

# PERSONAL HOMEWORK 1:

## SEARCH ALGORITHM

### 1 Research

In computer science, a search algorithm is an algorithm which solves the search problem, namely, to retrieve information stored within some data structure, or calculated in the search space of a problem domain, either with discrete or continuous values. Based on the type of search operation, these algorithms are generally classified into two categories:

1. Sequential Search
2. Interval Search

In this section, you are required to research search algorithms. Your research will be presented in the report, including:

- Explain all the search algorithms you know, at least 3 search algorithms.
- Find a real-life problem and apply an arbitrary search algorithm to solve it.

### 2 Programming

#### 2.1 Exercise 1: Winning Lottery Ticket

Imagine you are the owner of a lottery shop. Today is your birthday so the winning lottery ticket is not random but a number which meets the following conditions:

- It is in range  $[A, B]$ .
- It is a square number.
- Sum of its digits is maximum.

For example, you choose  $A = 30$ ,  $B = 90$ , list of square numbers from 30 to 90 is: 36, 49, 64 and 81. The number 49 has sum of its digits is  $4 + 9 = 13$  (maximum), so the winning lottery ticket is 49.

Write a function to solve the problem, following these rules:

- Name: `searchWinningLotteryTicket(int A, int B)`
- Return value:
  - If result exists, return result.
  - Otherwise, return -1.
- The function **must use sequential search (linear search) algorithm**.

## 2.2 Exercise 2: Harvesting Orchard

Imagine that you are not only the owner of a lottery shop but also the owner of an orchard. Your orchard is very special, the amount of fruit harvested is determined by the day. On day 1, you will harvest 1 fruit. On day 2, you will harvest 3 fruits. On day 3, you will harvest 6 fruits, ... On day  $k$ , you will harvest  $f(k) = 1 + 2 + 3 + \dots + (k - 1) + k$  fruits. In the near future, you have an order to supply  $T$  fruits. Find the day  $P$  when you can harvest  $T$  fruits from the orchard with the time to find is from day 1 to day  $N$ .

For example, you have an order to supply  $T = 10$  fruits and the maximum number of days to search is  $N = 5$ . We will check from  $f(1)$  to  $f(5)$ :  $f(1) = 1$ ,  $f(2) = 3$ ,  $f(3) = 6$ ,  $f(4) = 10$ ,  $f(5) = 15$ . We see that  $f(4) = 10 = T$ . So the day, when you can harvest the 10 fruits, is  $P = 4$ .

Write a function to solve the problem, following these rules:

- Name: `searchHarvestDay(int N, int T)`
- Return value:
  - If result exists, return result.
  - Otherwise, return -1.
- The function **must use binary search algorithm**.

### 3 Submission

- The submission file must be in the following format: **[Student\_ID.zip]**, is the compression of the **[Student\_ID]** folder. This folder contains:
  - The report file must be presented as a document **[Student\_ID.pdf]**. This file presented your research from section **1** and the information of code fragment (algorithms, functions) from section **2**.
    - \* Information (Names, Student IDs) must be declared clearly on the first page of your report. Your working progress (How much work have you completed?) should be demonstrated on this page, too.
    - \* The report file should be **structured, logical, clear** and **coherent**. The length of the submission should not exceed 10 pages for the document file.
    - \* All links and books related to your submission must be mentioned.
  - The programming file must be a single file **[Student\_ID.cpp]**. The code fragment must be clear, logical and commented.
- Submission with wrong regulation will result in a "0" (zero).
- Plagiarism and Cheating will result in a "0" (zero) for the entire course and will be subject to appropriate referral to the Management Board of the CLC program for further action.

THE END