# Program 3 Seven Step Problem Solving Methodology Skeleton

Problem Statement for Body Mass Index Program Enhancement:

Design a program that calculates 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:

BMI = (weight times 703) divided by height squared

In the formula, weight is measured in pounds and height is measured in inches. Enhance the program so it displays 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 25.0. If the BMI is less than 18.5, the person is considered to be underweight. If the BMI value is greater than 25.0, the person is considered to be overweight.

To avoid using a magic number, create a constant to represent the 703: declare constant real BMI_FACTOR set to 703.

1. **Word Analysis:** (Which nouns suggest a need for memory (a variable) and which verbs suggest a need for action (a function maybe).

**Nouns:**

~~Program~~
BMI
~~Person~~
~~Lifestyle~~
Overweight
Underweight
Optimal weight
Height
Weight
~~Formula~~
~~Pounds~~
~~Inches~~
Message
~~Value~~
BMI_Factor

**Verbs:**

~~design~~
calculates
~~is used~~
determines
is calculated
~~times~~
~~divided~~
~~squared~~
measured
displays
~~has~~
~~is~~
~~is considered~~
is between
is less than
Is greater than
~~create~~

## 2. Variable Chart: (Conversion of verbs into camelCase variable names).

| | Input | Interim | Output |
|---|---|---|---|
| **Function** | | | |
| main | | | |
| | | BMI | |
| | | healthStatus | |
| | | weight | |
| | | height | |
| getWeight | | | |
| | | | totalWeight |
| | | | |
| getHeight | | | |
| | | | totalHeight |
| | | | |
| setMass | | | |
| | | | totalMass |
| | localVarWeight | | |
| | localVarHeight | | |
| setOverUnder | | | |
| | localVarMass | | |
| | | | wellBeing |
| showBMI | | | |
| | localVarMass | | |
| | localVarHealth | | |

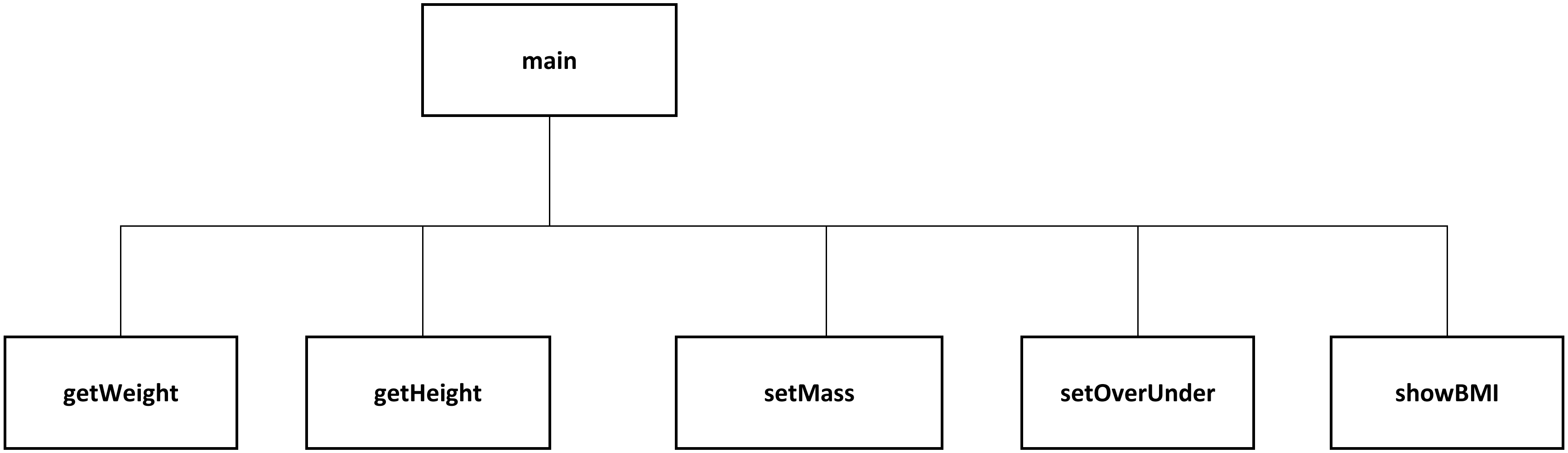
**Global Constants:**

Constant real BMI_FACTOR = 703
Constant real MASS_LOWER_LIMIT = 18.5
Constant real MASS_UPPER_LIMIT = 25.0

## 3. Major Task List (Keep it abstract; focus on the “what” high level)

a. Determine health status using BMI
b. Display results

4. **Structure Chart** (Your blue print plan for your functions…who calls who)



