---'Save As' this file using the name in the assignment instructions.
---Type you information.
---Submit the completed development plan via Blackboard with you other files.

NAME: J Hundley
ASSIGNMENT: Lab04.m / assign04.c
DATE: Feb. 8, 2012

PROBLEM SOLVING IN ENGINEERING AND SCIENCE
Always use a systematic problem-solving strategy.

1. STATE THE PROBLEM:
---Describe the problem to be solved for the assignment.

Find the Body Mass Index (BMI) for a given height(in inches) and weight(in pounds).
Determine the BMI catagory.
Compute and display the target weight for a given BMI.
Compute the Idea Body Weight (IBW) for given height and gender.
Validate all user enter data before using it.
height (59-78), weight (90-350), gender (1, 2), target BMI (18.5-30.0)
Do the above for one or more people.

2. DESCRIBE THE INPUT AND OUTPUT REQUIREMENTS:
---List and describe the following as needed to solve the problem, as needed.
---Include units where needed.

   CONSTANTS (known values that don't change):

none

   INPUT (values needed to find the output):

height in inches
weight in pounds
BMI
gender

   OUTPUT (unknowns)

BMI
weight in pounds
IBW

   OTHER VARIABLES

height in meters
weight in kilograms
number of people
count

   Relevant formulas:
      (for complicated equations, it may be helpful to divide it into parts)

BMI = mass in kg / (height in meters)^2
1 kg = 2.2046 pounds
1 inch = 2,54 cm

IBW (men)   = 50.0 + 2.3 * (height - 60)
IBW (women) = 45.5 + 2.3 * (height - 60)

3. WORK HAND EXAMPLES
---Solve the problem with a few hand examples.
---Record the input values used and the results

ht(in)	wt(lbs)	BMI	BMI	wt(lbs)	F/M	IBW
72	165	22.378	25	184.333	M	171.08
59	100	20.20	25	123.78	F	95.24

4. DEVELOP AN ALGORITHM:
---Think about the steps used to solve the problem to solve the problem by
   hand and list them here to create an algorithm.
---The algorithm steps should be used as comments in your program as a guide.

```
Prompt user for the number of people
for each person enter and compute stats
  INPUT
    While not a good weight, prompt the user to enter a value for weight in pounds
    While not a good height, prompt the user to enter a value for height in inches.
  BMI
    Compute conversions.
    Calculate.
    Display BMI.
    Display BMI classification
  Target BMI and weight
    Until good BMI, prompt the user to enter a value for BMI.
    Compute weight.
    Compute conversions.
    Display weight.
  IBW
    While not a good gender, prompt user to enter the gender (1 or 2)(F/f or M/m).
    Compute IBW for given height and gender.
    Compute conversions
    Display IBW.
```

5. SOLVE THE PROBLEM:
---This step represents your writing a computer program to solve the problem.
---NOTE: Do not type your program here. Submit it as a computer program file.
---Use steps in your algorithm as comments in your program
   to guide the development of you program.

