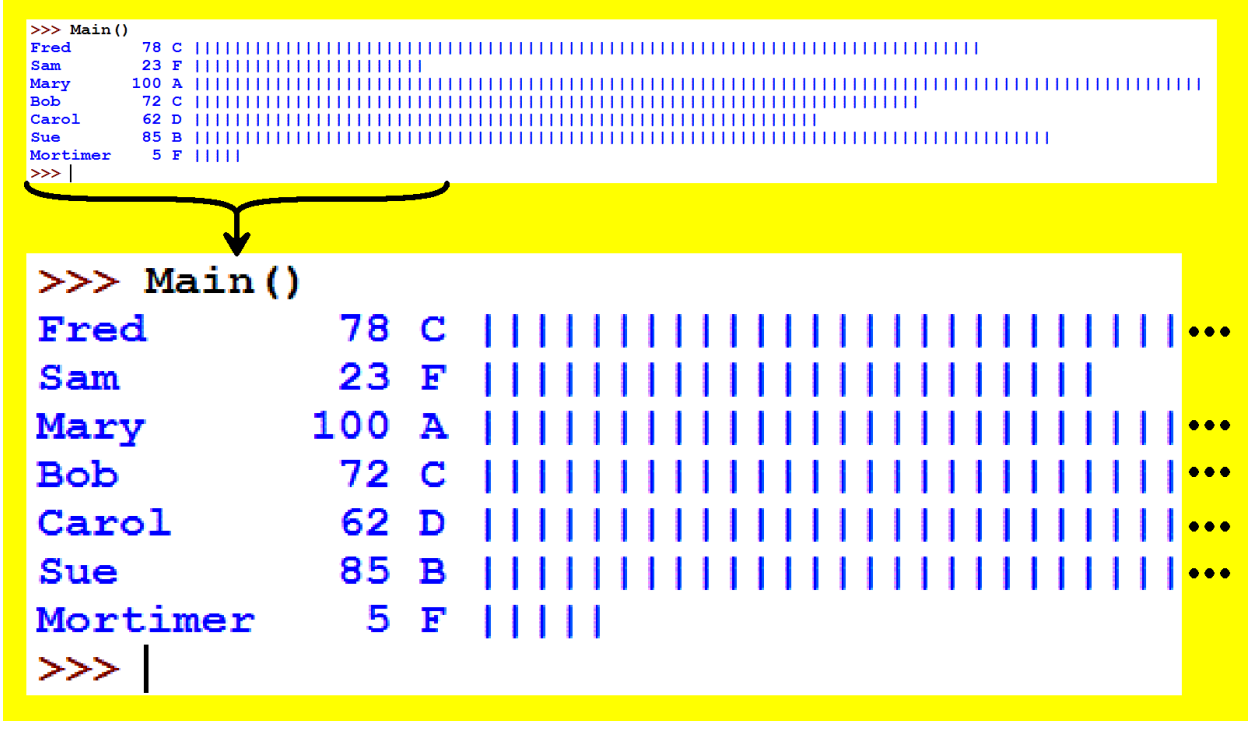
COMPSCI 119
LAB #2 – Bar Graphs

The goal of this Python programming assignment is to successfully create, enter, debug, and run a simple program in the Idle environment, based on a given framework containing a main program and the stubs of four functions. You are to complete the code inside those four functions.

