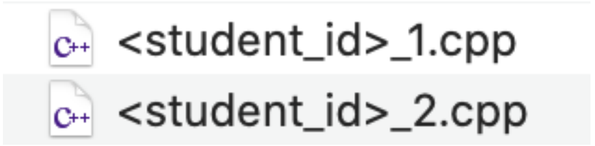
Week 3 Homework

Computer Programming Lab

2020/09/29

Remind

- 抄襲一律 0 分 （包含被抄襲者）
- 繳交期限: 10/4(Sun.) 11:59 p.m.
- 繳交的檔案格式、名稱請符合以下規定
  - 請繳交 zip檔至 Ceiba作業區，名稱為 <student_id>.zip
  - 解壓縮後須符合下圖的格式、名稱

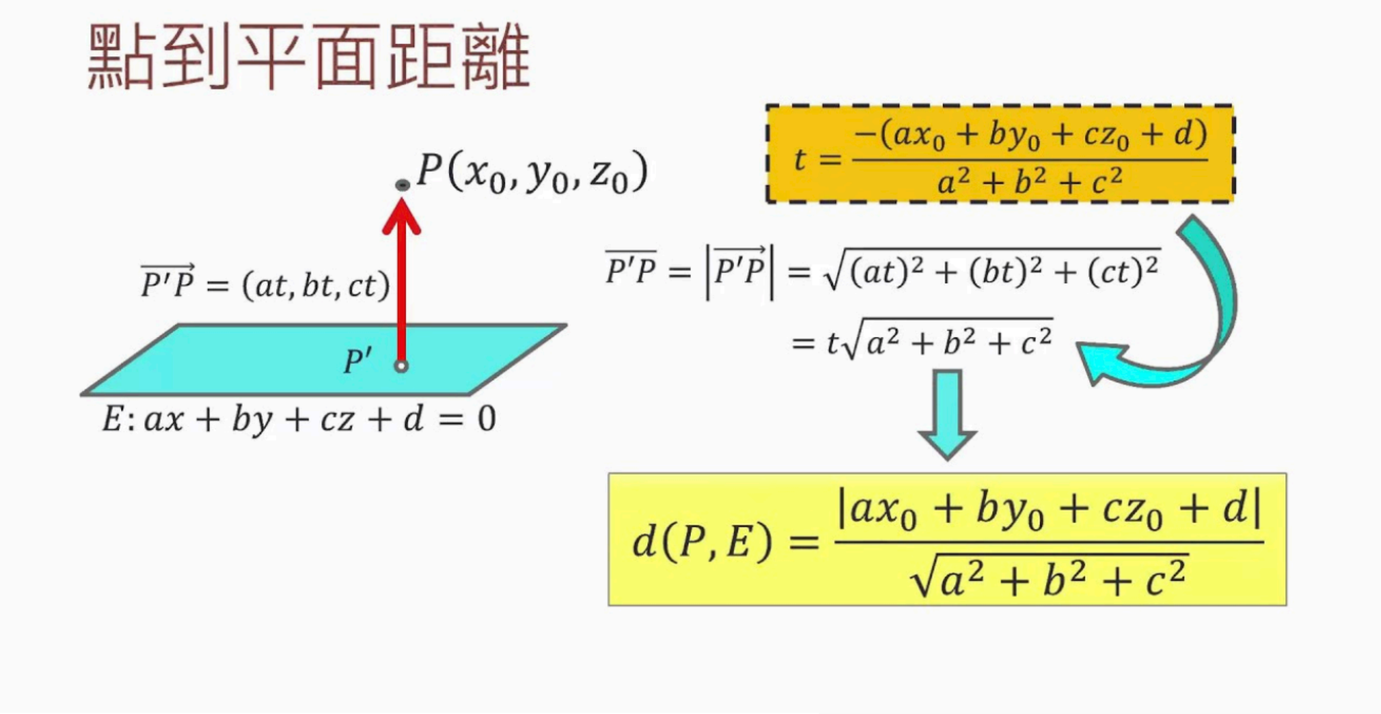


  - e.g. r09921051.zip
- 必須完成 Demo 才可以提早離開
- 若沒有完成 Demo 就中途早退，視同缺席

Problem 1 - The distance from a point to a plane (1%)

Description

Given a plane and a point in $\mathbb{R}^3$, calculate the distance from the point to the plane.



Hint: You can use library `#include <cmath>`

Problem 1 - The distance from a point to a plane (1%)

Input

The first line contains four integers a, b, c, d separated by a single space, indicates the parameters of the equation for the plane $ax + by + cz + d = 0$.

