Assigned in Laboratory 3, Due Start of Laboratory 4

This is a pledged assignment; you may receive help only from the class teaching assistants, ITC consultants, and the class professors. You may work in groups of up to two for this assignment. Members of a group must come from the same lab section.

Objective

The objective of this assignment is to continue coding programs that do interactive input and output, and to make sure that you understand how to use the `if` and `if-else` constructs. These are two fundamental programming language constructs that you will use in almost every program that you write from now on.

Problem Description

Interactive input of data, coupled with analysis of that data to set up further computations is a recurring activity in programs regardless of application area. While the task described below has to do with load analysis, the skills required to solve the task are similar to those required for many other engineering and scientific problems.

How much traffic can pass over an aging bridge is a function of a how much structural corrosion, support erosion and surface degradation has occurred over the years. If structural corrosion exceeds a certain limit the bridge should be closed, no matter what the state of the supports or the surface. Similarly if there is significant support erosion or significant surface degradation, the bridge should be closed regardless of other conditions. In addition, a combination of structural corrosion, support erosion and surface degradation values can force the closing of a bridge even though no one factor necessitates a bridge being closed. Note that a bridge that is left open can have its maximum load limit decreased. Such a restriction is based on the levels of structural corrosion, support erosion and surface degradation. To formalize our problem, we introduce the following terms:

LoadLimit	Maximum load bridge can handle under ideal conditions.
StructuralCorrosion	Percentage of the bridge structure that is corroded.
SupportErosion	Percentage of the bridge supports that are eroded.
SurfaceDegradation	Percentage of the road surface of the bridge that has deteriorated.
StructuralCorrosionWt	Relative importance of structural corrosion.
SupportErosionWt	Relative importance of support erosion.
SurfaceDegradationWt	Relative importance of surface degradation.
NewLoadLimit	Maximum load of bridge after analysis.

Your program should prompt and extract an integer value for *LoadLimit*, and floating point values for *StructuralCorrosion*, *SupportErosion*, and *SurfaceDegradation*. The relative weights *StructuralCorrosionWt*, *SupportErosionWt* and *SurfaceDegradationWt* should be floating point. The value *NewLoadLimit* should be integer. All integer values should be represented using the type `int`; all floating points should be represented using the type `double`.

The bridge evaluation should proceed in the following manner based on values for *StructuralCorrosion*, *SupportErosion* and *SurfaceDegradation*. (Note the constants used are for homework purposes. They do not reflect specific engineering practices).

- A *StructuralCorrosion* value that exceeds 50% causes the bridge to be closed.
- A *StructuralCorrosion* value of up to and including 20% means that the *StructuralCorrosionWt* should be 0.1, otherwise the *StructuralCorrosionWt* should be 0.2.
- A *SupportErosion* value of 40% or more causes the bridge to be closed.
- A *SupportErosion* value up to and including 30% means that the *SupportErosionWt* should be 0.10.
- A *SupportErosion* value greater than 30% but less the 32% means that the *SupportErosionWt* should be 0.15.
- A *SupportErosion* value of 32% or more means that the *SupportErosionWt* should be 0.2.
- A *SurfaceDegradation* value that exceeds 25% causes the bridge to be closed.
- The *SurfaceDegradationWt* should be 1 **-** *StructuralCorrosionWt* **-** *SupportErosionWt*.
- The value of *NewLoadLimit* is the value of *LoadLimit* less *LoadLimit*(*StructuralCorrosion*•*StructuralCorrosionWt* + *SupportErosion*•*SupportErosionWt* + *SurfaceDegradation*•*SurfaceDegradationWt*). If the value of *NewLoadLimit* is less than 30% of *LoadLimit* then the bridge should be closed.

Thus, the preceding specification indicates that there are four conditions that can cause the bridge to be closed: excessive corrosion, excessive support erosion, excessive surface degradation, and excessive load limit reduction. In reporting a closing of the bridge, the program should indicate which condition(s) apply. The excessive load limit reduction should not be reported if any of the other conditions apply. When reporting that the bridge can stay open, the program should also display the new load limit. The recommended approach is to individually test the conditions using separate if statements.

Next you will find a high-level preliminary design for the problem solution. You are welcome to use it. We suggest before you do use it, that you attempt to develop your own preliminary design and then compare yours to ours. Given your preliminary design, you should attempt to develop a more detailed design *before writing any code*. Later in the course there will be problems where no such designs are given. As you write your program, you should give much thought to how to test your program for correctness.

Preliminary design

- Display a brief message describing what input the program expects and what it computes.
- Individually prompt and extract in this order values for the load limit, structural corrosion, support erosion, and surface degradation.
- Display extracted values along with text that describes them.
- Using the problem specification determine whether the bridge should be closed. If so, indicate this fact and why. Otherwise, display the new load limit.

Notes

- The prompts should make it clear how the user is to input the numbers. After the numbers are extracted, they should be displayed to verify to the user their intended use.
- Test your program for various load limits, structural corrosions, support erosions, and surface degradations. Check thoroughly that your program handles the decision to close the bridge correctly.
- Use the features of the language discussed in class.
- Read the C++ style sheet given to you. Your grade will be based on both correctness and style.
- A complete and final version of your program must be submitted electronically to your laboratory assistant by the beginning of the scheduled laboratory under the name `hw02.cpp`. A hardcopy of the program must be turned in at the beginning of your scheduled laboratory. *Late homework will not be accepted.*
- Program interactions should be clearly labeled. A sample run is demonstrated below.