## 5. Pseudo Code

```
//Declare global constants
Declare constant real BMI_FACTOR = 703
Declare constant real MASS_LOWER_LIMIT = 18.5
Declare constant real MASS_UPPER_LIMIT = 25.0

//Define Function Prototypes
Function real getWeight()
Function real getHeight()
Function real setMass(real, real)
Function string setOverUnder(real)
Function void showBMI(string, real)


Begin function main

    // Declare variables
    Declare real weight
    Declare real height
    Declare real BMI                                      //Body Mass Index
    Declare string healthStatus                    //Optimal, Under, or Over weight

    // Get the user's weight
    Set weight = Call getWeight()

    // Get the user's height
    Set height = Call getHeight()

    // Calculate the user's Body Mass Index
    Set BMI = Call setMass(weight, height)

    //Determine the user's health status based on BMI
    Set healthStatus = Call setOverUnder(BMI)

    //Display the user's BMI and health status
    Call showBMI(healthStatus, BMI)
```

```
        return 0

End function main

// Function Definition for getWeight
Function real getWeight ()

        //Local variable declaration
        Declare real totalWeight                                     //To hold the user’s weight input from keyboard

        //Prompt the user for weight
        Display "Enter weight in pounds"
        Get totalWeight                                              //Takes the next real number from the input stream

        return totalWeight                                           //Sends value back to the caller

End function getWeight


// Function Definition for getHeight
Function real getHeight ()

        //Local variable declaration
        Declare real totalHeight                             //To hold the user’s height input from keyboard

        //Prompt the user for height
        Display "Enter height in inches"
        Get totalheight                                              //Takes the next real number from the input stream

        return totalHeight                                           //Sends value back to the caller

End function getHeight


//Function definition for setMass
Function real setMass (real localVarWeight, real localVarHeight)

        //Local variable declaration
        Declare real totalMass                               //To hold BMI
```

```
    // Calculate user’s body mass index
    Set totalMass = (localVarWeight * BMI_FACTOR) / (localVarHeight * localVarHeight)

    return totalMass                                        //Sends value back to the caller

End function setMass

//Functionn definition for setOverUnder, which determines user’s healthStatus base on BMI
Function string setOverUnder (real localVarMass)

    //Declare local variable
    Declare string wellBeing                    //To hold the user’s health status

    // Determine user’s health status based on his/her BMI
    if localVarMass is less than MASS_LOWER_LIMIT then
        wellBeing = "underweight"
    else if localVarMass is greater than MASS_UPPER_LIMIT then
        wellBeing= "overweight"
    else
        wellBeing = "optimal weight"

    return wellBeing                                        //Sends string value back to the caller

End function setOverUnder


//Function Definition for showBMI which displays the results
Function void showBMI (string localVarHealth, real localVarMass)
{

    // Display user’s BMI
    Display "Your BMI is ", localVarMass

    // Display user’s health status
    Display "You are ", localVarHealth

End function showBMI
```

## 6. Test Data:

You will need three sets of test data (so you can do three desk check cases) for height and weight to cover the three possibilities in this problem.

| Variable | Case 1 Optimal Weight | Case 2 Under Weight | Case 3 Over Weight |
|---|---|---|---|
| totalWeight | 120 lbs | 90 lbs | 250 lbs |
| totalHeight | 62 Inches | 62 Inches | 62 Inches |

## 7. Desk Check:

| Function | Variable Name | Values | Values | Values |
|---|---|---|---|---|
| main | | Case 1 | Case 2 | Case 3 |
| | weight | 120 | 90 | 250 |
| | height | 62 | 62 | 62 |
| | BMI | 21.95 | 16.46 | 45.72 |
| | healthStatus | optimal weight | underweight | overweight |
| getWeight | | | | |
| | totalWeight | 120 | 90 | 250 |
| getHeight | | | | |
| | totalHeight | 62 | 62 | 62 |
| setMass | | | | |
| | localVarWeight | 120 | 90 | 250 |
| | localVarHeight | 62 | 62 | 62 |
| | totalMass | 21.94 | 16.46 | 45.72 |
| setOverUnder | | | | |
| | localVarMass | 21.94 | 16.46 | 45.72 |
| | wellBeing | optimal weight | underweight | overweight |
| showBMI | | | | |
| | localVarHealth | 21.94 | 16.46 | 45.72 |
| | localVarMass | optimal weight | underweight | overweight |

Case 1

```
 Enter weight in pounds
 120
 Enter height in inches
 62
 Your BMI is 21.94
 You are optimal weight
```