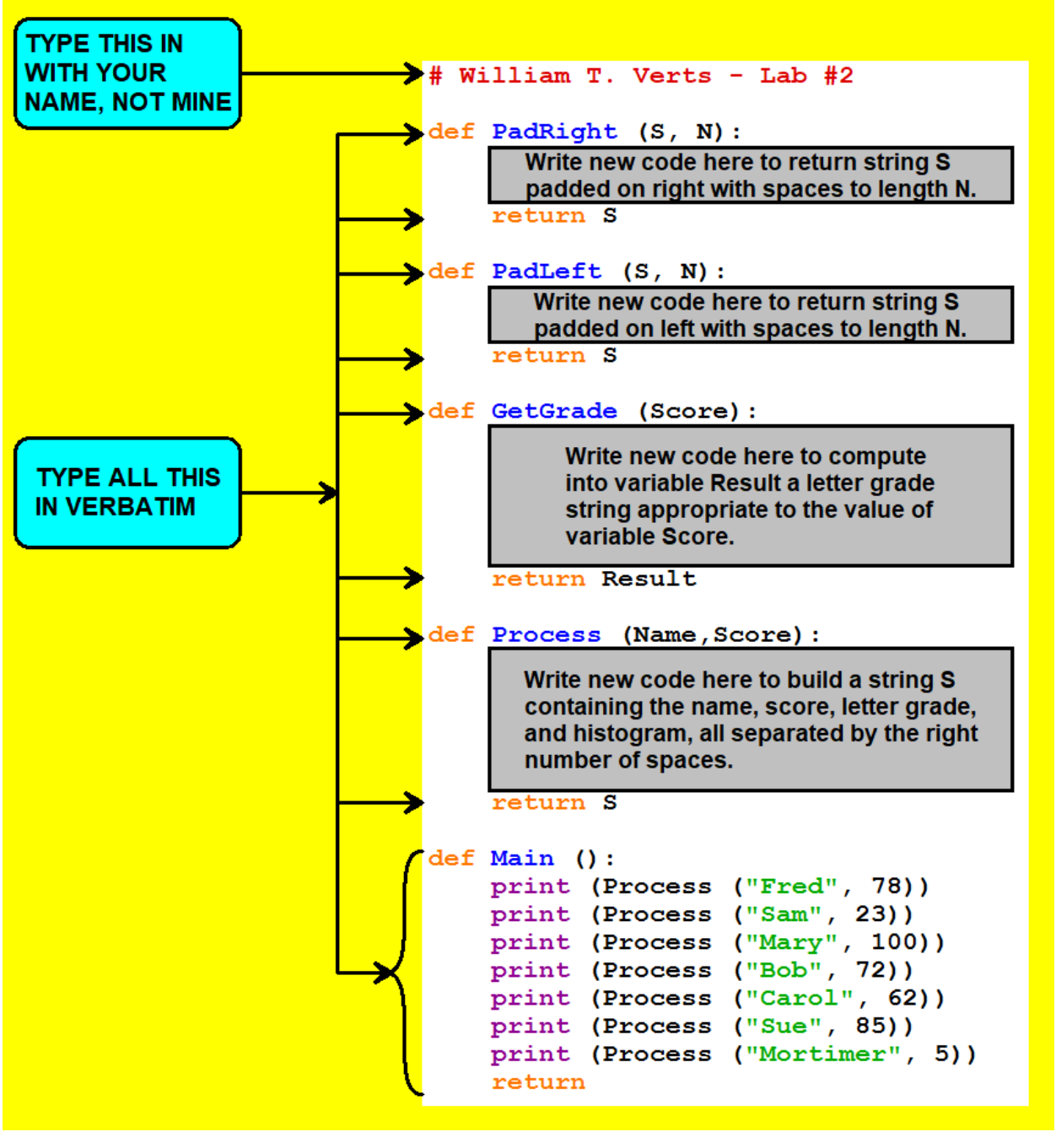
Background

In this assignment you are going to write a program to enter a set of grades for students who have taken an exam, and then generate a set of text-based bar graphs based on those grades. For example, if student Fred received a 78 on his exam, the line of output for Fred will be his name, his score, his letter grade, and then 78 copies of the | character (the vertical bar), padded appropriately with blanks. When your program runs, the expected output from Idle/Python will look like the following image (the top image is the whole output, the bottom is the left part zoomed up so you can see it more easily):



Setting up the Assignment

Type in the following program code framework ***exactly*** as you see it here, except with ***your name*** instead of mine and the ***date*** included in the initial comment, and then save it in your Python folder with `Lab2.py` as the filename. Leave the gray areas blank for now; you will write new code there later.



