

C++ Basics:**Band Saw Blade Tension**

A band saw is a wood- or metal-working tool that employs a ribbon-like blade which is spun continuously by two or more rotating wheels. In order to perform high-quality cuts in difficult material, the blade must be placed under sufficient tension to stabilize the blade against forces that would otherwise cause it to deflect.

There is a relationship [1] between the tension on the blade and the cross-section of the blade (under zero load) and the load being applied to the blade:

$$Tension = \frac{Load}{Area}$$

The load is measured in pounds, the area is measured in square inches, and the tension is given in pounds per square inch.

Band saw blade manufacturers generally agree that the tension on a blade should never exceed 15000 psi. For our purposes, we will assume that blades are always supposed to be tensioned to 15000 psi. A complicating factor is that the frame and other components of the band saw will deform, and eventually fail, if the force used to tension the blade is too high. We will assume that for any band saw, the maximum allowable load is known, and that it is unwise to apply a load that is more than 90% of the maximum allowable load.

In this project, you will complete a program that reads the data needed to apply the given formula to determine what load must be applied to a particular blade in order to achieve the desired tension. If the necessary load would be too high, your program will also emit warnings if the safe load threshold is exceeded.

Sample input and corresponding output:

Here is a sample input file for the program (named "BladeData.txt"):

```
Limit
-----
 331

Thickness  Width
-----
 0.010    0.710
 0.022    0.727
 0.016    0.247
 0.031    0.825
 0.012    0.963
 0.013    0.510
 0.024    0.567
 0.026    0.893
 0.018    0.594
 0.019    0.866
 0.040    0.524
```

The first two lines are just labels for human readers and should be ignored by your program. The third line specifies the maximum load that should be placed on the blades. The next three lines are also irrelevant to your program and should be ignored. Each of the remaining lines contains two positive decimal values specifying the thickness and width of a particular band saw blade.

There will always be at least one line of blade data, but there is no specified limit on how many might be given. So, your program must use the read-to-input-failure logic discussed in class.

You should assume that the input file will always conform to the specified syntax and have the specified name.

For each line of blade data, your program must calculate the area of the blade's cross-section (in square inches) and the load that would be necessary to raise the tension on the blade to 15000 psi. If the necessary load exceeds the specified load limit, your program should also print out the warning "inadvisable"; if the necessary load is less than the limit, but more than 90% of the load limit, your program should print out the warning "excessive".

Here is a sample output file for the program, which must be named "Results.txt":

	Cross-section	Load	
1	0.00710	106.5	
2	0.01599	239.9	
3	0.00395	59.3	
4	0.02557	383.6	excessive
5	0.01156	173.3	
6	0.00663	99.4	
7	0.01361	204.1	
8	0.02322	348.3	excessive
9	0.01069	160.4	
10	0.01645	246.8	
11	0.02096	314.4	inadvisable

It begins with two lines labeling the columns of computed values, followed by a line to delimit the labels from the table of values. Each line of the output table will contain three numeric values: a counter indicating which line of input was being processed, the area of the blade's cross-section, and the load needed to raise the tension on the blade to 15000 psi. If the computed load is too high (as described above) then the line will end with one of the warnings specified above.

The area values must be printed showing 5 digits after the decimal point, and the load values must be printed showing 1 digit after the decimal point.

If you have read the *Student Guide to the Curator*, you already know that all the fixed text must be precisely as shown in the sample output. The output should be aligned for easy readability. Additional samples of input and correct output will be available on the course website.

The final line of the file is just a repeat of the delimiting line that preceded the table.

Submitting your program:

You will submit this assignment to the Curator System (read the *Student Guide*), and it will be graded automatically. Instructions for submitting, and a description of how the grading is done, are contained in the *Student Guide*.

You will be allowed up to ten submissions for this assignment. Use them wisely. Test your program thoroughly before submitting it. Make sure that your program produces correct results for every sample input file posted on the course website. If you do not get a perfect score, analyze the problem carefully and test your fix with the input file returned as part of the Curator e-mail message, before submitting again. The highest score you achieve will be counted.

The *Student Guide* and other pertinent information, such as the link to the proper submit page, can be found at:

<http://www.cs.vt.edu/curator/>

Pledge:

Each of your program submissions must be pledged to conform to the Honor Code requirements for this course. Specifically, you **must** include the following pledge statement in the header comment for your program:

```
//    On my honor:
//
//    - I have not discussed the C++ language code in my program with
//      anyone other than my instructor or the teaching assistants
//      assigned to this course.
//
//    - I have not used C++ language code obtained from another student,
//      or any other unauthorized source, either modified or unmodified.
//
//    - If any C++ language code or documentation used in my program
//      was obtained from another source, such as a text book or course
//      notes, that has been clearly noted with a proper citation in
//      the comments of my program.
//
//    - I have not designed this program in such a way as to defeat or
//      interfere with the normal operation of the Curator System.
//
//    <Student Name>
```

Failure to include this pledge in a submission is a violation of the Honor Code.

References

[1] Mark Duginske and Aaron Gesicki, "Blade Tension", *Woodworker's Journal*, p. 66 – 73, Feb 2007