Pairs with difference k

Problem Description: You are given with an array of integers and an integer k. Write a program to find and print all pairs which have difference k.

Sample Input:

```
4                    (Size of array)
5 1 2 4              (Elements of array)
3                    (k)
```

Sample Output:

```
2 5
1 4
```

How to approach?

The naive approach to this problem would be to run a double nested loop and check every pair for their absolute difference. If it's equal to 'k', we print it else we move to the next iteration.
The double nested loop will look like this:

```
for(i <- 0; i < arr.size() - 1; i <- i + 1):
     for(j <- i + 1; j < arr.size(); j <- j + 1):
          if(absolute difference of arr[i] and arr[k] is equal to k):
               printPair();
```

The time complexity of this method is $O(n^2)$ because of the double nested loop and the space complexity is O(1) since we are not using any extra space.

We can improve the time complexity to O(n) at the cost of some extra space.
The idea is that in the naive approach, we are checking every possible pair that can be formed but we don't have to do that.
If we iterate through the array, and we encounter some element `arr[i]`, then all we need to do is to check whether we've encountered `(arr[i] - k)` or `(arr[i] + k)`

somewhere previously in the array and if yes, then how many times. Ideally, we would want to access this information in O(1) time. For this, we can use a HashMap.
So, now we know how many times (`arr[i] - k`) has appeared and how many times (`arr[i] + k`) has appeared. Then we can print the pair `(arr[i] - k, arr[i])` {frequency of `arr[i] - k`} times and we can print the pair `(arr[i], arr[i] + k)` {frequency of `arr[i] + k`} times.

Things to look out for!
Think about what will happen if k is 0. Then (`arr[i] + k`) will be equal to (`arr[i] - k`) and we will print our pairs twice! Obviously we don't want that to happen so we need to add an extra check for this special case.

The pseudo-code for this approach is shown on the next page.

```
function pairsWithDifferenceK(arr,k):
  HashMap(integer,integer) frequencyMap
  for element in arr:
    a <- element - k
    b <- element + k
    if(frequencyMap contains the key ‘a’):
      //print pair frequencyMap[a] times
    if(k != 0 and frequencyMap contains the key ‘b’):
      //print pair frequencyMap[b] times
    //frequencyMap[element] is initially 0
    frequencyMap[element] <- frequencyMap[element] + 1
```