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# Lab1

1. **Question 1: Comparing Algorithms of following problem.**

Find the largest distance between any two even integers in an integer array.

1. Algorithm 1. Create a new array consisting of even numbers only. Then use nested loops to solve the problem using the newly created array of even numbers only.
2. Algorithm 2. Use a nested loop to solve the problem without creating an extra array.
3. Algorithm 3. Use one loop. Find max and min of even integers. Compute max – min.
4. Algorithm 4. Use Streams to find the max and min. Compute max – min

I executed above 4 algorithms with 4 different size of arrays. Arrays are generated as random and result wrote to the file. Execution time is in milliseconds.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Size of Array | Time of algorithm 1 | Time of algorithm 2 | Time of algorithm 3 | Time of algorithm 4 |
| 10,000 | 230 | 420 | 1 | 99 |
| 20,000 | 601 | 1314 | 0 | 1 |
| 30,000 | 771 | 2393 | 0 | 1 |
| 40,000 | 1372 | 4554 | 0 | 1 |

Figure . Comparison of execution time

As shown in graph, Algorithm 3 and algorithm 4 are more efficient than algorithm 1 and algorithm2. Because last two algorithm’s execution time is almost constant when I increased size of array. Furthermore, the first two algorithm’s execution times are depends on size of arrays which means in order to reduce execution time, I have to use one loop or stream instead of using nested loops.

Also algorithm 1 is using additional list for finding even numbers which means it will use more memory that other three algorithms.

1. **Question 2: Proof by Induction Let F(n) denote the nth Fibonacci number. Prove for n > 4.**

**Best Cases:**

n = 5;

=>

n = 6;

=>

Results are true for base cases.

**Induction hypothesis**

Assume result is true for n >4.

**Induction step**

We need to prove the result of n = k + 1

Let’s use fact of following

is true. So the problem solved.