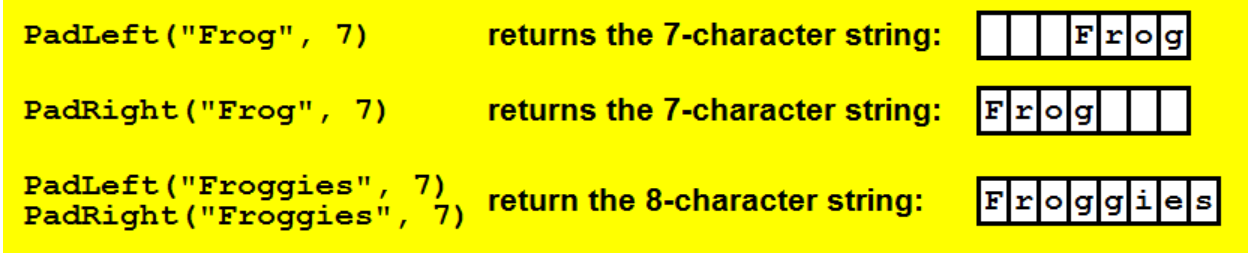
Notice that there are four functions which need to be finished, `PadRight`, `PadLeft`, `GetGrade`, and `Process`. You can complete and debug each function in order, before working on the next function in the program. Function `Main` is finished as-is and ***must not be modified*** from what you see here.

Task #1 – PadLeft and PadRight

The `PadRight` function has two parameters: `S` (a string) and `N` (an int), and returns as its result the string `S` padded on the right with blanks until the length of `S` contains no fewer than `N` characters. The `PadLeft` function is identical to `PadRight` except that it adds blanks to the left side of the string.

For example, the string `"Frog"` is four characters long, so `PadLeft("Frog",7)` would return the seven-character string `"   Frog"` (with three extra blanks on the left) and `PadRight("Frog",7)` would return the seven-character string `"Frog   "` (with three extra blanks on the right).

However, the string `"Froggies"` is *already* longer than seven characters, so both `PadLeft("Froggies",7)` and `PadRight("Froggies",7)` would return the original string `"Froggies"` unchanged as the result.



You will need to use a `while` loop in each function. You will also need to use the standard Python `len` function in your code to ask about the current length of a string, but no other functions. Even so, there are at least two separate methods that can be used here that satisfy the requirements.

You are ***not allowed*** to use a `for`-loop or any Python function that pads strings.

You are also ***not allowed*** to use the `+=` operator (we haven't covered that yet).

Complete these two functions.

Test these functions from the `>>>` command line prompt with different strings and different lengths to make sure that they handle all possible cases. That is, run the `PadLeft` function by typing `PadLeft("Frog",7)` at the `>>>` prompt to see if you get `"   Frog"`, for example, and then try the same task with `PadRight`. Do not proceed until these functions work correctly. Common problems include "off-by-one" errors, where the number of blanks might be one too few or one too many. Check this!

Note that `PadLeft` and `PadRight` ***return a value*** but ***do not print*** anything! You will lose points if either of these functions use the `print` statement! All printing happens in the `Main` function.

Task #2 - GetGrade

The `GetGrade` function has one `int` parameter called `Score`. The function must return the one-character string `'A'` if `Score` is greater than or equal to 90, `'B'` if `Score` is greater than or equal to 80, `'C'` if `Score` is greater than or equal to 70, `'D'` if `Score` is greater than or equal to 60, and `'F'` otherwise.

You should also notice that the `GetGrade` function ends with the `return Result` statement. That means you must assign variable `Result` to have the correct letter grade value before exiting the function, and you ***may not*** use any other `return` statements in this function.

Complete the `GetGrade` function.

