
**Assumption University of Thailand**

Vincent Mary School of Science and Technology

# CS 3201
# Algorithm Design
# Term Project Report

Semester 1/2020

Submit to
Asst. Prof. Dr. Thitipong Tanprasert

By
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# Problem

## 1885 – Passenger Comfort

Marketing managers of the company Oceanic Airlines started a new advertising campaign. Its aim was to emphasize the comfort of the passengers on board. However, when the board of directors watched the first commercial shot for the campaign, some questions appeared. The commercial ended with the catchy slogan "Oceanic Airlines. Blocked ears. Choose one of the two." But the chief executive remembered quite well how his ears had suffered during his last business trip to Bali with Oceanic Airlines…

According to the instructions, the airplane must climb to an altitude of ***h*** meters during the first ***t*** seconds of the flight and keep that altitude during the whole flight. The climbing rate must not be greater than ***v*** meters per second. The plane must not descend before the planned altitude is attained.

The marketing managers wanted to know if their advertising was truthful. They found out that ears were blocked only when a plane was ascending at a rate of more than ***x*** meters per second. Help the managers calculate the minimum and maximum amount of time during which passengers may have their ears blocked if the pilot adheres to the instructions. You may assume that the plane can change its speed instantly.

**Input**

The only line contains the integers ***h***, ***t***, ***v***, and ***x*** ($5\,000 \le h \le 12\,000$; $50 \le t \le 1\,200$; $1 \le x < v \le 100$; $h \le t \cdot v$).

**Output**

Output two real numbers, which are the minimum and maximum numbers of seconds during which passengers may have their ears blocked. The absolute or relative error of each number should not exceed 10^(−6).

**Sample**

In : 10000 500 50 10
Out : 125.0 500.0

# Problem Analysis

Firstly, the plane will have to climb to an altitude of **h** meter within **t** seconds. Moreover, such climbing rate during flight must not exceed **v** meter/sec. Lastly, the passengers would get ears blocked if the plane was ascending at a rate of more than **x** meter/sec. Therefore, we need to find the minimum and maximum number of second during which the passengers may have their ears blocked.