6. TEST THE SOLUTION:
---Run your program using the values from #3 to check for correctness.
---If there is an error, correct your program code and run again.

```c
// J Hundley
// assign04a
// Feb. 15, 2012
/* Input height and weight then compute and display BMI.
Print the classification for the computed weight.
Input a target weight then compute and display target weight.
Input gender (1=female, 2=male) then compute and display ideal weight
Validate all user enter data before using it.
height (59-78), weight (90-350), gender (1, 2), target BMI (18.5-30.0)
*/

#include <stdio.h>

   int main()
   {
      double inches, pounds,    // input
             meters, kilograms, // converted values
             bmi;               // output
      char   gender;            // female(F/f) or male(M/m)
      double ideal;             // ideal weight for gender


      // === INPUT ==============================
      // While not a good height, prompt the user to enter a value for height in inches
         do
         {
            printf("Enter the height in inches(59-78): ");
            scanf("%lf", &inches);
         } while ( inches < 59.0 || inches > 78.0 );

      // While not a good weight, prompt the user to enter a value for weight in poundss
         do
         {
            printf("Enter the weight in pounds(90-350): ");
            scanf("%lf", &pounds);
         }while ( pounds < 90.0 || pounds > 350.0 );

      // === BMI ================================
      // compute converstions
         meters = inches * 0.0254;
         kilograms = pounds / 2.2046;

      // calculate
         bmi = kilograms /(meters * meters);

      // display bmi
         printf("\nThe BMI is: %.2f\n", bmi);

      // display BMI classification
         printf("BMI Classification: ");
        if (bmi < 25)
            printf("Normal\n\n");
         else if (bmi >= 30)
            printf("Obese\n\n");
         else
            printf("Overweight\n\n");
```

```
   // === Target BMI and weight ===============
   // While not a good bmi, prompt the user to enter a value for BMI.
      do
      {
         printf("Enter the target BMI(18.5-30.0): ");
         scanf("%lf", &bmi);
      }while ( bmi < 18.5 || bmi > 30.0 );

   // Compute weight
      kilograms = bmi * meters * meters;
   // Compute conversions
      pounds = 2.2046 * kilograms;
   // Display weight
      printf("\nThe target weight is: %.2f\n\n", pounds);

   // === IBW ================================
   // While not a good gender, prompt user to enter the gender (F/f or M/m).
      do
      {
         printf("Is the person a female or male? Enter F or M: ");
         scanf(" %c", &gender);
         printf("gender=%c\n", gender);
      }while(!(gender=='m' || gender=='M' || gender=='f' || gender=='F'));

      // compute the IBW for the given height and gender
      if( gender=='F' || gender=='f')
         ideal = 45.5 + 2.3 * (inches-60);
      else
         ideal = 50.0 + 2.3 * (inches-60);
   // Compute conversions
      pounds = 2.2046 * ideal;
   // display IBW
      printf("\nThe ideal weight is %.2f pounds.\n", pounds);

   return 0;
}
```

```c
// J Hundley
// assign04b
// Feb. 15, 2012
/* Input height and weight then compute and display BMI.
Print the classification for the computed weight.
Input a target weight then compute and display target weight.
Input gender (1=female, 2=male) then compute and display ideal weight
Validate all user enter data before using it.
height (59-78), weight (90-350), gender (1, 2), target BMI (18.5-30.0)
Do the above for one or more people.
*/

#include <stdio.h>

    int main()
   {
      double inches, pounds,    // input
             meters, kilograms, // converted values
             bmi;               // output
      char   gender;            // female(F/f) or male(M/m)
      double ideal;             // ideal weight for gender
      int    numPeople,         // number of people
             count;             // count people

   // Prompt for the number of people
      printf("Enter the number of people: ");
      scanf("%d", &numPeople);

   // for each person enter and compute stats
      for (count=1; count<=numPeople; count++)
      {
      // === INPUT ==============================
      // While not a good height, prompt the user to enter a value for height in inches
         do
         {
            printf("Enter the height in inches(59-78): ");
            scanf("%lf", &inches);
         } while ( inches < 59.0 || inches > 78.0 );

      // Whilw not a good weight, prompt the user to enter a value for weight in poundss
         do
         {
            printf("Enter the weight in pounds(90-350): ");
            scanf("%lf", &pounds);
         }while ( pounds < 90.0 || pounds > 350.0 );

      // === BMI ================================
      // compute converstions
         meters = inches * 0.0254;
         kilograms = pounds / 2.2046;

      // calculate
         bmi = kilograms /(meters * meters);
```

```
   // display bmi
      printf("\nThe BMI is: %.2f\n", bmi);

   // display BMI classification
      printf("BMI Classification: ");
      if (bmi < 25)
         printf("Normal\n\n");
      else if (bmi >= 30)
         printf("Obese\n\n");
      else
         printf("Overweight\n\n");

   // === Target BMI and weight ===============
   // While not a good bmi, prompt the user to enter a value for BMI.
      do
      {
         printf("Enter the target BMI(18.5-30.0): ");
         scanf("%lf", &bmi);
      }while ( bmi < 18.5 || bmi > 30.0 );

   // Compute weight
      kilograms = bmi * meters * meters;
   // Compute conversions
      pounds = 2.2046 * kilograms;
   // Display weight
      printf("The target weight is: %.2f\n\n", pounds);

   // === IBW ================================
   // While not a good gender, prompt user to enter the gender (F/f or M/m).
      do
      {
         printf("Is the person a female or male? Enter F or M: ");
         scanf(" %c", &gender);
      }while(!(gender=='m' || gender=='M' || gender=='f' || gender=='F'));

   // compute the IBW for the given height and gender
      if( gender=='F' || gender=='f')
         ideal = 45.5 + 2.3 * (inches-60);
      else
         ideal = 50.0 + 2.3 * (inches-60);
   // Compute conversions
      pounds = 2.2046 * ideal;
   // display IBW
      printf("\nThe ideal weight is %.2f pounds.\n", pounds);

   }  // end for each person loop
   return 0;
}
```

COMP1200-C - Assign 04
Due midnight – Wednesday – February 15
Submit `assign04a.c, assign04b.c` and `devPlan04(.txt or .pdf)` **via Blackboard**

This assignment continues to demonstrate how to approach solving a large problem by solving one smaller part at a time. By solving a smaller part correctly before adding the next, one can keep the number of statements and errors that may result from them to a minimum. The addition requirements demonstrate how an existing problem may change in scope and thus the solution program must be modified. By saving the solution files with an incremental file name, additional versions can easily be saved using subsequent names providing good backup files.

NOTE: Your submitted file(s) MUST be spelled and cased as instructed.

PART a:

***Before you start writing your program**:*

Using the information in these instructions and previous devPlans, fill in the Software Development Plan (`devPlan04.txt`) to plan your solution to the assign04a assignment problem. If you do not use Notepad to edit the `devPlan04.txt` file, save it as a `.pdf` for submission.

Save your assign03.c as assign04a.c

Read all instructions before beginning your work.

