Final Project - Robert P.

Test Outputs:

1. Add Planet

```
e_prevost@ares:~/final_project$ ./finalProj1
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 1
Set the name of the planet: Zagarius
Set the mass of the planet: 2302300
Set the diameter of the planet: 4044040
Zagarius was added!
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 1
Set the name of the planet: Billy
Set the mass of the planet: 301301030
Set the diameter of the planet: 20202020
Billy was added!
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 1
Set the name of the planet: Shelly
Set the mass of the planet: 2302040
Set the diameter of the planet: 67678448
Shelly was added!
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 1
Set the name of the planet: Pizza
Set the mass of the planet: 230203024
Set the diameter of the planet: 11919
Pizza was added!
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
```

2. Delete a Planet

```
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 4
Planet #1:
The name of this planet is: Zagarius
The mass of this planet is: 2.3023e+06
The diameter of this planet is: 4.04404e+06
The surface area of this planet is 5.13784e+13
The density of this planet is 6.6484e-14
The acceleration due to gravity of the planet is 3.75822e-17
Planet #2:
The name of this planet is: Billy
The mass of this planet is: 3.0130le+08
The diameter of this planet is: 2.0202e+07
The surface area of this planet is 1.28215e+15
The density of this planet is 6.97939e-14
The acceleration due to gravity of the planet is 1.97089e-16
Planet #3:
The name of this planet is: Shelly
The mass of this planet is: 2.30204e+06
The diameter of this planet is: 6.76784e+07
The surface area of this planet is 1.43897e+16
The density of this planet is 1.41828e-17
The acceleration due to gravity of the planet is 1.34172e-19
Planet #4:
The name of this planet is: Pizza
The mass of this planet is: 2.30203e+08
The diameter of this planet is: 11919
The surface area of this planet is 4.46303e+08
The density of this planet is 0.000259653
The acceleration due to gravity of the planet is 4.32596e-10
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 2
Enter the name of the planet you want to delete: banana
Planet name was not in scope of list. Planet not deleted.
```

```
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 2
Enter the name of the planet you want to delete: Pizza
Planet successfuly deleted.
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 4
Planet #1:
The name of this planet is: Zagarius
The mass of this planet is: 2.3023e+06
The diameter of this planet is: 4.04404e+06
The surface area of this planet is 5.13784e+13
The density of this planet is 6.6484e-14
The acceleration due to gravity of the planet is 3.75822e-17
Planet #2:
The name of this planet is: Billy
The mass of this planet is: 3.01301e+08
The diameter of this planet is: 2.0202e+07
The surface area of this planet is 1.28215e+15
The density of this planet is 6.97939e-14
The acceleration due to gravity of the planet is 1.97089e-16
Planet #3:
The name of this planet is: Shelly
The mass of this planet is: 2.30204e+06
The diameter of this planet is: 6.76784e+07
The surface area of this planet is 1.43897e+16
The density of this planet is 1.41828e-17
The acceleration due to gravity of the planet is 1.34172e-19
```

3. Find Planet

```
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 3
enter name of the planet you want to find: Burger
The Planet was not found!
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 3
enter name of the planet you want to find: Zagarius
Zagarius was found at index: 0
The name of this planet is: Zagarius
The mass of this planet is: 2.3023e+06
The diameter of this planet is: 4.04404e+06
The surface area of this planet is 5.13784e+13
The density of this planet is 6.6484e-14
The acceleration due to gravity of the planet is 3.75822e-17
```

4. Show all Planets

```
Please Choose an Option from the List: 4
Planet #1:
The name of this planet is: Billy
The mass of this planet is: 3.0130le+08
The diameter of this planet is: 2.0202e+07
The surface area of this planet is 1.28215e+15
The density of this planet is 6.97939e-14
The acceleration due to gravity of the planet is 1.97089e-16
Planet #2:
The name of this planet is: Shelly
The mass of this planet is: 2.30204e+06
The diameter of this planet is: 6.76784e+07
The surface area of this planet is 1.43897e+16
The density of this planet is 1.41828e-17
The acceleration due to gravity of the planet is 1.34172e-19
Planet #3:
The name of this planet is: Zagarius
The mass of this planet is: 2.3023e+06
The diameter of this planet is: 4.04404e+06
The surface area of this planet is 5.13784e+13
The density of this planet is 6.6484e-14
The acceleration due to gravity of the planet is 3.75822e-17
```

