

Homework 2

Assigned Laboratory 2

Due start of Laboratory 4

Please perform the following activities in groups of size one or two. Although you are allowed to talk with other people outside your group regarding assignment requirements and debugging, the work of each group must be its own—code must not be shared from one group to another.

Assignments Files

A self-extracting archive `hw02.exe` has been created for this assignment. The archive will produce two files `histo5.ide` and `histo5.cpp`. Archive `hw02.exe` can be acquired by accessing the course home page `www.cs.virginia.edu/cs101`. The file is also available on many of our university servers in the directory `F:\public\csfiles\cs101\hw`. If you are copying this file using a web browser, it is recommended that you first copy the file to a hard drive and then use the file manager to copy the file to a floppy if need be. Our browsers seem to miscopy when downloading binary files directly to a floppy.

Objective

To practice using a graphical application programmer interface. Graphical programs are now the norm in most computing environments.

Problem

To extract five integer values from standard input and to display them histogram style using rectangles to represent the values. The values will be in the range $1 \dots 10$ (checking is not necessary). The area of a rectangle will correspond to the associated value. Figure 1 illustrates the type of input and output your program should produce.

Solution method

We will use the `EzWindows` graphical library and its classes `SimpleWindow` and `RectangleShape` to produce the histogram. In our histogram, all rectangles will have width 1. Therefore, the height of a rectangle will be the corresponding input value. An appropriate size for the display is 12×12 . In fact, in the partial solution created for you, such a `SimpleWindow` object is already defined—the name of the object is `W`.

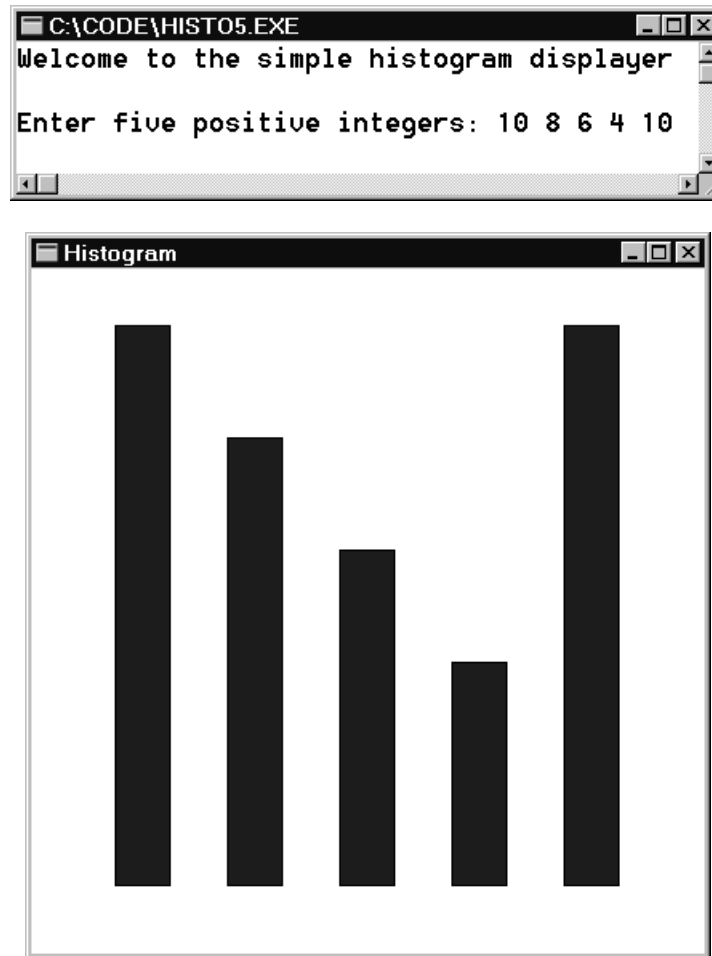
For aesthetic purposes, the rectangles should be drawn in the following manner:

- A bottom edge of a rectangle should be 1 unit from the bottom border of `W`.
- The leftmost rectangle should have its left edge $1\frac{1}{2}$ units from the left border of `W`.
- The rightmost rectangle should have its right edge $1\frac{1}{2}$ units from the right border of `W`.
- The rectangles should be equally-spaced from each other.

