,2,7,8,10]` `A2=[1,9,-4,12,-7,-6]`
4. Find `SUM2` for the following inputs:
   x=14 `A1=[5,2,7,-8,10,-20,13,64,0,-36,-10,-4,-44]`
   `A2=[1,2,3,5,6,7,8,10,12,13,14,15,16,17,19,20,21,`
   `22,23,25,26,27,28,30,31,33,34,35,36,37,41,41,43,`
   `44,47,48,49,50,51,52,53,54,56,57,58,63,64,65,67,`
   `68,69,70,75,80]`

Questions (no need to submit answer, just for reflection before moving on to the next task)

1. Describe, in plain English and in your own words, the method you used to solve the exercises.
2. Did the fact that the second array (`A2`) is sorted help you in the last exercise? If Yes, how? If No, why?

ALGORITHM

The following algorithm finds the SUM2 set given values of A1, A2, and x:

```
SUM2ALGORITHM (A1, A2, x)
1. SUM2 = {}
2. For each value, v1, in A1:
2.    v2 = x - v1
3.    Search array A2 for value v2. If v2 is found in A2:
4.          Add the pair (v1, v2) to SUM2
5. return SUM2
```

For the following tasks you will work with your assigned group. You will present your work to the class at the beginning of next session.

TASK 1: Running Time Analysis

Using similar notation to the running time analysis of Insertion Sort algorithm (attached), determine the running time ***T(n)*** of the algorithm above (where n is the size of the input). Specifically:

1. Next to each line, write the number of times the statement is executed
2. Calculate the sum of the running times of all statements and express the best case and worst case in theta notation (**Θ**)

Use ***n1*** and ***n2*** to denote the size of arrays ***A1*** and ***A2*** respectively.

For the Search in line 3, you will use the following search algorithm:

- Students in groups 1, 4 – Linear/Sequential Search
- Students in groups 2, 5 – Binary Search
- Students in groups 3, 6 – Hash-based Search

TASK 2: Implementation

Implement the algorithm as a function. For simplicity, instead of returning the pairs in SUM2, you can return only a count of the number of pairs in SUM2 (whatever you choose). Use the same search method that you were assigned in TASK 1.

The prototype of the **SUM2** function must be as follows:

```
int sum2 (int A1[], int A2[], int n1, int n2, int x)
```

For the *Search* method you can either use the tools provided by the language or implement your own function.

TASK 3: Testing

Test your function using the ***assert*** statement with the inputs given in the exercises 1 to 4. Remember that in order to use *assert* you have to include the *cassert* library at the top of your program:

```
#include <cassert>
```