

CS111 Homework 2 (Due Oct 4, 2018)

Name your programs **hw2a.cpp** for part A and **hw2b.cpp** for part B. Program must be able to compile or you will get at most 1 out of 2 points for the assignment.

Part A: BMI

The following exercise is taken from p.238 of Starting Out With C++ (7th ed.) by Tony Gaddis with slight modification.

Write a program that calculates and displays a person's body mass index (BMI). The BMI is often used to determine whether a person with a sedentary lifestyle is overweight or underweight for his or her height. A person's BMI is calculated with the following formula:

$$\text{BMI} = \text{weight} \times 703 / \text{height}^2$$

where weight is measured in pounds and height is measured in inches. The program should display a message indicating whether the person has optimal weight, is underweight, or is overweight. A sedentary person's weight is considered to be optimal if his or her BMI is between 18.5 and 25. If the BMI is less than 18.5, the person is considered to be under weight. If the BMI value is greater than 25, the person is considered to be overweight.

Test the inputs for out of bound conditions.

- i. If user enters a height less than 10, print out the following messages and **terminate** the program.

```
Input for height must be 10 inches or more.  
Terminating the program.
```

- ii. If user enters an invalid weight (i.e. non-positive number), use a **while** loop and print out the following message until user enters a correct value.

```
Please enter a weight greater than 0 lb:
```

Part B: Buoyancy (Ch.2 Q.12 in the textbook)

Buoyancy is the ability of an object to float. Archimedes' Principle states that the buoyant force is equal to the weight of the fluid that is displaced by the submerged object. The buoyant force can be computed by:

$$F_b = V \times \gamma$$

Where F_b is the buoyant force, V is the volume of the submerged object, and γ is the specific weight of the fluid. If F_b is greater than or equal to the weight of the object then it will float, otherwise it will sink.

Write a program that inputs the weight (in pounds) and radius (in feet) of a sphere and outputs whether the sphere will sink or float in water. Use $\gamma = 62.4 \text{ lb/ft}^3$ as the specific weight of water. The volume of a sphere is computed by $(4/3)\pi r^3$.

Sample outputs with user inputs shown in **bold**:

Part A:

```
[ctse@venus ans]$ make hw2a_fa18_sol
g++      hw2a_fa18_sol.cpp  -o hw2a_fa18_sol
[ctse@venus ans]$ ./hw2a_fa18_sol
Body Mass Index Program
What is your height measured in inches? 72
What is your weight measured in pounds? 160
Your BMI is 21.70 and is considered normal.
[ctse@venus ans]$ ./hw2a_fa18_sol
Body Mass Index Program
What is your height measured in inches? 60
What is your weight measured in pounds? 160
Your BMI is 31.24 and is considered overweight.
[ctse@venus ans]$ ./hw2a_fa18_sol
Body Mass Index Program
What is your height measured in inches? 80
What is your weight measured in pounds? 160
Your BMI is 17.57 and is considered underweight.
[ctse@venus ans]$ ./hw2a_fa18_sol
Body Mass Index Program
What is your height measured in inches? 5
Input for height must be 10 inches or more.
Terminating the program.
[ctse@venus ans]$ ./hw2a_fa18_sol
Body Mass Index Program
What is your height measured in inches? 72
What is your weight measured in pounds? -1
Please enter a weight greater than 0 lb: 0
Please enter a weight greater than 0 lb: 100
Your BMI is 13.56 and is considered underweight.
```

Part B:

```
[ctse@venus ans]$ ./hw2b_fa18_sol
Input weight of the sphere in pounds.
500.05
Input radius of the sphere in feet.
1
The sphere will sink in water.
[ctse@venus ans]$ ./hw2b_fa18_sol
Input weight of the sphere in pounds.
500.05
Input radius of the sphere in feet.
3.5
The sphere will float in water.
```