CSci 1113: Introduction to C/C++
Programming for Scientists and Engineers
Homework 0
Spring 2020

Due Date: Friday, February 7, 2020 before 11:55pm.

Instructions: This is an individual homework assignment. There is one problem worth 20 points. Solve the problem below by yourself (unlike the labs, where you work collaboratively), and submit the solution as a C++ source code file. Here are a few more important details:

1. Unlike the computer lab exercises, this **is not** a collaborative assignment. You must design, implement, and test the solution to each problem on your own without the assistance of anyone other than the course instructor or TAs. In addition, you may not include solutions or portions of solutions obtained from any source other than those provided in class: examples from the textbook, lectures, or code you and your partner write to solve lab problems. Otherwise obtaining or providing solutions to any homework problems for this class is considered academic misconduct. See the "collaboration rules" file on the class website page for more details, and ask the instructor if you have questions.

2. Because all homework assignments are submitted and tested electronically, the following are important:
   - You follow the naming conventions mentioned at the end of the problems.
   - You submit the correct file(s) on gradescope (https://www.gradescope.com/) by the due deadline.
   - You follow the example input and output formats exactly given in each problem description.
   - **Regardless of how or where you develop your solutions, your programs compile and execute on gradescope computers (which run Linux/Ubuntu operating system like the cselabs machines).**

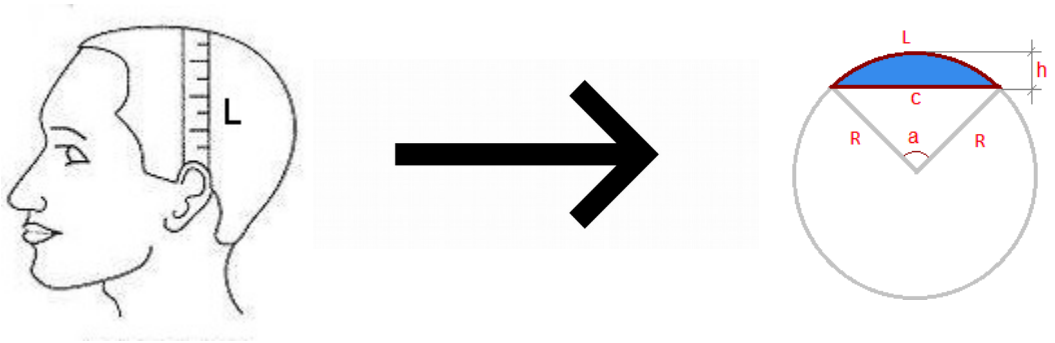
3. The problem descriptions will usually show at least one test case and the resulting correct output. However, you should test your program on other test cases (that you make up) as well. Making up good test cases is a valuable programming skill, and is part of ensuring your code solution is correct.

Problem A: Party Hats (20 points)
Your sibling is having their golden birthday and you are planning on making custom-made party hats for them. To figure out how much materials you need, you need to do some math... specifically the party hats are the shape of a cone.

https://www.instructables.com/id/How-to-Make-a-Party-Hat/

The cone's height will always be 30cm (about 1 ft), but you are unsure how wide you have to make the cone as this depends on how big a person's head is. Being a diligent person, you go off and measure all the guests (and your sibling in secret).

This measuring is done by putting a tape measure across their head and reading the output. Unfortunately, this is not the “base width” of the cone, as the distance is an arc. So you make some code to do a conversion for you.



You assume the their head is a circle and the angle you measured was 90 degrees. The formula for the straight line distance from where you measured is then:

$$c = \frac{2L}{a} \sin\left(\frac{a}{2}\right)$$

... where L is the length you measured, a is the angle (in radians) and c is the direct line distance (chord).

Now that you have the dimensions for the cone, compute the surface area to know how big of a sheet of paper you need.

$$SA = \pi r \sqrt{r^2 + h^2}$$

... where r is the radius of the cone, h is the height and SA is the surface area.

Note: you can get the value of π from including the <cmath> library and using: M_PI (a variable)

Technical note: below should be the default output format for numbers on the cselabs machine. You should be able to simply cout the variable without modifying any of cout’s settings.

Example 1 (user input is underlined for clarity, underlined text in your program is not needed):

```
What length did you measure (in cm)?
20
Surface area is:
885.915
```

Example 2 (user input is underlined for clarity, underlined text in your program is not needed):

```
What length did you measure (in cm)?
20000
Surface area is:
2.54649e+08
```

Test your program using not only the example data above, but other cases as well. And revise your program until you are sure it is correct.

When you are done, name the source code file hw0A.cpp. Then log into gradescope and upload your file for the “Homework 0A” submission. **If you name your file incorrectly it will be unable to compile and run your code, so you will fail all test cases**. You may submit cpp files as many times as you want until the deadline to try and fix the code if you fail a test case. Following rigorous naming conventions and using test cases are something computer programmers often must do in “real life” programming, and so submitting your program with the correct name and functionality is part of doing this assignment correctly.