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Functions

To be reported on canvas. Create a PDF. Include screenshots of code and execution. Include copy-pasteable text of code. Be careful with variable names and indentation. You must use the templates.

Problem 3. Menu-driven program with file and functions

In the lab of Chapter 5, we created a menu-driven program. Modify it so it will have functions for each of the options, instead of having all the code in the main() function.

In the code, some variables must be globals, because their values need to be accessible from the functions.

USE THE NEXT TEMPLATE (MANDATORY):

```
//DO NOT MODIFY THIS SECTION
#include <iostream>
#include <fstream>
#include <string>

using namespace std;

//prototypes
void modify1();
void modify2();
void modify3();
void displayData();
void save();

//globals
int age1, age2, age3, option=0;
string name1, name2, name3;
ifstream ifile;
ofstream ofile;
bool saved;

int main()
{
    ifile.open( "students.txt" );
    //ADD YOUR CODE FROM HERE, INCLUDE YOUR FUNCTIONS
```

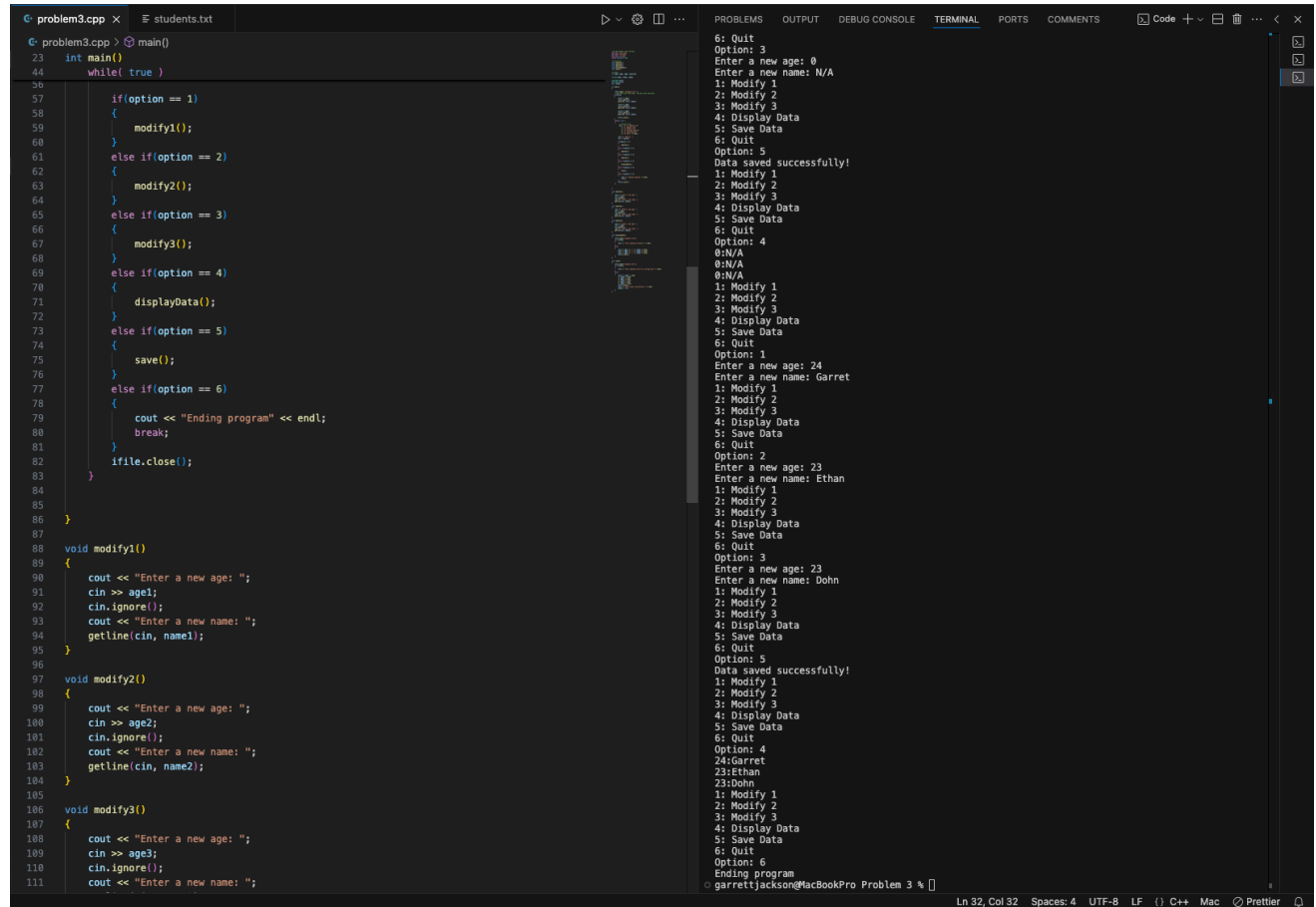
The image shows a C++ IDE with a file named `problem3.cpp` and a terminal window. The code implements a program to manage a text file named `students.txt`. It includes functions for displaying data, modifying it, and saving it. The terminal shows the program's execution, including a menu, user input for modifying and saving data, and successful completion.

```
problem3.cpp > displayData()
1 //DO NOT MODIFY THIS SECTION
2 #include <iostream>
3 #include <fstream>
4 #include <string>
5 using namespace std;
6
7 //prototypes
8 void modify1();
9 void modify2();
10 void modify3();
11 void displayData();
12 void save();
13
14 //globals
15 int age1, age2, age3, option=0;
16
17 string name1, name2, name3;
18
19 ifstream ifile;
20 ofstream ofile;
21 bool saved;
22
23 int main()
24 {
25
26     ifile.open( "students.txt" );
27     //ADD YOUR CODE FROM HERE, INCLUDE YOUR FUNCTIONS
28     if(ifile)
29     {
30         ifile >> age1;
31         ifile.ignore();
32         getline( ifile, name1);
33
34         ifile >> age2;
35         ifile.ignore();
36         getline( ifile, name2);
37
38         ifile >> age3;
39         ifile.ignore();
40         getline( ifile, name3);
41
42         ifile.close();
43     }
44     while( true )
45     {
46         // Display menu
47         cout << "1: Modify 1\n"
48              << "2: Modify 2\n"
49              << "3: Modify 3\n"
50              << "4: Display Data\n"
51              << "5: Save Data\n"
52              << "6: Quit" << endl;
53
54         cout << "Option: ";
55         cin >> option;
56
57         if(option == 1)
58         {
```