Test the function with different values for `Score` to make sure it handles all five grade ranges correctly. That is, test the function by typing `GetGrade(90)` at the >>> command prompt and see if you get `'A'` as the result, but also test other values to make sure that the correct grade is returned for each value. Remember to test edge cases such as 89 and 90, 79 and 80, 69 and 70, and 59 and 60.

Note that `GetGrade` ***returns a value*** but ***does not print*** anything! You will lose points if this function uses the `print` statement! All printing happens in the `Main` function.

Task #3 - Process

The `Process` function has two parameters, `Name` and `Score`. Those parameters will be passed the name and the score for a particular student. For example, if the function is called as `Process("Fred",78)` then `Name` will contain the string `"Fred"` and `Score` will contain the integer `78`.

The `Process` function initializes a string `S` to the empty string, and then builds up and returns `S` as the value of the function, where `S` will contain the following items, in this order:

1: Student's name, padded on the right to 10 characters (columns 1…10),
2: Student's score, converted to a string, and padded on the left to 3 characters (columns 11…13),
3: Student's letter grade, padded on the left to 2 characters (columns 14…15),
4: one extra blank (column 16),
5: the correct number of vertical bar characters (columns 17…17+Score-1).

This function starts to build the string `S` by calling `PadLeft`, `PadRight`, and `GetGrade` with the appropriate actual parameters.

This function then also requires the use of a loop to add to the string the correct number of vertical bar characters; for this assignment I want you to use a counter loop (a variable with a `while`-loop). You are ***not allowed*** to use a `for`-loop or any special Python functions or code that creates copies of strings (that is, you are ***not allowed*** to use any variant of the statement `"|"*Score` in your code).

Complete the `Process` function by writing code in the gray area to do all of this.

Note that `Process` ***returns a value*** but ***does not print*** anything! You will lose points if this function uses the `print` statement! All printing happens in the `Main` function.

Test the function by calling `Process` from the >>> command line prompt as `Process("Fred",78)` which would return as the value of `S` the following string:

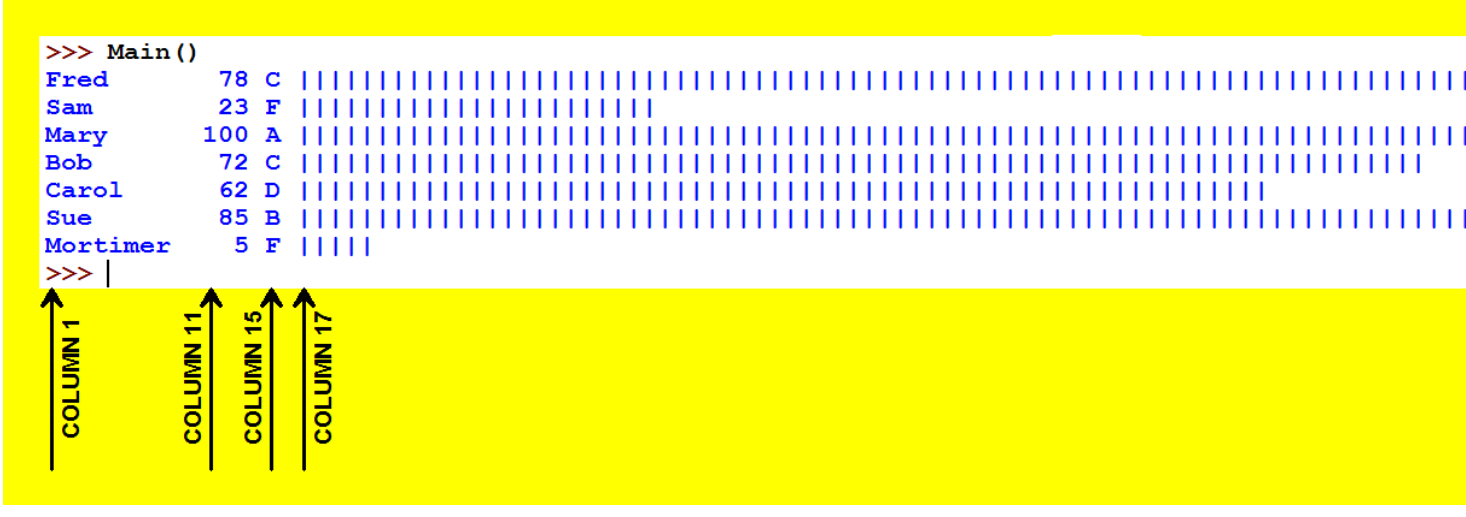
```
Fred       78 C ||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
```

