

Bibek Dhungana

Lab 2 - Out of Lab Assignment

Due Saturday, February 6, 2021, 11 am

Acknowledge your collaborators or source of solutions, if any. Do all of the following.

- 1) Consider a satellite that is in a low orbit about the Earth at a given altitude in km above Earth's surface. Write a program that takes input from the user for the altitude of the satellite and calculates the orbital speed of this satellite. The orbital speed may have decimal values that should be rounded up using the ceiling. The output should be a meaningful sentence. You need to use functions for the calculation when using the equation. Use the information given below.

The formula is:

$$\text{velocity} = \sqrt{(\text{gravitational constant} * \text{total mass} / \text{orbitradius})}$$

$$v = \sqrt{(G * M / r)}$$

Important information:

Gravitational constant $G = 6.673 * 10^{-11} \text{ Nm}^2/\text{Kg}^2$

Mass of earth $M = 5.98 * 10^{24} \text{ kg}$

Radius $r = \text{Radius of earth} + \text{altitude provided by the user}$

Radius of earth $= 6.37 * 10^6 \text{ m}$

Check the “Programming Guideline” document on Blackboard to know what to submit.

A sample of input and output:

Orbital speed Calculator

Input: Enter the altitude of the Satellite in km: 220

Output: The orbital speed of the satellite is 7782 m/s.

Code:

```
/*
AUTHOR: Bibek Dhungana
FILENAME: Lab2.c
SPECIFICATION: This program takes altitutue of satellite as input and
output orbital speed of the satellite.
FOR: CS 1412 Programming Principles 2 Section 504
*/

/*importing all the required libraries*/
#include <stdio.h>
```

```

#include <math.h>

/*function prototype of orbitalVelocity*/
double orbitalVelocityCalculator(double gravitationalConstant , double totalMass,
double orbitRadius);

int main(void) {

/*defining all the constant for the program*/
/*value of universal gravitational constant*/
const double gravitationalConstant = (6.673E-11);

/*value of mass of earth*/
const double totalMass = (5.98E24);

/*value of radius of earth*/
const double radiusOfEarth = (6.37E6);


/*initializing all the required variable*/
double satelliteAltitude;
double orbitalVelocity;
double orbitRadius;
int roundedOrbitalVelocity;

printf("Orbital speed Calculator\n");

/*Taking input of altitude of satellite in km*/
printf("Enter the altitude of the Satellite in km:");
scanf("%lf",&satelliteAltitude);

/*calculating the orbit radius in m*/
orbitRadius = radiusOfEarth + (satelliteAltitude * 1000);

/*calling the orbital VelocityFunction*/
orbitalVelocity = orbitalVelocityCalculator(gravitationalConstant, totalMass, or
bitRadius);

/*using ceil() function to round orbitalVelocity*/
roundedOrbitalVelocity = ceil(orbitalVelocity);

/*Printing out the result to user*/
printf("The orbital speed of the satellite is %d m/s\n",roundedOrbitalVelocity);

return 0;

```

```

}

/*
//function definition of orbital velocity
NAME: orbitalVelocity
INPUT: Gravitational constant (G), Mass of earth (M), Radius (r)
OUTPUT: orbitalVelocity(v)
SPECIFICATION: This function takes Gravitational constant (G), Mass of earth (M),
                Radius (r) as input perform following formula:
                velocity =  $\sqrt{\text{gravitational constant} * \text{total mass} / \text{orbit radius}}$ 
                and return orbital velocity of the satellite
*/

double orbitalVelocityCalculator(double gravitationalConstant , double totalMass,
double orbitRadius){

    return sqrt((gravitationalConstant * totalMass)/orbitRadius );
}

```

Output:

```

PS C:\Users\Dhung\OneDrive\Spring 2021\CS 1412\Assignment\lab2> g++ -o lab2 lab2.c
PS C:\Users\Dhung\OneDrive\Spring 2021\CS 1412\Assignment\lab2> ./lab2
Orbital speed Calculator
Enter the altitude of the Satellite in km:220
The orbital speed of the satellite is 7782 m/s
PS C:\Users\Dhung\OneDrive\Spring 2021\CS 1412\Assignment\lab2> ./lab2
Orbital speed Calculator
Enter the altitude of the Satellite in km:550
The orbital speed of the satellite is 7594 m/s
PS C:\Users\Dhung\OneDrive\Spring 2021\CS 1412\Assignment\lab2>

```