In defining a `RectangleShape` object, we must give the following information as initialization parameters.

- The `SimpleWindow` object in which the rectangle is to be drawn. For this program, it is object `W`.

Figure 1: Sample input/output behavior of project `histo5.ide`.



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- The x-coordinate of the center of the rectangle.
 - The y-coordinate of the center of the rectangle.
 - The color of the rectangle.
 - The width of the rectangle.
 - The height of the rectangle.

The only nonstraightforward parameters to be specified for the histogram rectangles are their center coordinates. Based on the aesthetic discussion, the x-coordinates for the five rectangles are respectively 2, 4, 6, 8, and 10. The y-coordinates are more difficult to compute. Suppose h is the height of the current `RectangleShape` to be created. Then to align the bottom edge of the rectangle so that it has a y-coordinate of 11 (one unit away from the bottom border of the window), the center of the rectangle must have y-coordinate $11 - h/2.0$.

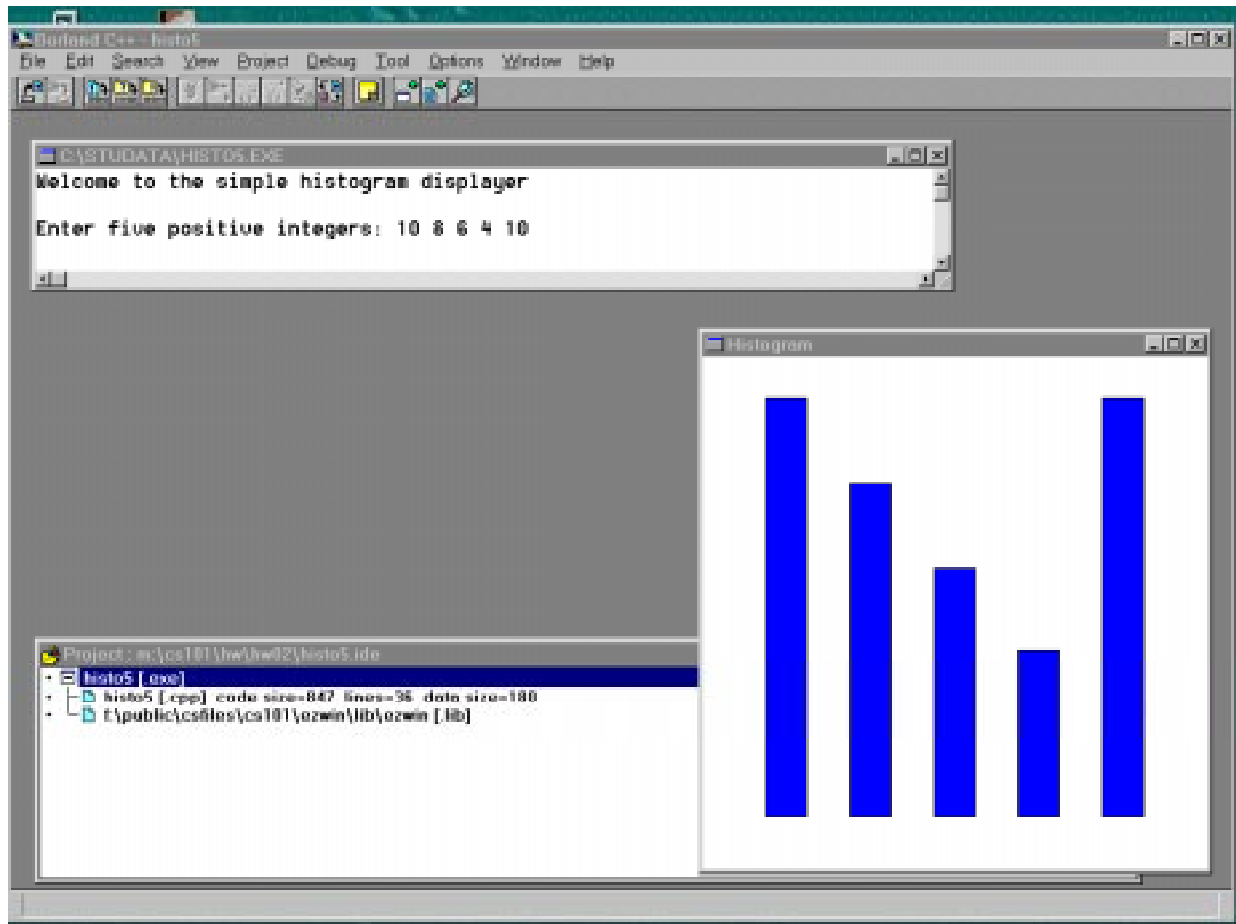
Algorithm for ApiMain()

