CSE 4304: Data Structures
Lab: 05
Topic: Problems related to queue , heap

Task 1

Implement Enqueue & Dequeue operation using

- Linear Queue
- Circular Queue

Task 2

Suppose an arbitrary array of size N is given as input. Your task is to build a **max-heap** from the set of numbers. Finally, sort the numbers using **Heap-sort**.

Task 3

Use the Heap that you created in **Task 2** as a 'Min Priority Queue' and implement the following functionalities:

- Heap_Minimim()
- Heap_extract_min()
- Min_heap_insert()
- Heap_decrease_key()

C++ has Some built-in functions for performing operations on Queue, Heap/ Priority Queue. Check the following links for better understanding:

- https://www.geeksforgeeks.org/queue-cpp-stl/
- https://www.geeksforgeeks.org/heap-using-stl-c/
- https://www.geeksforgeeks.org/heap-using-stl-c/

Task 4

Jesse loves cookies. He wants the sweetness of all his cookies to be greater than value **K**. To do this, Jesse repeatedly mixes two cookies with the least sweetness. He creates a special combined cookie with:

Sweetness = *(1 x Least sweet cookie* + 2 x *2nd least sweet cookie*).

He repeats this procedure until all the cookies in his collection have a sweetness $\geq$ **K**

You are given Jesse's cookies. Print the number of operations required to give the cookies a sweetness $\geq$ **K** Print **-1** if this isn't possible.

Input format

The first line consists of integers **N**, the number of cookies and **k**, the minimum required sweetness, separated by a space.

The next line contains **N** integers describing the array ***A*** where A_i is the sweetness of the i^{th} cookie in Jesse's collection.

Output format

Output the number of operations that are needed to increase the cookie's sweetness $\geq$ **K**

Output **-1** if this isn't possible.

Sample Input

6 7

12 9 1 3 10 2

Sample Output

2

Explanation

Combine the first two cookies to create a cookie with *sweetness* = 1 x 1 + 2 x 2 = 5

After this operation, the cookies are (3, 5, 9, 10, 12)

Then, combine cookies with sweetness and sweetness , to create a cookie with resulting *sweetness* = 1 x 3 + 2 x 5 = 13

Now, the cookies are (9, 10, 12, 13).

All the cookies have a sweetness $\geq$7

Thus, **2** operations are required to increase the sweetness.

[Note: You need to use Heap to solve this problem.]