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**Week 3: Binary Search**

A monotonic function is a function which value increases or decreases on all of a given interval. When a function is monotonic a binary search with the “ordered list” of all numbers contained in this interval can be used to find the solution to said function. A binary search is used because of its time efficiency.

Table

Description automatically generated

As seen in the above table for large sizes the binary search does very few comparisons, this allows us to use it for said purpose with a decent precision.

**Problem:**

Given the input

One line with a positive integer: the number of test cases. Then for each test case:

• One line with two integers N and F with 1 ≤ N, F ≤ 10000: the number of pies and the number of friends.

• One line with N integers ri with 1 ≤ ri ≤ 10000: the radii of the pies.

Find the largest possible piece of pie to give to everyone.

**Code:**

Text

Description automatically generated

The code solves the monotonic function given by “pieces”. The function counts the number of pieces of size “mid” which can be taken from each pie. The count then is compared to the number of persons that are in the party and a binary search is done until the two numbers coincide. This is to say the number tested “mid” is equal to the biggest piece size that can be taken from all cakes, so everybody gets an equally sized piece.

Note that before the main function is implemented the number F is increased by one to include the person hosting the party and the volume of the cakes is computed. All of them have height of 1 so the formula for the volume is pi\*radii^2. After these preliminary steps are done, the binary search ,which will have a time complexity of O(lg n), in this case n is the numbers from 0 to max int, is implemented to solve the function.

**Result:**

Company name

Description automatically generated with low confidence