Assignment #6 – Floats & Command Line Arguments CS 218 Fall 2021

Purpose: This program will involve writing functions to perform a variety of tasks related to floating points, the command line, and integrating with C/C++ code.

You will need to write this assembly program from scratch. A C++ file will be included to provide additional functionality for your program.

Program Specifications
Write a program to calculate how many spherical helium filled balloons are required to lift a given weight.

Balloon Volume (ft^3) = 4/3 x PI x $(diameter/2)^3$
Lift Per Cubic Foot of Helium (lb/ft^3) = 0.06689
Balloons Required = ceil($\frac{Weight}{Balloon\,Volume \times Helium\,Lift}$)
PI = 3.14159

The input will come from 5 command line arguments:
1. Name of Program
2. -W
3. Weight as a double value (in pounds)
4. -D
5. Diameter of balloon as a double value (in feet)

Example Command Line: ./a.out -W 146.52 -D 10.0

Process Command Line Arguments
Write a function that will check and convert the command line arguments.

The first two arguments should be argc and argv as provided to the main function. The third and fourth arguments should be addresses to two double values to store the weight and diameter values respectively. The function will need to call the c standard library function atof to convert the string arguments into their double values. See https://www.cplusplus.com/reference/cstdlib/atof/

Make sure to include in your assembly file:
extern atof, ceil, printBalloonsRequired

If only a single command line argument was used to start the program (argc is 1), then return 0 and have main print out an example of how to call the program.

If the number of arguments is not exactly 5, return -1 to report that the command line tags were incorrect.

The function should then check to make sure that command line arguments 2 and 4 match "-W" and "-D". If the second command line argument is not "-W", return -2. If the fourth command line argument is not "-D", return -4.

Finally, if either double value is returned from atof as 0.0 or less, the function should return -3 for an invalid input.

Return 1 if all checks have succeeded.

Main should output an appropriate error message for any negative return values from the function.

The atof function will accept and convert any string as long as it starts with a readable floating point value. You do not need to perform any additional error checks in these cases. Example 14.6f3g will be read in as 14.6

Balloon Calculations

Write a function that will calculate the number of balloons required to lift the specified weight using the formulas above. Return the number of balloons required.

Use the standard library function ceil to round up the number of balloons to a whole value. See https://www.cplusplus.com/reference/cmath/ceil/

In Main

Make sure to use main: instead of _start: as your starting function and use **g++ -g -no-pie helper.cpp assemblyFile.o** to link your program.

Align your stack to a multiple of 16 before calling any C/C++ functions.

Pass the command line arguments along with the addresses to the double variables for weight and diameter to the process command line arguments function.

If the function returns a success (1), then pass the values on to the balloon calculation function. Otherwise, output an appropriate error message and stop.

Call printBalloonsRequired from the helper file to output the results. You will need to pass in the number of balloons, weight, and diameter as arguments to the function.

You may include additional assembly functions as desired.
You may not use any other standard library functions other than ceil and atof.
Do not make any alterations to the provided .cpp file.

Debugging with Multiple Files
To set a breakpoint in another file type in the gdb command window:
break <fileName>:<lineNumber>

Example: break assignment6.asm:40

Submission
Once you are satisfied with the program, upload the assembly source code (.asm) file to the class website.

Example Executions

```
$ ./a.out
Please include the following: -W weight -D diameter

$ ./a.out Wrong Arguments
Expected 4 arguments: -W weight -D diameter

$ ./a.out -Q 19.6 -D 41.2
Expected a -W argument.

$ ./a.out -W 19.6 -Q 41.2
Expected a -D argument.

$ ./a.out -W abc -D 41.2
Invalid number entered.

$ ./a.out -W 19.6 -D abc
Invalid number entered.

$ ./a.out -W -1.2 -D 2.6
Invalid number entered.

$ ./a.out -W 140.6 -D 9.12
In order to lift 140.6 pounds, 6 balloons 9.12 feet wide will be required.

$ ./a.out -W 12042 -D 15
In order to lift 12042 pounds, 102 balloons 15 feet wide will be required.

$ ./a.out -W 12042 -D 15ft
In order to lift 12042 pounds, 102 balloons 15 feet wide will be required.

$ ./a.out -W 12042 -D 15ft5in
In order to lift 12042 pounds, 102 balloons 15 feet wide will be required.
```