***Program*: assign04a.c**

A growing number of people are becoming more health conscious watching their diet and exercising more. Statistics are available to help them monitor their progress toward becoming a healthier person. The body mass index (BMI) is a statistical measure which compares a person's weight and height. Though it does not actually measure the percentage of body fat, it is used to estimate a healthy body weight. The following equation is used to calculate body mass index. Note: The mass is the body weight in kilograms and height is in meters. [http://en.wikipedia.org/wiki/Body_mass_index]

When relying on user input, data validation is important to ensure that correct information is enter. Use a `do_while` loop to validate each user input. This requirement needs to be added to this program for each value entered: height (59-78), weight (90-350), gender (M,m,F,f), and target BMI (18.5-30.0). Each range is inclusive.

***Additional Problem Constants*:**
None.
***Additional Problem Inputs*:**
None
Additional Problem Outputs:
None
Additional Other variables:
None

- ☐ INPUT
  - Until good weight, prompt the user to enter a value for *weight in pounds*
  - Until good height, prompt the user to enter a value for *height in inches*.
- ☐ BMI
  - Compute conversions.
  - Calculate.
  - Display *BMI*.
  - Display *BMI classification*
- ☐ Target BMI and weight
  - Until good BMI, prompt the user to enter a value for *BMI*.
  - Compute *weight*.
  - Compute conversions.
  - Display *weight*.
- ☐ IBW
  - Until good gender, prompt user to enter the *gender* (F/f or M/m).
  - Compute *IBW* for given *height* and *gender*.
  - Compute conversions
  - Display *IBW*.

New commands
`do…while`

Sample Input/Output:

```
Enter the height in inches(59-78): 50
Enter the height in inches(59-78): 80
Enter the height in inches(59-78): 72
Enter the weight in pounds(90-350): 85
Enter the weight in pounds(90-350): 400
Enter the weight in pounds(90-350): 165

The BMI is: 22.38
BMI Classification: Normal

Enter the target BMI(18.5-30.0): 18
Enter the target BMI(18.5-30.0): 31
Enter the target BMI(18.5-30.0): 25

The target weight is: 184.33

Is the person a female or male? Enter F or M: x
Is the person a female or male? Enter F or M: m

The ideal weight is 171.08 pounds.
```

PART b:

Before you start writing your program*:*

Add the assign04b requirements to your devPlan04 Development Plan to plan your solution to the assign04b assignment problem. Save your assign04a.c as assign04b.c and add the new requirements.

***Program*: assign04b.c**

Once you have all the previous requirements implemented correctly for one person, you are ready to add a loop to run the program for a given number of people using a `for` loop.

***Additional Problem Constants*:**
None.
***Additional Problem Inputs*:**
number of people
Additional Problem Outputs:
None
Additional Other variables:
counter

New commands
`for`
nested loops

Algorithm:

- ☐ Prompt user for the number of people
- ☐ for each person enter and compute stats
    - INPUT
        - While not a good weight, prompt the user to enter a value for *weight in pounds*
        - While not a good height, prompt the user to enter a value for *height in inches*.
    - BMI
        - Compute conversions.
        - Calculate.
        - Display *BMI*.
        - Display *BMI classification*
    - Target BMI and weight
        - Until good BMI, prompt the user to enter a value for *BMI*.
        - Compute *weight*.
        - Compute conversions.
        - Display *weight*.
    - IBW
        - While not a good gender, prompt user to enter the *gender* (F/f or M/m).
        - Compute *IBW* for given *height* and *gender*.
        - Compute conversions
        - Display *IBW*.

Sample Input/Output:

```
Enter the number of people: 2

Enter the height in inches(59-78): 60
Enter the weight in pounds(90-350): 145

The BMI is: 28.32
BMI Classification: Overweight

Enter the target BMI(18.5-30.0): 25
The target weight is: 128.01

Is the person a female or male? Enter F or M: F
The ideal weight is 100.31 pounds.

Enter the height in inches(59-78): 72
Enter the weight in pounds(90-350): 165

The BMI is: 22.38
BMI Classification: Normal

Enter the target BMI(18.5-30.0): 25
The target weight is: 184.33

Is the person a female or male? Enter F or M: M
The ideal weight is 171.08 pounds.
```

General Instructions:

- ☐ Insert comments at the top and throughout each file
  - o Include the follow comments at the beginning of this (and ALL) files.
    - // your name
    - // assignment number
    - // date you completed the assignment
    - // **statement(s) about collaboration**
    - // a short narrative about what the file does
  - o Use the algorithm as comments throughout each file
- ☐ Use descriptive variable names.
- ☐ Use Sample Input/Output as a guide.
- ☐ Use descriptive labeling with output.

-7 points per file for absence of any of these required comments at the top

- ☐ Divide you solution program code into sections as noted in the algorithm. Use section comments as well as the algorithm step comments.
- ☐ Assign01b.c used **`scanf`** for a character; notice that there is a space in front of **`%c`**.
  `scanf(" %c", &gender);`
- ☐ Indent all blocks. Use CSD.

Submit via Blackboard:

`assign04a.c`	C program file
`assign04b.c`	C program file
`devPlan04.txt` or `.pdf`	Development plan

If you do not use Notepad to edit the `devPlan04.txt` file, save it as a .pdf for submission.

NOTE: Your submitted file(s) MUST be spelled and cased as instructed.