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PAA (G)

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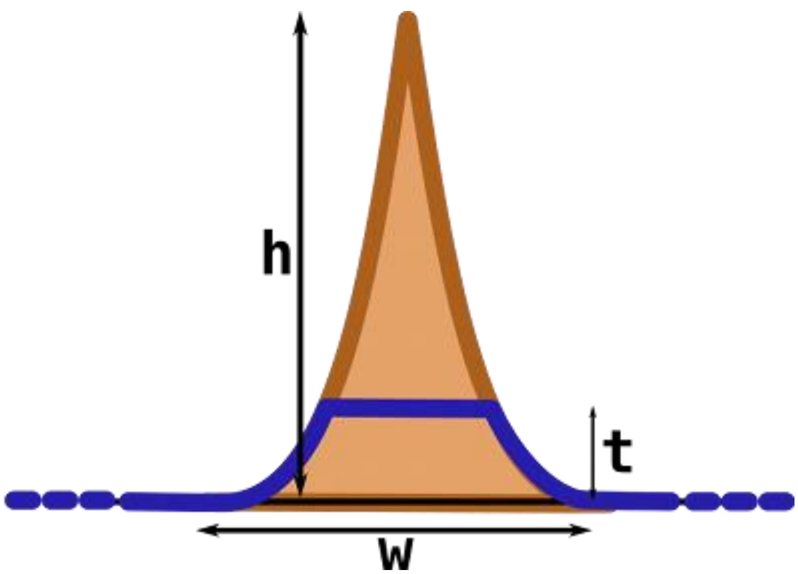
Soal 1 – 7704 Civil Engineering (https://www.spoj.com/problems/CIVIL/**)**

Problem Description

in this task, you take the role of a civil engineer who is to build a tunnel through a mountain. Unfortunately, you have a very limited budget, and must construct the cheapest possible tunnel.

Because engineers have a habit of simplifying things, we will model the mountain and the tunnel using basic geometric shapes. First of all, consider that the earth is flat, and two-dimensional. On this flat surface stands a mountain of height h and width w. Each side of the mountain is parabolic (i.e. satisfies $y = ax^2 + bx + c$ for some a, b, c). You also know that the base of the mountain is smooth, which means that its steepness at the base is zero.



The tunnel is modeled as a horizontal line through the mountain. The best possible tunnel is the one which minimizes construction cost. This cost is proportional to the length of the road which leads to the tunnel, plus the length of the tunnel itself. Consider that each meter of the tunnel is a factor f times as expensive as a meter of road.

Problem abstraction

Given a two-dimensional mountain represented as a parabolic shape we can input height, wide, and t times use int as a input. The goal was to locate the tunnels to minimize construction costs. The cost is proportional to the length of the road leading to the tunnel plus the length of the tunnel itself, with the cost per meter of tunnel being t times the cost of one meter of road. We need to find the minimum tunnel cost by considering the parabolic shape of the mountain and the horizontal line of the tunnel.

Solution

The solution to this problem is to find the cheapest way to build a tunnel through the parabolic hill. The mountain is represented by horizontal line crossing it, and each side of the mountain is a parabola with different coefficients. Construction costs depend on the length of the road leading to the tunnel and the tunnel itself. The cost per meter of tunnel is f times that of one meter of road.

In order to rationalize the costs, it is necessary to minimize the length of the tunnel and the routes leading to it, which can be achieved by minimizing them. By representing the tunnel as a horizontal line, the height of the mountain at any point inside the tunnel can be calculated using the parabolic equation. This elevation estimate allows calculation of the length of the tunnel and the length of the road approaching it.

The most efficient tunnel design was considered to be a straight horizontal line through the mountain, while using a parabolic curve to represent the mountainside. Each side of the mountain can be represented by a quadratic equation (y = ax2 + bx), where x is the distance from the center of the mountain and y is the height of the mountain at that particular distance. By determining the width of the mountain, the total effort for road and tunnel construction can be minimized. This is achieved by utilizing a narrower mountain, which keeps both the tunnel and road lengths as short as possible.

