

Specification

calculate the distance traveled by an object over some period of seconds when it is dropped based on gravity.

The equation for the distance traveled by a freely falling object is $y = \frac{1}{2}gt^2$, where t is time in seconds and g is the acceleration of gravity near the surface of the Earth, $g = 9.8 \frac{m}{s^2}$. Notice that this equation is independent of the mass of the object.

Create a program that outputs a sentence expressing the distance traveled in the given time. For example, an input of 10 seconds should have the output sentence “After the first 10 seconds, the object has fallen 490 meters.”

Analysis

inputs How many seconds

process Using the gravitational constant. The maximum possible distance it can travel would be based on how high it is dropped from.

outputs The distance traveled.

Reference: Gravitational Acceleration

Design

- Create a constant for the gravitational acceleration.

$$9.8m/s^2$$

- acceleration due to gravity is 9.8 m/s². This means that an object, such as a ball, dropped from a small distance above the ground will accelerate towards the ground at 9.8 m/s². If the ball starts with a velocity of zero, it will be traveling at 9.8 m/s² after falling for one second.
- $a = \frac{2d}{t^2}$ where a is acceleration, t is time in seconds, and d is distance. Solve for d :

$$d = \frac{at^2}{2}$$

- Display the distance to the nearest tenth.

Implementation

```
// cs102 lab 1
#include <iostream>
#include <string>
#include <cmath>
using namespace std;
int main()
{
    /*
       Create a constant for the gravitational acceleration.

                                $9.8m/s^2$ 

    */

    const double g = 9.8;
    cout << "please enter the number of seconds the object traveled :";
    double seconds_it_takes;
    cin >> seconds_it_takes;
    cout << "The distance the object travelled in a given time is " << "d = gt^2/2 ,where d

    //
```

```
}    return 0;
```

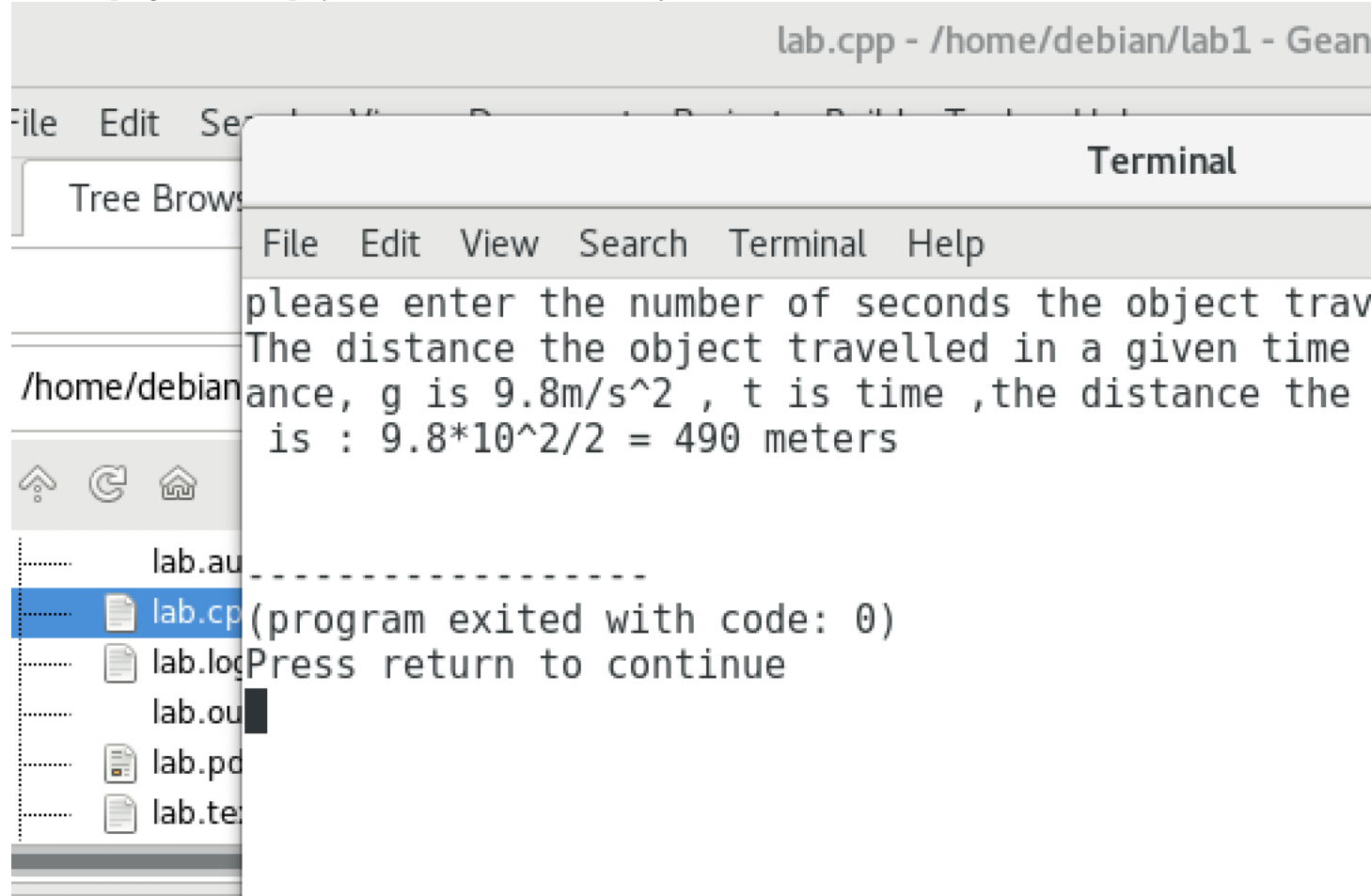
Test

Testcase 1

For example if the user types in 1 (second),

$$4.9 = \frac{9.8 \times 1^2}{2}$$

then the program will display: After the 1st second, the object has fallen 4.9 meters



Testcase 2

For example if the user types in 2 (seconds),

$$19.6 = \frac{9.8 \times 1^2}{2}$$

,then the program will display: After the 2 seconds, the object has fallen 19.6 meters