The second line contains three integers x_0, y_0, z_0 separated by a single space, indicate a point (x_0, y_0, z_0).

Output

The distance from the point (x_0, y_0, z_0) to the plane $ax + by + cz + d = 0$.

The output value should be a floating-point number and have exactly two digit after the decimal point.

Problem 1 - The distance from a point to a plane (1%)

Sample Input

```
1 2 2 4
3 2 1
```

Plain Text

Sample Output

```
4.33
```

Plain Text

File Name

{Student_ID}_1.cpp

Problem 2 - Vector operations (1%)

Description

Vector addition and scalar multiplication

In $\mathbb{R}^3$, a vector $\mathbf{v} = (v_1, v_2, v_3)$ is a three tuple that follow certain algebraic properties where $v_i \in \mathbb{R}$ for all $i \in \{1, 2, 3\}$. We can perform vector addition and scalar multiplication on vectors. To be precise, let $\mathbf{v} = (v_1, v_2, v_3)$ and $\mathbf{w} = (w_1, w_2, w_3)$ be two vectors, and $\alpha \in \mathbb{R}$ be a real scalar. Then the vector addition is defined to be

$$\mathbf{v} + \mathbf{w} := (v_1 + w_1, v_2 + w_2, v_3 + w_3),$$

and the scalar multiplication is defined to be

$$\alpha\mathbf{v} := (\alpha v_1, \alpha v_2, \alpha v_3).$$

Note that both vector addition and scalar multiplication returns vectors. Here we want to write a program that takes two vectors $\mathbf{v} = (v_1, v_2, v_3)$ and $\mathbf{w} = (w_1, w_2, w_3)$, and a scalar α, and then return the vector addition and scalar multiplication.

Problem 2 - Vector operations (1%)

Description

Inner product

The inner product of $\mathbf{v} = (v_1, v_2, v_3)$ and $\mathbf{w} = (w_1, w_2, w_3)$ is defined to be

$$\mathbf{v} \cdot \mathbf{w} := v_1 w_1 + v_2 w_2 + v_3 w_3.$$

Cross product

The cross product of $\mathbf{v} = (v_1, v_2, v_3)$ and $\mathbf{w} = (w_1, w_2, w_3)$ is defined to be

$$\mathbf{v} \times \mathbf{w} := \left(\begin{vmatrix} v_2 & v_3 \\ w_2 & w_3 \end{vmatrix}, \begin{vmatrix} v_3 & v_1 \\ w_3 & w_1 \end{vmatrix}, \begin{vmatrix} v_1 & v_2 \\ w_1 & w_2 \end{vmatrix} \right)$$

where $\begin{vmatrix} a & b \\ c & d \end{vmatrix}$ is defined as $ad - bc$.

Problem 2 - Vector operations (1%)

Input

We need two vectors $\mathbf{v}$ and $\mathbf{w}$, and a scalar $\alpha \in \mathbb{R}$ for inputs, and thus there will be three lines. For simplicity, we assume all numbers are integers. The first line consists of three integers for $\mathbf{v} = (v_1, v_2, v_3)$. The second line also consists of three integers for $\mathbf{w} = (w_1, w_2, w_3)$. Finally, the third line consists of a singel integer. Numbers in the same line should be seperated by whitespaces.

Sample input

```
1 2 3
4 5 6
100
```

Plain Text

Sample Output

```
5 7 9
100 200 300
400 500 600
32
-3 6 -3
```

Plain Text

Problem 2 - Vector operations (1%)

Output

The output consists of five lines:

- The first line: the vector addition of $\mathbf{v}$ and $\mathbf{w}$, which consists of three integers seperated by whitespaces
- The seconde line: the scalar multiplication of $\mathbf{v}$ by α, which consists of three integers seperated by whitespaces
- The third line: the scalar multiplication of $\mathbf{w}$ by α, which consists of three integers seperated by whitespaces
- The fourth line: the inner product $\mathbf{v} \cdot \mathbf{w}$, which is an integer
- The fifth line: the cross product $\mathbf{v} \times \mathbf{w}$, which consists of three integers seperated by whitespaces

Problem 2 - Vector operations (1%)

Sample input

```
1 2 3
4 5 6
100
```

Plain Text

Sample Output

```
5 7 9
100 200 300
400 500 600
32
-3 6 -3
```

Plain Text

File Name

{Student_ID}_2.cpp

常見問題

- 不需輸出於 sample output 沒有的字串
  e.g. “Enter the first vector”, “The answer is:”

- zip檔解壓縮後應直接為cpp檔案，不需再包一層資料夾

- 學號的第一個字母請小寫
  e.g. b12345678