To determine the most cost-effective range for a mountain lair, it's possible to work the fact that the outgrowth of the cost equation with respect to the range reaches a minimum at zero. This system allows us to calculate the optimal range of the lair using the following formula cost of the lair section is

$$(t^2 - 1)\ x\ width^2\ x(height * 16)$$

Then print the output with setprecition (3)

Source Code

```
#include <iostream>

#include <iomanip>

#include <cmath>
```

```
using namespace std;

double kuadrat(double a)

{

    double b = a * a;

    return b;

}


int main()

{

    double height, width, t, x1, x2, output;

    cin >> height >> width >> t;

    while (height != 0)

    {

        x1 = kuadrat(t);

        x2 = kuadrat(width);

        output = ((x1 - 1) * x2 / (16 * height));

        cout << fixed << setprecision(3) << output << endl;

        cin >> height >> width >> t;

    }

    return 0;

}
```

SS accepted

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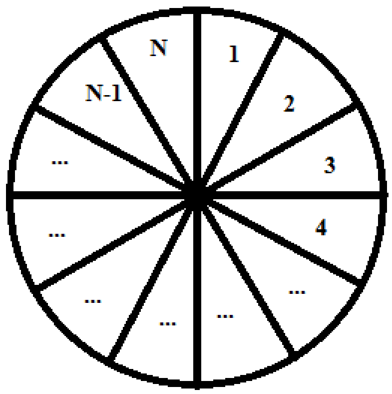
Soal 2 -- 12746 Colorful Circle (EASY) (SPOJ.com - Problem CRCLE_UI)

Problem Deskription

take this problem from my midterm exam today, because for me and some of my friends it's interesting, so I decided to translated this problem into English and upload this problem to SPOJ. See the original problem in Indonesian language here.

Given **N** sectors where $1<\mathbf{N}<10^{1000}$, from a circle that sown in the picture below:



We will color each sector with **K** different colors, where $2<\mathbf{K}<10^{1000}$ such that each sector colored with one color and each adjacent sector must have different color. Your task is to count how many ways to color all that sectors.

Problem Abstraction

The problem provides a set of points with their coordinates, and the task is to determine the center and radius of the smallest circle that encloses all of the given points. The solution must output the coordinates of the center and the radius of the circle, rounded to two decimal places.

Solution

To solve this problem, one can use the concept of the circumcircle, which is the circle that passes through all the vertices of a polygon. In this case, the set of points given can be considered a polygon, and the circumcircle of this polygon will be the smallest circle that encloses all the points.

To compute the center and radius of the circumcircle, one can use the formulae for the center and radius of a circle given three points on its circumference. Specifically, one can take any three points from the set of given points, compute the circumcenter of the triangle formed by these three points, and check whether this circle encloses all the other points. If it does, then this is the smallest enclosing circle, and the center and radius can be computed using the formulae. If the circle does not enclose all the other points, one can repeat the process with a different set of three points, until the smallest enclosing circle is found.

Source Code

```
#include <bits/stdc++.h>

#include <boost/multiprecision/cpp_int.hpp>

namespace mp = boost::multiprecision;

using namespace mp;

using namespace std;

const int limit = 1000000007;

int cal(int x1, cpp_int x2)

{

    long long count = 1, data = x1;

    while (x2)

    {

        if (x2 & 1)

            count = count * data;

        if (count >= limit)

            count = count - (count / limit) * limit;

        data = data * data;

        if (data >= limit)

            data = data - (data / limit) * limit;

        x2 >>= 1;
```

```
    }
    return count;
}
int main()
{
    int lim;
    cpp_int k1, k2;
    long long output, a1;
    for (scanf("%d", &lim); lim--;)
    {
        cin >> k1 >> k2;
        k2--;
        if (k2 >= limit)
            k2 %= limit;
        output = (long long)k2;
        if (k1 & 1)
            output = output * (-1);
        a1 = cal((int)k2, k1);
        printf("%lld\k1", (a1 + output + limit) % limit);
    }
}
```

SS Accepted

30986465	2023-03-09 17:20:11	rian syah	Colorful Circle (EASY)	**accepted** edit ideone it	0.08	5.3M	C++ 4.3.2

Declaration

No

Date

"By the name of Allah (God) Almighty, herewith I pledge and truly declare that I have solved quiz 1 by myself, didn't do any cheating by any means. I am going to accept all of the consequences by any means if it has proven that I have done any cheating and/or plagiarism."

Surabaya, 9 Maret 2023

(Muhammad Febriansyah)

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