Terminal Output:

```
6: Quit
Option: 3
Enter a new age: 0
Enter a new name: N/A
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 5
Data saved successfully!
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 4
0:N/A
0:N/A
0:N/A
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 1
Enter a new age: 24
Enter a new name: Garret
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 2
Enter a new age: 23
Enter a new name: Ethan
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 3
Enter a new age: 23
Enter a new name: Dohn
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 5
Data saved successfully!
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 4
24:Garret
23:Ethan
23:Dohn
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 6
Ending program
garrettjackson@macBookPro Problem 3 %
```

Ln 127, Col 23 Spaces: 4 UTF-8 LF C++ Mac Prettier



```
problem3.cpp x students.txt
G: problem3.cpp > main()
23 int main()
44 while( true )
56
57     if(option == 1)
58     {
59         modify1();
60     }
61     else if(option == 2)
62     {
63         modify2();
64     }
65     else if(option == 3)
66     {
67         modify3();
68     }
69     else if(option == 4)
70     {
71         displayData();
72     }
73     else if(option == 5)
74     {
75         save();
76     }
77     else if(option == 6)
78     {
79         cout << "Ending program" << endl;
80         break;
81     }
82     ifile.close();
83 }
84
85 void modify1()
86 {
87     cout << "Enter a new age: ";
88     cin >> age1;
89     cin.ignore();
90     cout << "Enter a new name: ";
91     getline(cin, name1);
92 }
93
94 void modify2()
95 {
96     cout << "Enter a new age: ";
97     cin >> age2;
98     cin.ignore();
99     cout << "Enter a new name: ";
100     getline(cin, name2);
101 }
102
103 void modify3()
104 {
105     cout << "Enter a new age: ";
106     cin >> age3;
107     cin.ignore();
108     cout << "Enter a new name: ";
109 }
110
111
```

```
6: Quit
Option: 3
Enter a new age: 0
Enter a new name: N/A
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 5
Data saved successfully!
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 4
0:N/A
0:N/A
0:N/A
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 1
Enter a new age: 24
Enter a new name: Garret
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 2
Enter a new age: 23
Enter a new name: Ethan
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 3
Enter a new age: 23
Enter a new name: Dohn
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 5
Data saved successfully!
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 4
24:Garret
23:Ethan
23:Dohn
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 6
Ending program
g: garrettjackson@MacBookPro Problem 3 %
```

