

# Course Goals

- 알고리즘 시간에서 다루지 않은 주제들과 자료구조에 대해 학습한다.
- 배운 알고리즘, 자료구조 지식을 활용하여 다양한 문제의 효율적인 해결책을 찾는 능력을 배양한다.
- 프로그래밍 과제를 통해, 각종 프로그래밍 경진대회 출전할 능력을 함양한다.

# 문제 풀이 사이트

- 정올:
  - [jungol.co.kr](http://jungol.co.kr)
- 백준
  - <https://www.acmicpc.net/>
- Algospot
  - <https://www.algospot.com/>
- Codeforces:
  - <http://codeforces.com/problemset>
- Uva:
  - <http://uva.onlinejudge.org>
- ACM-ICPC in Korea
  - <http://acm.kaist.ac.kr/>

# Prob: The $3n+1$ Problem

- Background
  - Problems in Computer Science are often classified as belonging to a certain class of problems (e.g., NP, Unsolvable, Recursive). In this problem you will be analyzing a property of an algorithm whose classification is not known for all possible inputs.

# Prob: The $3n+1$ Problem (cont'd)

- The Problem
  - Consider the following algorithm:
    1. input  $n$
    2. print  $n$
    3. if  $n = 1$  then STOP
    4. if  $n$  is odd then  $n \leftarrow 3n + 1$
    5. else  $n \leftarrow n/2$
    6. GOTO 2.

# Prob: The $3n+1$ Problem (cont'd)

- The Problem
  - Given the input 22, the following sequence of numbers will be printed 22 11 34 17 52 26 13 40 20 10 5 16 8 4 2 1
  - It is conjectured that the algorithm above will terminate (when a 1 is printed) for any integral input value. Despite the simplicity of the algorithm, it is unknown whether this conjecture is true. It has been verified, however, for all integers  $n$  such that  $0 < n < 1,000,000$  (and, in fact, for many more numbers than this.)
  - Given an input  $n$ , it is possible to determine the number of numbers printed (including the 1). For a given  $n$  this is called the *cycle-length* of  $n$ . In the example above, the cycle length of 22 is 16.
  - For any two numbers  $i$  and  $j$  you are to determine the maximum cycle length over all numbers between  $i$  and  $j$ .

# Prob: The $3n+1$ Problem (cont'd)

- The Input
  - The input will consist of a series of pairs of integers  $i$  and  $j$ , one pair of integers per line. All integers will be less than 1,000,000 and greater than 0.
  - You should process all pairs of integers and for each pair determine the maximum cycle length over all integers between and including  $i$  and  $j$ .
  - You can assume that no operation overflows a 32-bit integer.

# Prob: The $3n+1$ Problem (cont'd)

- The Output
  - For each pair of input integers  $i$  and  $j$  you should output  $i$ ,  $j$ , and the maximum cycle length for integers between and including  $i$  and  $j$ . These three numbers should be separated by at least one space with all three numbers on one line and with one line of output for each line of input. The integers  $i$  and  $j$  must appear in the output in the same order in which they appeared in the input and should be followed by the maximum cycle length (on the same line).

# Prob: The $3n+1$ Problem (cont'd)

## Sample Input

1 10

100 200

201 210

900 1000

## Sample Output

1 10 20

100 200 125

201 210 89

900 1000 174



# Prob: Trip

- The Problem

- A number of students are members of a club that travels annually to exotic locations. Their destinations in the past have included Indianapolis, Phoenix, Nashville, Philadelphia, San Jose, and Atlanta. This spring they are planning a trip to Eindhoven. The group agrees in advance to share expenses equally, but it is not practical to have them share every expense as it occurs. So individuals in the group pay for particular things, like meals, hotels, taxi rides, plane tickets, etc. After the trip, each student's expenses are tallied and money is exchanged so that the net cost to each is the same, to within one cent. In the past, this money exchange has been tedious and time consuming. Your job is to compute, from a list of expenses, the minimum amount of money that must change hands in order to equalize (within a cent) all the students' costs.

# Prob: Trip (cont'd)

- The Input

- Standard input will contain the information for several trips. The information for each trip consists of a line containing a positive integer,  $n$ , the number of students on the trip, followed by  $n$  lines of input, each containing the amount, in dollars and cents, spent by a student. There are no more than 1000 students and no student spent more than \$10,000.00. A single line containing 0 follows the information for the last trip.

- The Output

- For each trip, output a line stating the total amount of money, in dollars and cents, that must be exchanged to equalize the students' costs.

# Prob: Trip (cont'd)

## Sample Input

3  
10.00  
20.00  
30.00  
4  
15.00  
15.01  
3.00  
3.01  
0

## Sample Output

\$10.00  
\$11.99