Morgan State University
Department of Electrical & Computer Engineering

EEGR 409: C Programming Applications

Project 2

Objective:
The Botanist from Project 1 was very pleased with your application for recording measurements and displaying the data in histogram from. Because of this, you have decided to make the application more robust so that it can be marketed as a solution for data collection and visualization. Modify your application from Project 1 to incorporate the following features:

1. Nested navigation menus
2. Support for up to 5 banks of measurement data
3. Statistical analysis functions
4. Ability to produce both histograms and scatter plots

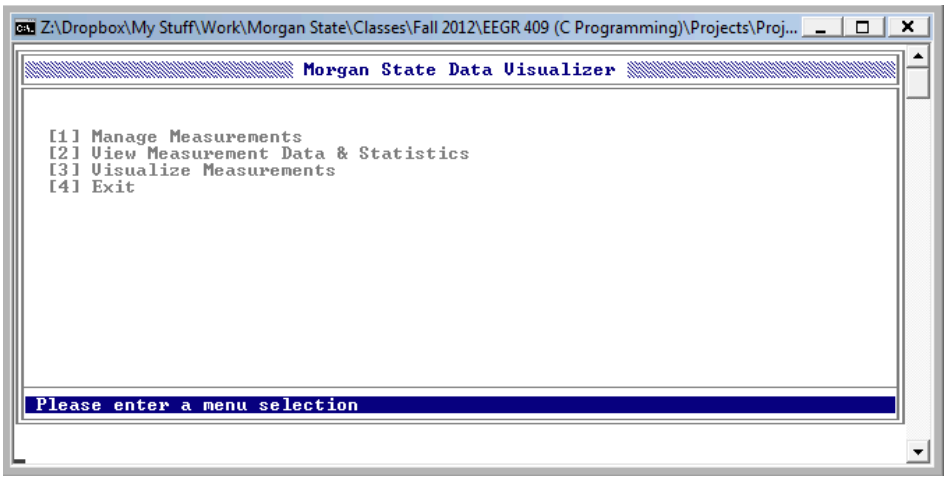
Since this is intended to be commercial software, it is ***absolutely critical*** that the end user cannot crash your application. ***Download and run the Project_2.exe to view the expected behavior.***

Phase 1: Nested Navigation Menus
Your program should be able to display the following menu choices for the various functions of the application:

[1] Manage Measurements
    [1] Clear Measurements
        [1] Clear Bank 1
        [2] Clear Bank 2
        [3] Clear Bank 3
        [4] Clear Bank 4
        [5] Clear Bank 5
        [6] Return to Manage Measurements6
    [2] Add to Measurements
        [1] Add to Bank 1
        [2] Add to Bank 2
        [3] Add to Bank 3
        [4] Add to Bank 4
        [5] Add to Bank 5
        [6] Return to Manage Measurements Menu
    [3] Change Memory Bank Label
        [1] Change label for Bank 1
        [2] Change label for Bank 2
        [3] Change label for Bank 3
        [4] Change label for Bank 4
        [5] Change label for Bank 5

[6] Return to Manage Measurements Menu
[4] Return to Main Menu
[2] View Measurement Data & Statistics
[1] View All Measurements
[2] View Statistics
[3] Return to Main Menu
[3] Visualize Measurements
[1] Show Histogram
[2] Show Scatter Plot
[3] Return to Main Menu
[4] Exit

The menus should be displayed within borders as indicated in the image below (ignore the colors for now):



In order make the process easier for creating the borders and placing text within the borders, consider each position on the screen as a cell in a 2-dimensional character array (matrix), called *page,* which has 24 rows and 80 columns. Create the following 5 functions, which will be responsible for putting content into the *page* matrix:

- **ClearPage** (set all elements of the *pages* array to spaces)
- **DisplayPage** (clear the console, can use *system("cls")*, and display the content of the *pages* array)
- **NewPage** (will accept a title and status message, call **ClearPage**, setup the *pages* array to have borders, place a title in the header section, and a status message in the footer section, and then call **DisplayPage**)
- **InsertText**(will place a given string of text at a specific row and column starting location within the *pages* array)
- **DisplayMenu**(will call NewPage, InsertText, and DisplayPage to display a menu page and return a *valid* menu selection)

If these functions are implemented correctly, you should be able to navigate through all menu options and display appropriate error messages if an invalid menu option is given. You should be able to generate a single menu (and retrieve the user's selection) in one line, for example:

```
ch = DisplayMenu("Morgan State Data Visualizer","[1] Manage Measurements\n[2] View Measurements\n[3] Exit",page);
```