Case 2

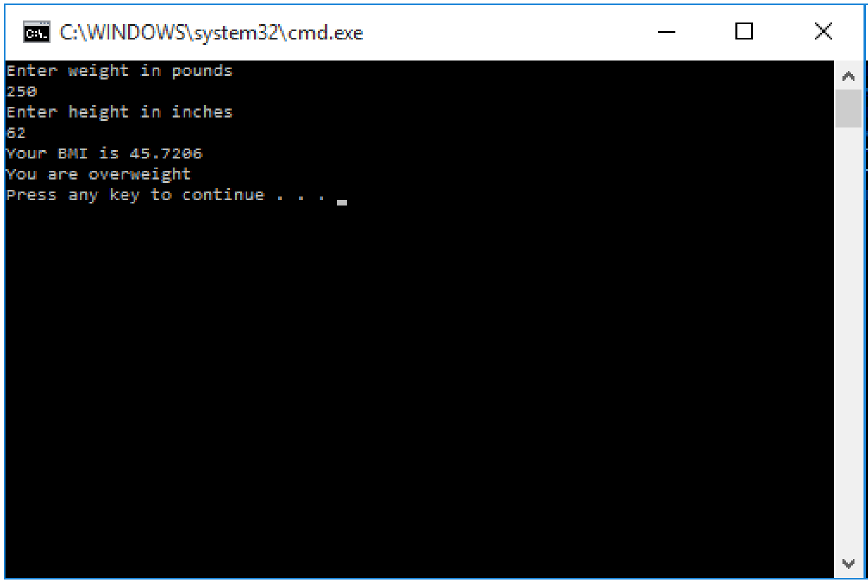
```
 Enter weight in pounds
90
 Enter height in inches
 62
 Your BMI is 16.46
 You are underweight
```

Case 3

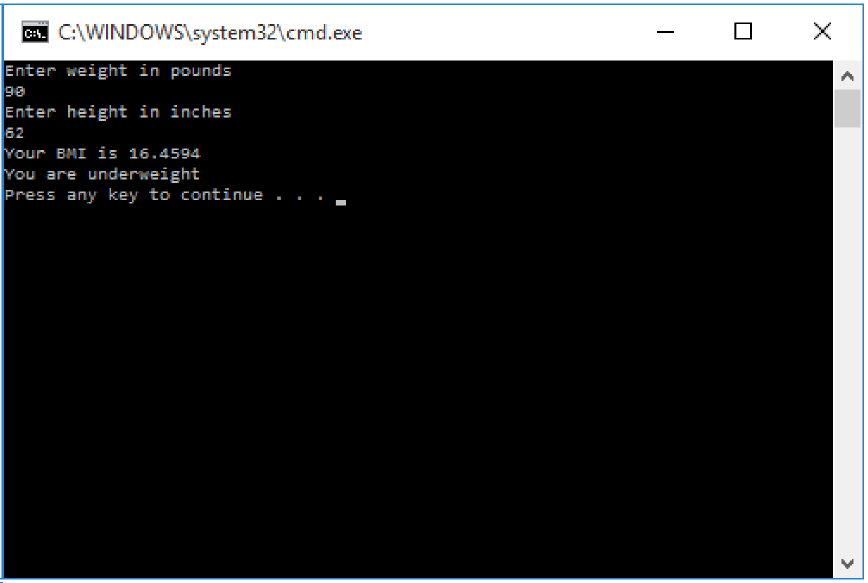
```
 Enter weight in pounds
 250
 Enter height in inches
 62
 Your BMI is  45.72
 You are overweight
```

