DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY
(MA39203)
Department of Mathematics
Indian Institute of Technology, Kharagpur
Assignment : 04
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1. Given a sorted integer array arr[ ] and an integer x, find the first and last occurrences of x in the given array. Use $< iostream >$ header only.

Example 1: Input: N = 6, arr[ ] = $\{1, 3, 5, 5, 5, 6\}$, $x = 5$ Output: 2, 4

Example 2: Input: N = 6, arr[ ] = $\{1, 3, 5, 5, 5, 6\}$, $x = 4$ Output: $-1, -1$

2. You have to read n books. Numbers of pages of the books are given in the array pages[ ]. You have d days to finish reading them all.
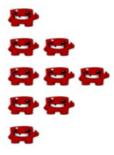
You can decide a reading speed of k pages per day. Each day, you pick a single book and read k pages from it. If the book has fewer than k pages left, you finish it and rest for the remainder of the day.

You are lazy, so you want to read as slowly as possible while still finishing all the books within d days. (You read each page only once) Find the minimum integer k such that you can read all the books within d days.

Example: Input: $n = 4$, pages[ ] = $\{50, 100, 30, 70\}$, $d = 8$ Output: 35

Explanation: Reading 34 pages per day takes 9 days to finish all the books. 35 pages per day is the minimum possible reading speed that allows to finish all the books in 8 days.

3. You are chatting on a streaming platform and you want to chill and spam something. More precisely, you want to spam an emote triangle of size k. It consists of $2k - 1$ messages. The first message consists of 1 emote, the second one - of 2 emotes, ..., the k-th one - of k emotes, the $k + 1$-th one - of $k - 1$ emotes, ..., and the last one - of one emote. For example, the emote triangle for $k = 3$ consists of 5 messages:

Now, the platform will ban you right after you spam at least x emotes in succession. How many messages will you be able to write before getting banned? Note that if you get banned as a result of writing a message, this message is also counted.

Example 1: Input: $k = 3, x = 6$ Output: 3

Example 2: Input: $k = 3, x = 4$ Output: 3

Example 3: Input: $k = 3, x = 7$ Output: 4

4. There is a group of N members $(P_0, P_1, ..., P_{N-1})$ and all of them are competing in an election to be the leader of that group. Each member P_i has an influence level of $\text{arr}[i]$.

A single member may cast any number of votes. P_j will vote for P_i $(i \neq j)$ if and only if the influence level of P_j is greater than or equal to the sum of influence levels of all the members between them (excluding the P_i and P_j). Find the number of votes received by each member. Your program should have $O(N \log N)$ time complexity.

Example: Input: $N = 5$, arr[ ]=$\{1, 2, 2, 3, 1\}$ Output: $\{2, 3, 2, 3, 1\}$
Explanation:

- P_1 and P_2 vote for P_0,
- P_0, P_2 and P_3 vote for P_1,
- P_1 and P_3 vote for P_2,
- P_1, P_2 and P_4 vote for P_3,
- Only P_3 votes for P_4,