5. Sort Planets

```
Please Choose an Option from the List: 4
Planet #1:
The name of this planet is: Zagarius
The mass of this planet is: 2.3023e+06
The diameter of this planet is: 4.04404e+06
The surface area of this planet is 5.13784e+13
The density of this planet is 6.6484e-14
The acceleration due to gravity of the planet is 3.75822e-17
Planet #2:
The name of this planet is: Billy
The mass of this planet is: 3.01301e+08
The diameter of this planet is: 2.0202e+07
The surface area of this planet is 1.28215e+15
The density of this planet is 6.97939e-14
The acceleration due to gravity of the planet is 1.97089e-16
Planet #3:
The name of this planet is: Shelly
The mass of this planet is: 2.30204e+06
The diameter of this planet is: 6.76784e+07
The surface area of this planet is 1.43897e+16
The density of this planet is 1.41828e-17
The acceleration due to gravity of the planet is 1.34172e-19
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 5
List was sorted!
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 4
Planet #1:
The name of this planet is: Billy
The mass of this planet is: 3.01301e+08
The diameter of this planet is: 2.0202e+07
The surface area of this planet is 1.28215e+15
The density of this planet is 6.97939e-14
The acceleration due to gravity of the planet is 1.97089e-16
Planet #2:
The name of this planet is: Shelly
The mass of this planet is: 2.30204e+06
The diameter of this planet is: 6.76784e+07
The surface area of this planet is 1.43897e+16
The density of this planet is 1.41828e-17
The acceleration due to gravity of the planet is 1.34172e-19
Planet #3:
The name of this planet is: Zagarius
The mass of this planet is: 2.3023e+06
The diameter of this planet is: 4.04404e+06
The surface area of this planet is 5.13784e+13
The density of this planet is 6.6484e-14
The acceleration due to gravity of the planet is 3.75822e-17
```

6. Save to file

```
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 6
Please enter the name of the file you want to save to.planet_list
1. Add a Planet
2. Delete a Planet (by name)
3. Find a Planet (by name)
4. Show all Planets
5. Sort Planets (by name)
6. Save Planets To File
7. Quit
Please Choose an Option from the List: 7
e_prevost@ares:~/final_project$ cat planet_list
Planet #1:
The name of this planet is: Billy
The mass of this planet is: 3.01301e+08
The diameter of this planet is: 2.0202e+07
The surface area of this planet is: 1.28215e+15
The density of this planet is: 6.97939e-14
The acceleration of this planet is: 1.97089e-16
Planet #2:
The name of this planet is: Shelly
The mass of this planet is: 2.30204e+06
The diameter of this planet is: 6.76784e+07
The surface area of this planet is: 1.43897e+16
The density of this planet is: 1.41828e-17
The acceleration of this planet is: 1.34172e-19
Planet #3:
The name of this planet is: Zagarius
The mass of this planet is: 2.3023e+06
The diameter of this planet is: 4.04404e+06
The surface area of this planet is: 5.13784e+13
The density of this planet is: 6.6484e-14
The acceleration of this planet is: 3.75822e-17
```

```
e_prevost@ares:~/final_project$ ls
finalProj1  finalProj1.C  planet_list  Save  saveHere
e_prevost@ares:~/final_project$
```

(planet_list file was created and saved)