# Idea

I found out 2 cases that could happen

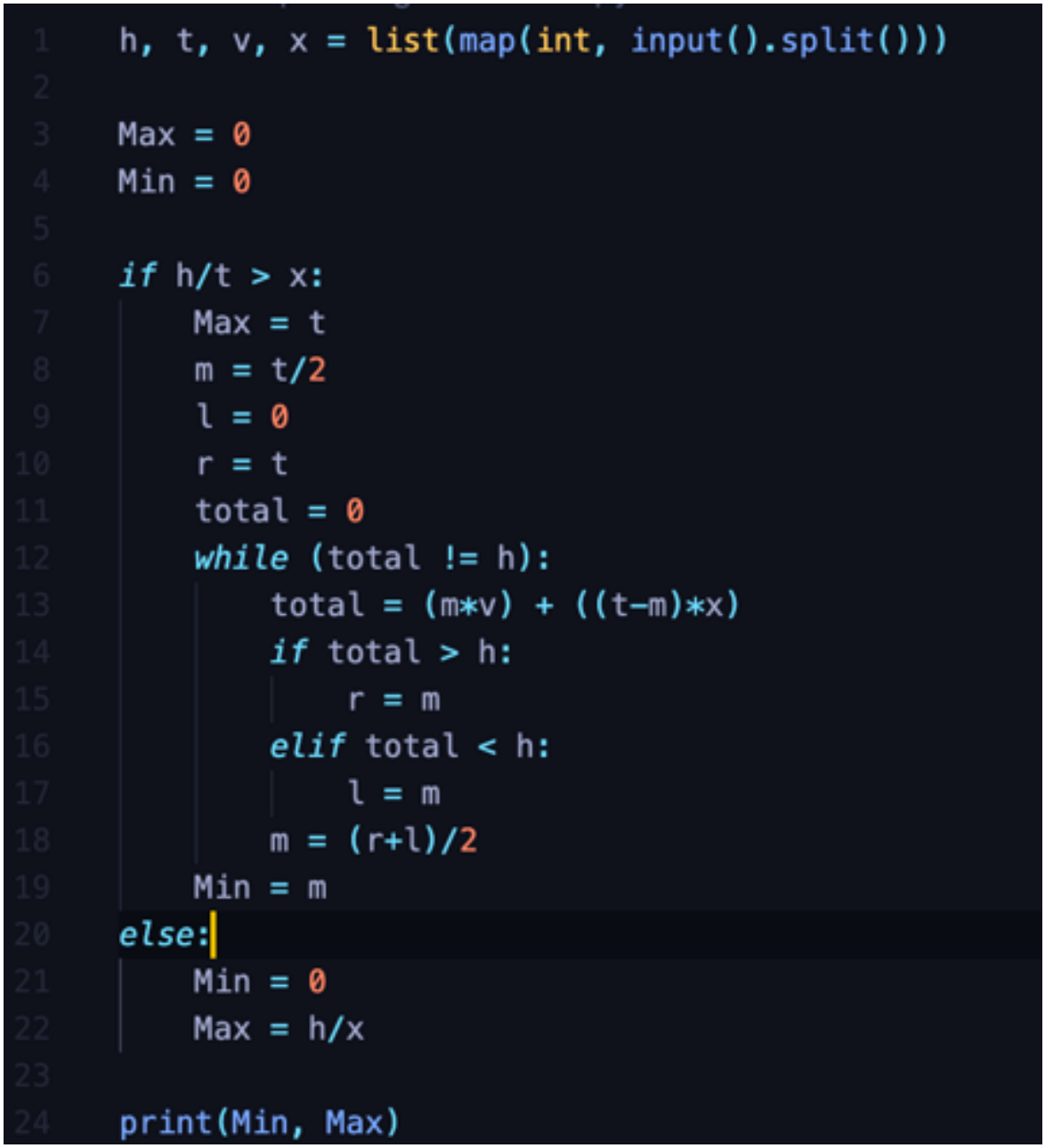
**Case 1**
I found that if the average speed of ascending to the height **h** during **t** seconds is greater than speed **x**, then **MAX** is **t** because the **MAX** would come from ascending the average speed to reach **h** which is greater than **X**. To find the MIN, we need to find the exact proportion of combining ascending **v** speed for **?** seconds and ascending of **x** speed for **t-?** seconds to reach height **h**. That **?** seconds will be **MIN**

**Case 2**
Otherwise, the **MAX** is **h**/**x**. Also, the **MIN** will be 0 because if the plane goes with the average speed which is less than or equal **x**, the ears block will never occur.

**For example**
Given h = 10000, t = 500, v = 50, x = 10
The average speed to reach h within t = 10000/500 = **20 meter/sec**
With such climbing rate which greater than x, the passenger would get ears blocked the entire time during climbing, so MAX = **500 sec**
To find min, we need to separate into 2 stages, first one is ascending with v speed, and another one is ascending with x speed. To find MIN, we need to apply **Binary Search** to find the exact proportion of these 2 stages. After calculating the proportion, we would get, ascending with 50 meter/sec or v for 125 sec so we could get the altitude of **6250 meter**, and ascending with 10 meter/sec or x for 375 sec then we would get another **3750 meter**, which would become 10000 meter. So, MIN = **125 sec**

Given h = 10000, t = 500, v = 50, x = 21
The average speed to reach h within t = 10000/500 = **20 meter/sec**
Now we can see if we keep ascending with this rate which is less than x, the passengers would never get ears blocked. Therefore, MIN = **0 sec**.
MAX would come from ascending with x speed (+ EPS, a very small number) to reach H, so it becomes 10000/21 = **476.190476 sec**

## Implementation



```
1   h, t, v, x = list(map(int, input().split()))
2
3   Max = 0
4   Min = 0
5
6   if h/t > x:
7       Max = t
8       m = t/2
9       l = 0
10      r = t
11      total = 0
12      while (total != h):
13          total = (m*v) + ((t-m)*x)
14          if total > h:
15              r = m
16          elif total < h:
17              l = m
18          m = (r+l)/2
19      Min = m
20  else:
21      Min = 0
22      Max = h/x
23
24  print(Min, Max)
```

From line 6 until 19, I handle case 1 by using Binary Search.
From line 20 until 22, are for case 2.