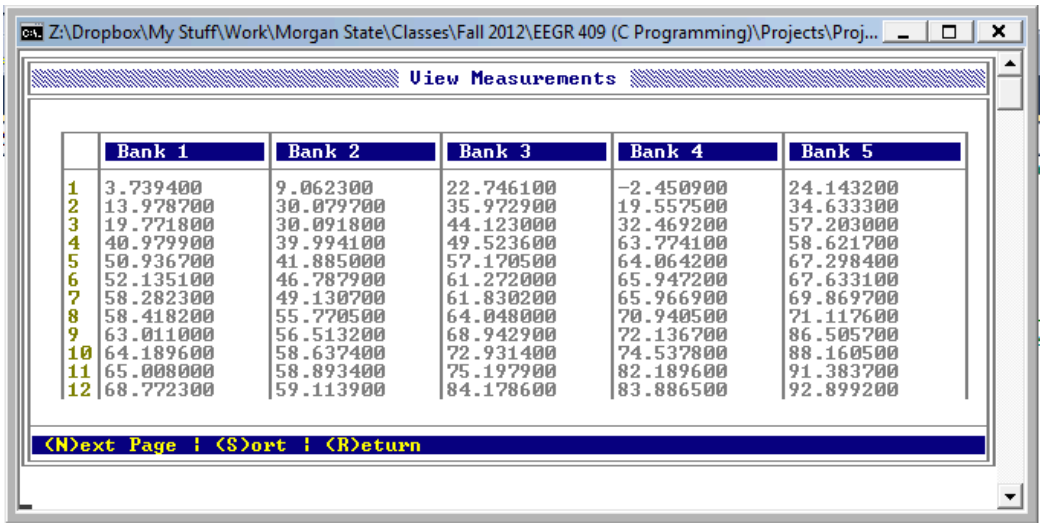
Note: using *getchar()* will require you to hit <ENTER> before the character is read. If you want to read a single character immediately (without having to press <ENTER> afterwards) you can use the Microsoft function *_getch()* (needs conio.h)

Phase 2: View Measurement Data & Statistics

Your application should have the capability of storing 5 sets of measurements (5 banks), where each bank can hold *up to* 50 floating point numbers. To help make development easier, you should initialize your data arrays to those stored in the file "default data.txt". Within this file you will find variable definitions for:

- data – stores 5 banks of 50 random measurements
- label – stores 5 character arrays (labels) for each bank
- dataMax – the number of data points in each bank

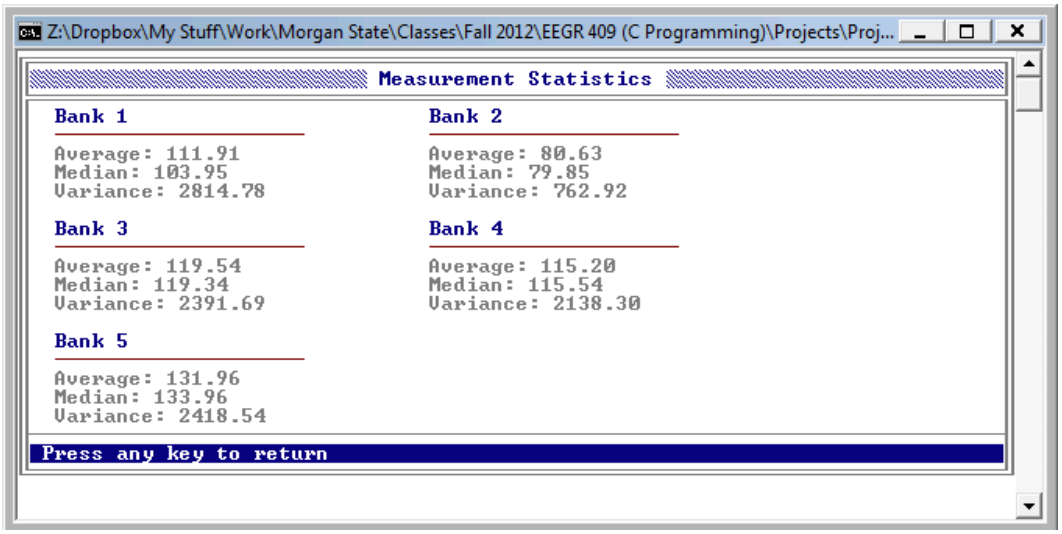
Start by adding the ability to view all 5 banks of data under "View Measurement Data & Statistics". Selecting "View Measurements" will result in the following display:



	Bank 1	Bank 2	Bank 3	Bank 4	Bank 5
1	3.739400	9.062300	22.746100	-2.450900	24.143200
2	13.978700	30.079700	35.972900	19.557500	34.633300
3	19.771800	30.091800	44.123000	32.469200	57.203000
4	40.979900	39.994100	49.523600	63.774100	58.621700
5	50.936700	41.885000	57.170500	64.064200	67.298400
6	52.135100	46.787900	61.272000	65.947200	67.633100
7	58.282300	49.130700	61.830200	65.966900	69.869700
8	58.418200	55.770500	64.048000	70.940500	71.117600
9	63.011000	56.513200	68.942900	72.136700	86.505700
10	64.189600	58.637400	72.931400	74.537800	88.160500
11	65.008000	58.893400	75.197900	82.189600	91.383700
12	68.772300	59.113900	84.178600	83.886500	92.899200