Source Code:

```cpp
#include <iostream>
#include <cmath>
#include <string>
#include <climits>
#include <vector>
#include <fstream>
#include <cstdlib>

using namespace std;

const long double G = 6.67408 * pow(10.0,-11.0);
template<typename inputType>
inputType ReadValue(std::string prompt)
{
	inputType returnValue=0;
	std::cout << prompt;
	std::cin >> returnValue;
	while (std::cin.fail()==1) {
		std::cout << "Error! Cannot read input.\n";
		std::cin.clear();
		std::cin.ignore(INT_MAX,'\n');
		std::cout << prompt;
		std::cin >> returnValue;
	}
	return returnValue;
}


template<typename inputType>
inputType ReadValue(std::string prompt, inputType minValue)
{
	inputType returnValue=0;
	returnValue=ReadValue<inputType>(prompt);
	while (returnValue < minValue) {
		std::cout << "Error!  Value must be >= " << minValue << std::endl;
		returnValue=ReadValue<inputType>(prompt);
	}
	return returnValue;
}


template<typename inputType>
inputType ReadValue(std::string prompt, inputType minValue, inputType maxValue)
{
	inputType returnValue=0;
	returnValue=ReadValue<inputType>(prompt,minValue);
	while (returnValue > maxValue) {
		std::cout << "Error!  Value must be <= " << maxValue << std::endl;
		returnValue=ReadValue<inputType>(prompt,minValue);
	}
	return returnValue;
}
class Planet
{
	private:
		string name;
		double mass;
		double diameter;
	public:
		Planet();
		void SurfaceArea();
		void Density();
		void Acceleration();
		void setName(string n);
		void setMass(double m);
		void setDiameter(double d);
		string getName();
		double getMass();
		double getDiameter();
		void Input();
		void Display();
		double getAcceleration();
		double getDensity();
		double getSurfaceArea();
};
```

```
class List
{
	private:
		vector<Planet> planets;
		bool IsEqual();
	public:
		List();
		void Add();
		bool Delete();
		int Find(string p);
		bool Find(string p, string prompt);
		void ShowAllPlanets();
		void SortPlanets();
		bool SaveToFile(string fileName);

};
List::List()
{
;
}
bool List::SaveToFile(string fileName)
{
	//code pulled from Carl Molyneaux
	//edited by Robert Prevost
	int returnValue=0;

	ofstream output;
	output.open(fileName,ios::out);
	int len = planets.size();
	if (output.is_open()) {
		for(int i = 0; i < len; i++)
		{
			output << "Planet #" << i + 1 << ":" << endl;

			output<< "The name of this planet is: "<< planets[i].getName() << endl;
			output<< "The mass of this planet is: "<< planets[i].getMass() << endl;
			output<< "The diameter of this planet is: "<< planets[i].getDiameter() << endl;
			output << "The surface area of this planet is: " << planets[i].getSurfaceArea() << endl;
			output << "The density of this planet is: " << planets[i].getDensity() <<endl;
			output << "The acceleration of this planet is: " << planets[i].getAcceleration() << endl;

			if (output.fail()) {
				cerr << "Error writing to file!\n";
			}
		}
		output.close();
	 }
	else {
		cerr << "Error!  Cannot open file!\n";
		returnValue=1;
	}
	return returnValue;
}
void List::Add()
{
	Planet a;
	a.Input();
	planets.push_back(a);
	cout << a.getName() << " was added!" << endl;
}
int List::Find(string p)
{
	int rv = -1;
	int len = planets.size();
	for(int i = 0; i < len && rv == -1; i++){
		if(planets[i].getName() == p){
			rv = i;
		}
	}
	return rv;
}
bool List::Delete()
{
	string name;
	cout << "Enter the name of the planet you want to delete: ";
```

```
        cin.ignore();
        getline(cin,name);
        int pos = Find(name);
        if(pos != -1){
                int len = planets.size();
                for(int i = pos; i < len-1; )
                {
                        planets[i] = planets[i+1];
                }
                planets.pop_back();
        }
        return pos != -1;
}
bool List::Find(string p, string prompt)
{
        int rv = -1;
        int len = planets.size();
        for(int i = 0; i < len && rv == -1; i++){
                if(planets[i].getName() == p){
                        rv = i;
                }
        }
        if(rv != -1)
        {
                cout << prompt << rv << endl; //index
                planets[rv].Display();
                return true;
        }
        else
        {
                cout << "The Planet was not found!" << endl;
                return false;
        }

        return false;
}
/*bool List::IsEqual(Planet a, Planet b)
{
        bool rv = false;
        if(a.getName() == b.getName()){
                rv = true;
        }
        return rv;
} */
void List::ShowAllPlanets()
{
        int len = planets.size();
        for(int i = 0; i < len; i++)
        {
                  cout << "Planet #" << i + 1 << ":" << endl;
                  planets[i].Display();
        }
        if(len == 0)
        {
                cout << "List is empty." << endl;
        }
}
void List::SortPlanets()
{
        //code pulled from Bubble Sort algorithm by Carl Molyneaux
        //Updated to match List class
        long len=planets.size();
        for (long pass=0; pass<len; pass++) {
                for (long i=0; i<len-1; i++) {
                        if (planets[i].getName() > planets[i+1].getName()) {
                                Planet tmp;
                                tmp=planets[i];
                                planets[i]=planets[i+1];
                                planets[i+1]=tmp;
                        }
                }
        }
        cout << "List was sorted!" << endl;
}
```

```
Planet::Planet()
{
	name = "";
	mass = 0.0;
	diameter = 0.0;
}
void Planet::setName(string n)
{
	name = n;
}
void Planet::setMass(double m)
{
	mass = m;
}
void Planet::setDiameter(double d)
{
	diameter = d;
}
void Planet::SurfaceArea()
{
	double sa = pow(diameter,2.0) * M_PI;
	cout << "The surface area of this planet is " << sa <<endl;
}
void Planet::Density()
{
	double v = (M_PI * pow(diameter,3.0))/6.0;
	double density = mass/v;
	cout<< "The density of this planet is " << density <<endl;
}
void Planet::Acceleration()
{
	double a = (G * mass)/pow((diameter/2.0),2.0);
	cout<< "The acceleration due to gravity of the planet is " << a <<endl;
}
double Planet::getAcceleration()
{
	return (G * mass)/pow((diameter/2.0),2.0);