Ln 32, Col 32 Spaces: 4 UTF-8 LF C++ Mac Prettier

```

E:\problem3.cpp > main()
88 void modify1()
89 {
90     cout << "Enter a new age: ";
91     cin >> age1;
92     cin.ignore();
93     cout << "Enter a new name: ";
94     getline(cin, name1);
95 }
96
97 void modify2()
98 {
99     cout << "Enter a new age: ";
100    cin >> age2;
101    cin.ignore();
102    cout << "Enter a new name: ";
103    getline(cin, name2);
104 }
105
106 void modify3()
107 {
108     cout << "Enter a new age: ";
109     cin >> age3;
110     cin.ignore();
111     cout << "Enter a new name: ";
112     getline(cin, name3);
113 }
114
115 void displayData()
116 {
117     ifile.open("students.txt");
118     if (!ifile)
119     {
120         cout << "Error opening file\n\n" << endl;
121     }
122     else
123     {
124         cout << age1 << " " << name1 << endl;
125         cout << age2 << " " << name2 << endl;
126         cout << age3 << " " << name3 << endl;
127         ifile.close();
128     }
129 }
130
131 void save()
132 {
133     ofile.open("students.txt");
134     if (!ofile)
135     {
136         cout << "Error opening file for writing!\n\n" << endl;
137     }
138     else
139     {
140         ofile << age1 << endl
141         << name1 << endl
142         << age2 << endl
143         << name2 << endl
144         << age3 << endl
145         << name3 << endl;
146     }
147 }
148
149 int main()
150 {
151     int option = 0;
152     while (option != 6)
153     {
154         cout << "1: Modify 1\n2: Modify 2\n3: Modify 3\n4: Display Data\n5: Save Data\n6: Quit\nOption: ";
155         int option;
156         cin >> option;
157         cin.ignore();
158         switch (option)
159         {
160             case 1:
161                 modify1();
162                 break;
163             case 2:
164                 modify2();
165                 break;
166             case 3:
167                 modify3();
168                 break;
169             case 4:
170                 displayData();
171                 break;
172             case 5:
173                 save();
174                 break;
175             case 6:
176                 break;
177             default:
178                 cout << "Invalid option\n\n";
179         }
180         if (option == 5)
181             cout << "Data saved successfully!\n\n";
182     }
183     cout << "Ending program\n\n";
184     return 0;
185 }

```

6: Quit
Option: 3
Enter a new age: 0
Enter a new name: N/A
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 5
Data saved successfully!
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 4
0:N/A
0:N/A
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 1
Enter a new age: 24
Enter a new name: Garret
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 2
Enter a new age: 23
Enter a new name: Ethan
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 3
Enter a new age: 23
Enter a new name: Dohn
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 5
Data saved successfully!
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 4
24:Garret
23:Ethan
23:Dohn
1: Modify 1
2: Modify 2
3: Modify 3
4: Display Data
5: Save Data
6: Quit
Option: 6
Ending program