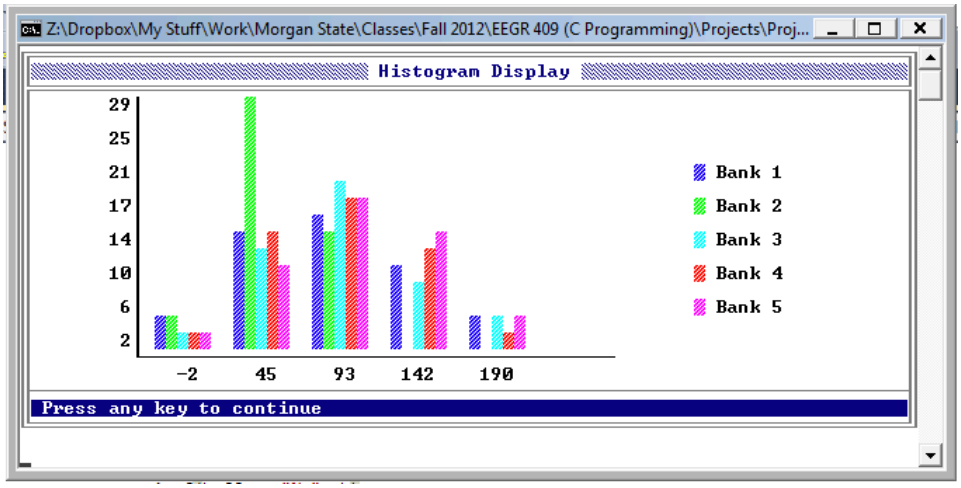
Once again, ignore text colors. Display a page full of data at a time. When the user hits the next key, the next page of data is displayed. Hitting the previous key will cause the previous page of data to be displayed. When the user has reached the end of the list of numbers, the bottom border of the table is displayed to indicate the user has reached the edge. Hitting the Sort key will cause all data to be sorted in ascending order.

When the user selected Measurement Statistics from the View Measurement Data & Statistics Menu, the following page will be displayed with statistical data for each bank:

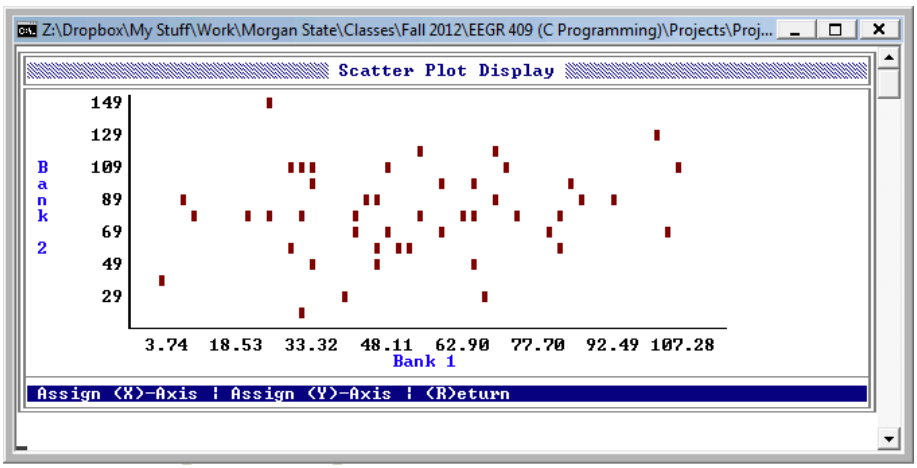


Phase 3: Visualize Measurements

The "Visualize Measurements" menu will enable the user to produce both a histogram plot and a scatter plot. The histogram plot will be similar to that in Project 1, however all data from all five banks will be displayed



To distinguish each measurement bank, you can use different ASCII characters instead of different colors. When display the scatter plot, default to showing Bank 2 on the y axis and Bank 1 on the x axis. The user should be able to change the assignment of each access.



Grading:

The grader should be able to test the following features and confirm they work as specified in this document to receive full credit, however you can receive partial credit for each item:

- Nested navigation menus (10)
- Clear measurements in any bank (10)
- Add measurements to any bank (10)
- Change label associated with memory bank (10)
- Initialize arrays to default values from file and view measurements (only one page) (10)
- View statistics (average only) (10)
- Show histogram of all bins (20)
- Show scatter plot (only bin 1 & bin 2) (20)

Extra Credit

- Under View Measurements, be able to advance to next/previous pages (+10)
- Under View Statistics, calculate median and variance (+10)
- Under Scatter Plot, be able to change x and y axis to any bin (+20)
- Use color as in the examples shown (+10)