}
double Planet::getDensity()
{
	double v = (M_PI * pow(diameter,3.0))/6.0;
	return mass/v;
}
double Planet::getSurfaceArea()
{
	return pow(diameter,2.0) * M_PI;
}
string Planet::getName()
{
	return name;
}
double Planet::getMass()
{
	return mass;
}
double Planet::getDiameter()
{
	return diameter;
}
void Planet::Display()
{
	cout<< "The name of this planet is: "<< getName() << endl;
	cout<< "The mass of this planet is: "<< getMass() << endl;
	cout<< "The diameter of this planet is: "<< getDiameter() << endl;
	SurfaceArea();
	Density();
	Acceleration();
}
void Planet::Input()
{
	string name;
	cin.ignore();
	cout<<"Set the name of the planet: ";
	getline(cin,name);
```

```
        double mass = ReadValue<double>("Set the mass of the planet: ");
        double diameter = ReadValue<double>("Set the diameter of the planet: ");

        setName(name);
        setMass(mass);
        setDiameter(diameter);
}
int main()
{
        /*Planet a;
        Planet b;

        string name1 = "";
        cout<<"Set the name of the first planet: ";
        getline(cin,name1);
        double mass1 = ReadValue<double>("Set the mass of the first planet: ");
        double diameter1 = ReadValue<double>("Set the diameter of the first planet: ");

        a.setName(name1);
        a.setMass(mass1);
        a.setDiameter(diameter1);

        cout<< "Information of First Planet: " << endl;
        cout<< "The name of this planet is "<< a.getName() << endl;
        cout<<"The mass of this planet is " <<a.getMass() << endl;
        cout<< "The diameter of this planet is "<< a.getDiameter() << endl;

        a.SurfaceArea();
        a.Density();
        a.Acceleration();

        cin.clear();
        cin.ignore(INT_MAX, '\n');

        string name2 = "";
        cout<<"Set the name of the second planet: ";
        getline(cin,name2);

        double mass2 = ReadValue<double>("Set the mass of the second planet: ");
        double diameter2 = ReadValue<double>("Set the diameter of the second planet: ");

        b.setName(name2);
        b.setMass(mass2);
        b.setDiameter(diameter2);

        cout<< "Information of Second Planet: " << endl;
        cout<< "The name of this planet is "<< b.getName() << endl;
        cout<<"The mass of this planet is " <<b.getMass() << endl;
        cout<< "The diameter of this planet is "<< b.getDiameter() << endl;

        b.SurfaceArea();
        b.Density();
        b.Acceleration();

        double x = ReadValue<double>("Set a distance between the two planets ");
        double radius1 = diameter1/2.0;
        double radius2 = diameter2/2.0;

        double d = x + radius1 + radius2;
        double F = ((mass1*mass2)/(pow(d,2.0)))*G;

        cout<< "The force exerted between the two planets by eachother is: " << F << endl;*/
        List planetList;
        int choice;
        cout<< "1. Add a Planet" << endl;
        cout<< "2. Delete a Planet (by name)" << endl;
        cout<< "3. Find a Planet (by name)" << endl;
        cout<< "4. Show all Planets" << endl;
        cout<< "5. Sort Planets (by name)" << endl;
        cout<< "6. Save Planets To File" << endl;
        cout<< "7. Quit" << endl;
        choice = ReadValue<int>("Please Choose an Option from the List: ",1,7);

        if(choice == 7)
        {
```

```
        {
                cout<< "See ya!" << endl;
        }
        while(choice != 7){
                switch(choice){
                        case 1:
                        {
                                planetList.Add();
                        }
                        break;
                        case 2:
                        {
                                bool val = planetList.Delete();
                                if(val == true)
                                {
                                        cout << "Planet successfuly deleted." <<endl;

                                }
                                else
                                {
                                        cout << "Planet name was not in scope of list. Planet not deleted." << endl;
                                }
                        }
                        break;
                        case 3:
                        {
                                cin.ignore();
                                string name = "";
                                cout<< "enter name of the planet you want to find: ";
                                getline(cin, name);
                                string prompt = name + " was found at index: ";
                                planetList.Find(name, prompt);
                        }
                        break;
                        case 4:
                        {
                                planetList.ShowAllPlanets();
                        }
                        break;
                        case 5:
                        {
                                planetList.SortPlanets();
                        }
                        break;
                        case 6:
                        {
                                cin.ignore();
                                string file = "";
                                cout << "Please enter the name of the file you want to save to.";
                                getline(cin,file);
                                planetList.SaveToFile(file);
                        }
                        break;
                        case 7:
                        {
                                cout<< "See ya!" << endl;
                        }
                        break;
                }

                cout<< "1. Add a Planet" << endl;
                cout<< "2. Delete a Planet (by name)" << endl;
                cout<< "3. Find a Planet (by name)" << endl;
                cout<< "4. Show all Planets" << endl;
                cout<< "5. Sort Planets (by name)" << endl;
                cout<< "6. Save Planets To File" << endl;
                cout<< "7. Quit" << endl;
                choice = ReadValue<int>("Please Choose an Option from the List: ",1,7);
        }


        return 0;
}
```