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Assignment: **Integration problem using function pointers**

Short Report/Summary:

We are given a function (shape of curve), lower bound and upper bound between which we have to approximate the area under the curve. In simple words, we have to do integration to find total area under curve of a given graph/function between that boundary (“a” and “b”).

The basic algorithm to solve this problem is to use the Riemann sum to estimate the desired area. To do that, we will divide the curve into lots of small rectangles. The smaller the rectangles, better the approximation of area will be. After dividing that into pieces of rectangles, we can measure the area of each rectangle by multiplying their widths and heights. After we get them, then we can add up the areas of those rectangles and the total sum of areas will be the desired approximation of area under the curve.

In the program, “double x” ( a + (0.0001 / 2) ) represents the horizontal position of the rectangle, “f(x)” represents the height, and “double width” represents the width of the rectangle. I set it to 0.0001. The smaller this width is, the better our approximation will be. We used typedef and “\*FUNC” which is a pointer to a function that takes a double as input. We used a while loop in the program and inside the while loop, we used “ sum = sum + (f(x) \* width); ” to calculate area of each rectangle and keep adding them up until “x” reaches its upper bound (double b). When we call f(x), it calls “double line” or “double square” or “double cube” function depending on what function we’ve passed as the first parameter.

After adding up the area of all the pieces of rectangles (reaching upper limit), the while loop terminates. The function returns “sum” which is the sum of areas of all of those rectangles.

In the main function, when we call “integrate” function, it takes 1st parameter to determine the shape (function) and 2nd and 3rd parameter to set the lower and upper limit then follow the algorithm in the way mentioned above and prints the approximated integration result.

Comment: This is my algorithm & summary to solve this integration problem using Riemann sum approach. We multiplied height (f(x)) and width because we know the formula to calculate the area of a rectangle = height \* width. I compiled and ran the code; it ran successfully and printed correct integration results.

Screenshot of Output:

