

Project: Find the most frequent duplicate



Mar 30, 2026

1 Overview

In this individual project, you are required to explore **at least three different methods** to find out the most frequent duplicate element in a given list of numbers.

2 Detailed Requirements

You are asked to implement and compare different methods of finding out the most frequent duplicate element in a given list of numbers. If there are two or more elements having the same appearing frequency, return the one that appears first in the list. In particular, you need to provide at least **three** (i.e., ≥ 3) different methods and compare their performance with time complexity analysis.

In your submitted report, you need to explicitly explain:

- the algorithms and data structures of the methods you have tried;
- the time complexity of each method (mainly the worst-case time complexity);

Note that you are NOT required to provide formal time complexity analysis, but some intuitive or informal discussion.

Experimental Evaluations

In this project, you may design and generate some test data for each method so that you can evaluate and compare the differences in efficiency among different methods over different generated inputs. Figures that intuitively show how the input data affects the selection among different methods are appreciated but optional. Note that, the compiling command for compiling your programs (written in C++) should be clearly stated in the report. Some available compiling options are `-std=c++11`, `-lm`, `-O2`.

If you **cannot pass the OJ test cases**, the maximum marks you can get is 30.

3 OJ Input and Output

You can check the similar material in Question 897 on the OJ system.

Input

The input contains multiple test cases. For each test case, it contains a line of integers (the number of integers is less than 10^5 while each integer is $\in (-10^5, 10^5)$).

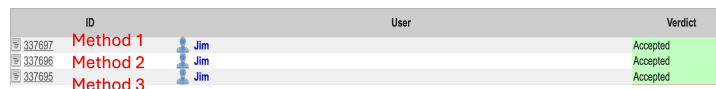
Output

Each line of the output is the most frequent duplicated element in the list.

Sample Input	Sample Output
-1 1 -1 8	-1
1 2 3 3 3 4 4 5	3
2 3 1 5 4 3 2 1	2

4 Due Date and Submission

- The project is due at **23:59 on Apr 23, 2026**.
- Test your solutions by submitting your codes to the Online Judge system (Question 897).
- Submit a zip file (size $\leq 5\text{MB}$) onto Canvas, containing all your materials, i.e., 1) the screenshots of Accepted records from different methods, with showing the corresponding method orders (organized as the format below), and 2) the final report in a doc(x) file.



ID	User	Verdict
337897 Method 1	Jim	Accepted
337898 Method 2	Jim	Accepted
337899 Method 3	Jim	Accepted

Figure 1: Screenshot Format