Similarly, manually test `Process("Sam",23)` and `Process("Mary",100)` to verify that your function works correctly. Common problems include "off-by-one" errors, where the number of vertical bars might be one too few or one too many. Check this!

Running the Program

Run the program by typing `Main()` at the command prompt.

You should then get all seven lines of output as shown here, with the spacing as indicated in the following image:



If the output does not contain the correct information, debug your program and run it again. Continue to edit and test your program until the resulting output does contain the correct information.

Finishing Up

When you are finished and everything runs correctly, go to the class site and click on the link for submitting lab assignments. In Idle select all the text, copy it to the clipboard, in the Web page paste the text into the program area of the submission form, fill in your name and ID number and the lab number in the appropriate slots, and then submit the assignment for grading as Lab #2.

The graders will score your program by running `Main` to see if it correctly generates the appropriate graphs. You will also be graded on efficiency, completeness, and how well you follow the directions. The graders will be also testing each of your functions explicitly.

Grading

Study carefully the "Grading Codes" document on the class Web site. That is the generic rubric for all programming assignments in this class. It lays out the rules you must follow for all programs (you must have your name, lab number, and date in a comment at the top of the program, the program must run to completion without errors, it must solve the assigned problem, etc.) Each infraction gets a certain number of points removed and a letter code indicating which infraction was involved.

The generic rubric covers codes A-G and Z. However, here are two cases where the generic rubric needs extra explanation:

F. -5 **Program uses advanced methods not covered in class.** In this program, this code covers cases such as `PadLeft` and/or `PadRight` using functions from the Python string library, a `for`-loop, or the += operator, or `Process` using a `for`-loop, for example. There are a lot of functions that can do the padding task for you, but I want students to learn the basics first. Similarly, the `for`-loop, multiplying a string by a constant, and the += operator can all make the code tighter than it would be otherwise, but you have to learn to do things the hard way before taking any shortcuts. Walk before you run, and follow the directions!

G. -5 **Program works correctly but changes the assignment in order to do it.** In this program, all functions except `Main` return a value in a specific variable at the end of the function body. If any function returns its value internally through an additional `return` statement, the assignment has been changed and this penalty is incurred. If the template on page 2 is altered in any way, this penalty is incurred.

For this particular assignment, the *additional* error codes are as follows:

H. -1 **Missing lines of output.** There are seven students, so there should be seven lines of output. This error code will be assessed if there are more than or fewer than the specified seven lines.

I. -1 **Functions other than Main print their result.** Only `Main` is allowed to print; all other functions return a value.

J. -1 **Functions return the wrong data type.** A function that does not explicitly return a value can be said to return the special Python value `none`, which would affect the other functions that call it. Functions must return values of the correct type

K. -1 **Functions return the wrong values.** `PadLeft` and `PadRight` might return the wrong number of characters (such as off-by-one errors), or `GetGrade` returns `'B'` for a Score of 90 (likely using > instead of >= in a comparison), or `Process` returns the wrong number of `"|"`.

L. -1 **The output is missing terms.** An example would be that the letter grade or score are missing, but everything else is there as required.

M. -1 **The output spacing is wrong.** Ignore this code if codes K or L occur. However, the output may still have incorrect spacing even when codes K or L do not occur (such as omitting the blank in column 16).