# Submission

| ID | Date | Author | Problem | Language | Judgement result | Test # | Execution time | Memory used |
|---|---|---|---|---|---|---|---|---|
| 9016017 | 11:26:16 12 Sep 2020 | yg.san | 1885. Passenger Comfort | Python 3.8 x64 | Accepted | | 0.093 | 380 KB |

# References

https://acm.timus.ru/problem.aspx?space=1&num=1885
https://acm.timus.ru/forum/thread.aspx?id=27390&upd=634948362971427211

TERM PROJECT

# CS3201 ALGORITHM DESIGN

# PROBLEM

Marketing managers of the company Oceanic Airlines started a new advertising campaign. Its aim was to emphasise the comfort of the passengers on board. However, when the board of directors watched the first commercial shot for the campaign, some questions appeared. The commercial ended with the catchy slogan “Oceanic Airlines. Blocked ears. Choose one of the two.” But the chief executive remembered quite well how his ears had suffered during his last business trip to Bali with Oceanic Airlines…

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The marketing managers wanted to know if their advertising was truthful. They found out that ears were blocked only when a plane was ascending at a rate of more than $x$ meters per second. Help the managers calculate the minimum and maximum amount of time during which passengers may have their ears blocked if the pilot adheres to the instructions. You may assume that the plane can change its speed instantly.

Difficulty: 197
Problem Author: Denis Dublennykh
Problem Source: NEERC 2011, Eastern subregional contest

# PROBLEM

## Input

The only line contains the integers ***h***, ***t***, ***v***, and ***x*** ($5\,000 \le h \le 12\,000$; $50 \le t \le 1\,200$; $1 \le x < v \le 100$; $h \le t \cdot v$).

## Output

Output two real numbers, which are the minimum and maximum numbers of seconds during which passengers may have their ears blocked. The absolute or relative error of each number should not exceed 10^(−6).

## Sample

In : 10000 500 50 10
Out : 125.0 500.0

# SOLUTION

MAX = the maximum number of seconds that ears blocked may occur
MIN = the minimum number of seconds that ears blocked may occur
? = Amount of time used to keep ascending at **v** speed

## Case 1

I found that if the average speed of ascending to the height **h** during **t** seconds is greater than speed **x**, then **MAX** is **t** because the **MAX** would come from ascending the average speed to reach **h** which is greater than **X**. To find the MIN, we need to find the exact proportion of combining ascending **v** speed for **?** seconds and ascending of **x** speed for **t-?** seconds to reach height **h**. That **?** seconds will be **MIN**

## Case 2

Otherwise, the **MAX** is **h/x**. Also, the **MIN** will be 0 because if the plane goes with the average speed which is less than or equal **x**, the ears blocked will never occur.

# CODE

```python
h, t, v, x = list(map(int, input().split()))

Max = 0
Min = 0

if h/t > x:
    Max = t
    m = t/2
    l = 0
    r = t
    total = 0
    while (total != h):
        total = (m*v) + ((t-m)*x)
        if total > h:
            r = m
        elif total < h:
            l = m
        m = (r+l)/2
    Min = m
else:
    Min = 0
    Max = h/x

print(Min, Max)
```

Binary Search Approach

# CODE

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## Case 2

Otherwise, the **MAX** is **h**/**x**. Also, the **MIN** will be 0 because if the plane goes with the average speed which is less than  or equal **x**, the ears blocked will never occur.

# SUBMISSION STATUS

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# AUTHOR

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