- Step 1. Prompt user for five input values.
- Step 2. Extract the five input values v_1 , v_2 , v_3 , v_4 , and v_5 .
- Step 3. Define the center x-coordinates x_1 , x_2 , x_3 , x_4 , and x_5 .
- Step 4. Define the center y-coordinates y_1 , y_2 , y_3 , y_4 , and y_5 based upon the formula described previously.
- Step 5. Define the five `RectangleShape` objects R_1 , R_2 , R_3 , R_4 , and R_5 . These definitions should be respectively using the x-coordinates and y-coordinates defined in the previous steps.
- Step 6. Use the `Draw()` member functions of the five `RectangleShape` objects to display the histogram rectangles.
- Step 7. Return success.

Notes

- Graphical programs require a project file when using the Borland IDE. The project file for this assignment, `histo5.ide`, was created when `hw02.exe` is executed. When working on the project, the file `histo5.ide` must be opened. To open an IDE file, select the item `Open Project` under Borland's `Project` menu.
- Your `ApiMain()` is to be placed in `histo5.cpp`. This file is created when `hw02.exe` is executed. The created version will contain a blank standard program header and an almost blank function `ApiMain()`. To open the file for editing, double click on its filename in the project window (this window is typically displayed in the bottom of the IDE). *Remember to save your program frequently.*
- When your program is run, it will create two windows. One window is a console window for the interactive input/output. The other window is for the graphical display. Note that the graphical display window is not automatically redrawn when a window that covers it is moved away. Therefore, when you run your program before typing in the five data values, resize the console window and adjust the positions of the two program windows so that they do not overlap. This situation is depicted in Figure 2.
- The project file for this assignment was developed for use in one of the on-grounds ITC computer laboratories such as the Stacks. As part of the project file, the location of the `EzWindows` graphical libraries and the Borland standard libraries must be specified. Our specification is their location on the ITC servers. If you decide to work on this assignment elsewhere using your own copy of the Borland IDE, you will have to place a copy of the libraries on your local hard disk and also edit the project file (a copy of the `EzWindows` libraries comes on the floppy with the text book). To edit the project file it first must be opened and then you must select the item `Project`, under the menu `Options`. This item has an entry, `Directories`, which will need to be updated to reflect the location of the standard libraries and the `EzWindows` libraries on your PC. You will also need to edit the entry `F:\public\csfiles\ezwin` in the project window. To edit the entry, first left click on it and then right click on it. Next select `Edit Node Attributes`. Then modify its `Name` attribute to reflect its location on your PC.

Figure 2: Configuring windows so that the both the console window and the graphical display window are visible.



- File `histo5.cpp` should be copied electronically to your class account before the laboratory in which it is due. You should also turn in a hardcopy (print out) at the beginning of the laboratory in which its due.
- The program should follow course programming style guidelines. The guidelines are contained in the course workbook and the course web page.
- The grading criteria for this assignment can be found on our course web page.