## 8. Source Code & Screen Capture

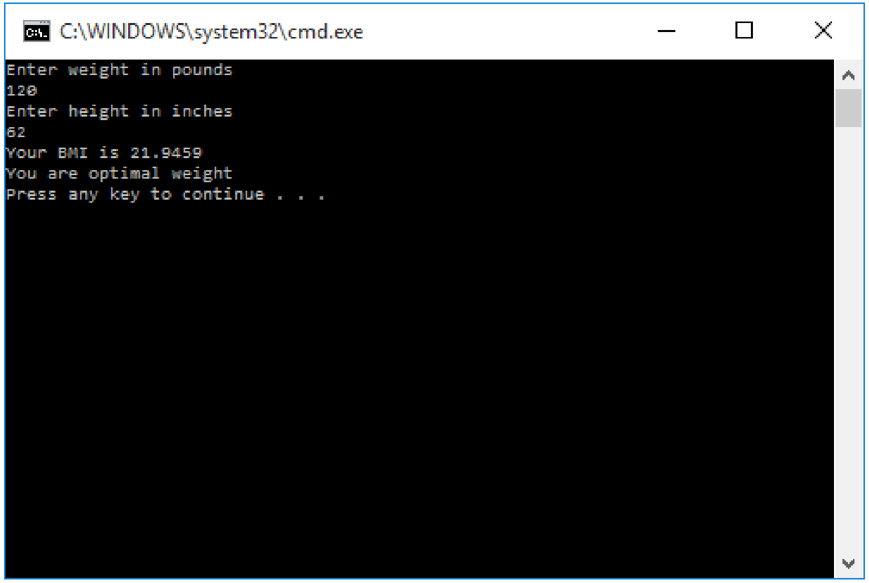
```
//Program Name: LoriaM-Prog3
//Name: Mindy Loria
//Purpose: This program gets end user input for weight and height to calculate BMI
//     and determine if a person is at optimal weight, overweight, or underweight
//Date Created: 2015-10-01
//Assumptions: This program will only run once (no loop)



//Preprocessor directives
#include <string>
#include <iostream>
using namespace std;

//Declare global constants
const double BMI_FACTOR = 703;
const double MASS_LOWER_LIMIT = 18.5;
const double MASS_UPPER_LIMIT = 25.0;

//Define Function Prototypes
double getWeight();
double getHeight();
double setMass(double, double);
string setOverUnder(double);
void showBMI(string, double);


//Begin function main
int main()
{
       // Declare variables
       double weight;                                  //User's weight
       double height;                                  //User's height
       double BMI;                                     //Body Mass Index
       string healthStatus;              //Optimal, Under, or Over weight

       weight = getWeight();                           // Get the user’s weight

       height = getHeight();                           // Get the user’s height

       BMI = setMass(weight, height);           // Calculate the user’s Body Mass Index

       healthStatus = setOverUnder(BMI); //Determine the user’s health status based on BMI
       showBMI(healthStatus, BMI);               //Display the user’s BMI and health status

       return 0;

} //End main



// Function Definition for getWeight
double getWeight()                                            //Function header; start of the function definition
{

       //Local variable declaration
       double totalWeight;                                    //To hold the user’s weight input from keyboard

       //Prompt the user for weight
       cout << "Enter weight in pounds" << endl;
       cin >> totalWeight;                                    //Takes the next real number from the input stream

       return totalWeight;                                    //Sends value back to the caller

} //End getWeight




// Function Definition for getHeight
double getHeight()                                            //Function header; start of the function definition
{
       //Local variable declaration
       double totalHeight;                              //To hold the user’s height input from keyboard

       //Prompt the user for height
       cout << "Enter height in inches" << endl;
       cin >> totalHeight;                              //Takes the next real number from the input stream

       return totalHeight;                              //Sends value back to the caller

} // End getHeight


//Function definition for setMass
double setMass(double localVarWeight, double localVarHeight)  //Function header; start of the function definition
{
       //Local variable declaration
       double totalMass;                                //To hold BMI

       // Calculate user’s body mass index - BMI = (weight times 703) divided by height squared
       totalMass = (localVarWeight * BMI_FACTOR) / (localVarHeight * localVarHeight);

       return totalMass;                                      //Sends value back to the caller

} //End setMass



//Functionn definition for setOverUnder, which determines user’s healthStatus base on BMI
string setOverUnder(double localVarMass) //Function header; start of the function definition
{

       //Declare local variable
       string wellBeing;                        //To hold the user’s health status

       // Determine user’s health status based on his/her BMI
       if (localVarMass < MASS_LOWER_LIMIT) {
              wellBeing = "underweight";
       }
       else if (localVarMass > MASS_UPPER_LIMIT) {
              wellBeing = "overweight";
       }
       else {
              wellBeing = "optimal weight";
       }

       return wellBeing;                                      //Sends string value back to the caller

} //End setOverUnder



//Function Definition for showBMI which displays the results
void showBMI(string localVarHealth, double localVarMass)      //Function header; start of the function definition
{

       // Display user’s BMI
       cout << "Your BMI is " << localVarMass << endl;

       // Display user’s health status
       cout << "You are " << localVarHealth << endl;

} //End showBMI
```



```
Enter weight in pounds
250
Enter height in inches
62
Your BMI is 45.7206
You are overweight
Press any key to continue . . .
```



```
Enter weight in pounds
90
Enter height in inches
62
Your BMI is 16.4594
You are underweight
Press any key to continue . . .
```



```
Enter weight in pounds
120
Enter height in inches
62
Your BMI is 21.9459
You are optimal weight
Press any key to continue . . .
```