//DO NOT MODIFY THIS SECTION

```
#include <iostream>
```

```
#include <fstream>
```

```
#include <string>
```

```
using namespace std;
```

```
//prototypes
```

```
void modify1();
```

```
void modify2();
```

```
void modify3();
```

```
void displayData();
```

```
void save();
```

```
//globals
```

```
int age1, age2, age3, option=0;
```

```
string name1, name2, name3;
```

```
ifstream ifile;
```

```
ofstream ofile;
```

```
bool saved;
```

```
int main()
```

```
{
```

```
    ifile.open( "students.txt" );
```

```
    //ADD YOUR CODE FROM HERE, INCLUDE YOUR FUNCTIONS
```

```
    if(ifile)
```

```
    {
```

```
        ifile >> age1;
```

```
        ifile.ignore();
```

```
        getline( ifile, name1);
```

```
        ifile >> age2;
```

```
        ifile.ignore();
```

```
        getline( ifile, name2);
```

```
        ifile >> age3;
```

```
        ifile.ignore();
```

```
        getline( ifile, name3);
```

```
        ifile.close();
```

```
    }
```

```
    while( true )
```

```
    {
```

```
// Display menu
cout << "1: Modify 1\n"
    << "2: Modify 2\n"
    << "3: Modify 3\n"
    << "4: Display Data\n"
    << "5: Save Data\n"
    << "6: Quit" << endl;
```

```
cout << "Option: ";
cin >> option;
```

```
if(option == 1)
{
    modify1();
}
else if(option == 2)
{
    modify2();
}
else if(option == 3)
{
    modify3();
}
else if(option == 4)
{
    displayData();
}
else if(option == 5)
{
    save();
}
```

```
    }  
    else if(option == 6)  
    {  
        cout << "Ending program" << endl;  
        break;  
    }  
    ifile.close();  
}  
  
}
```

```
void modify1()  
{  
    cout << "Enter a new age: ";  
    cin >> age1;  
    cin.ignore();  
    cout << "Enter a new name: ";  
    getline(cin, name1);  
}
```

```
void modify2()  
{  
    cout << "Enter a new age: ";  
    cin >> age2;  
    cin.ignore();  
    cout << "Enter a new name: ";  
    getline(cin, name2);  
}
```

```
void modify3()
```

```
{  
    cout << "Enter a new age: ";  
    cin >> age3;  
    cin.ignore();  
    cout << "Enter a new name: ";  
    getline(cin, name3);  
}
```

```
void displayData()
```

```
{  
    ifile.open("students.txt");  
    if (!ifile)  
    {  
        cout << "Error opening file\n\n" << endl;  
    }  
    else  
    {  
        cout << age1 << ":" << name1 << endl;  
        cout << age2 << ":" << name2 << endl;  
        cout << age3 << ":" << name3 << endl;  
        ifile.close();  
    }  
}
```

```
void save()
```

```
{  
    ofile.open("students.txt");  
    if (!ofile)  
    {
```



```
    cout << "Error opening file for writing!\n\n" << endl;
}
else
{
    ofile << age1 << endl
    << name1 << endl
    << age2 << endl
    << name2 << endl
    << age3 << endl
    << name3 << endl;
    ofile.close();
    cout << "Data saved successfully!" << endl;
    saved = true;
}
}
```

Problem 4. Geometry Calculator with functions and menu

Make a C++ program that calculates the area of different geometric shapes: circle, rectangle, and triangle. The program should allow the user to choose a shape, enter the required dimensions, and receive the computed area. All arguments should be passed by value.

Implement a **loop** to allow repeated calculations until the user chooses to exit.

It must have the following functions:

- displayMenu(): Displays a menu with options: Circle, Rectangle, Triangle, and Exit.
- calculateCircleArea(double): Accepts the radius as a parameter (by value) and returns the area using the formula:

$$A = \pi \times r^2$$

- calculateRectangleArea(double, double): Accepts the length and width (by value) and returns the area using the formula:

$$A = \text{length} \times \text{width}$$

- `calculateTriangleArea(double, double)`: Accepts the base and height (by value) and returns the area using the formula:

$$A = 1/2 \times \text{base} \times \text{height}$$

- `displayResult(double, std::string)`: Accepts the computed area and shape name (by value) and displays the result.

USE THE NEXT TEMPLATE (MANDATORY):

```
//DO NOT MODIFY THIS SECTION
#include <iostream>
#include <iomanip>
#include <cmath>    // For pow function (if needed in extensions)

using namespace std;

// Function Prototypes
void displayMenu();
double calculateCircleArea(double radius);
double calculateRectangleArea(double length, double width);
double calculateTriangleArea(double base, double height);
void displayResult(double area, string shape);

int main() {
    int choice;
    double radius, length, width, base, height, area;

    do {
        displayMenu();
        cout << "Enter your choice: ";
        cin >> choice;

//ADD YOUR CODE FROM HERE, INCLUDE YOUR FUNCTIONS
```

Example of execution:

Geometry Calculator

1. Circle
2. Rectangle
3. Triangle
4. Exit

Enter your choice: 1

Enter the radius: 5

The area of the circle is 78.54 square units.

Enter your choice: 2

Enter the length: 8

Enter the width: 4

The area of the rectangle is 32 square units.

Enter your choice: 3

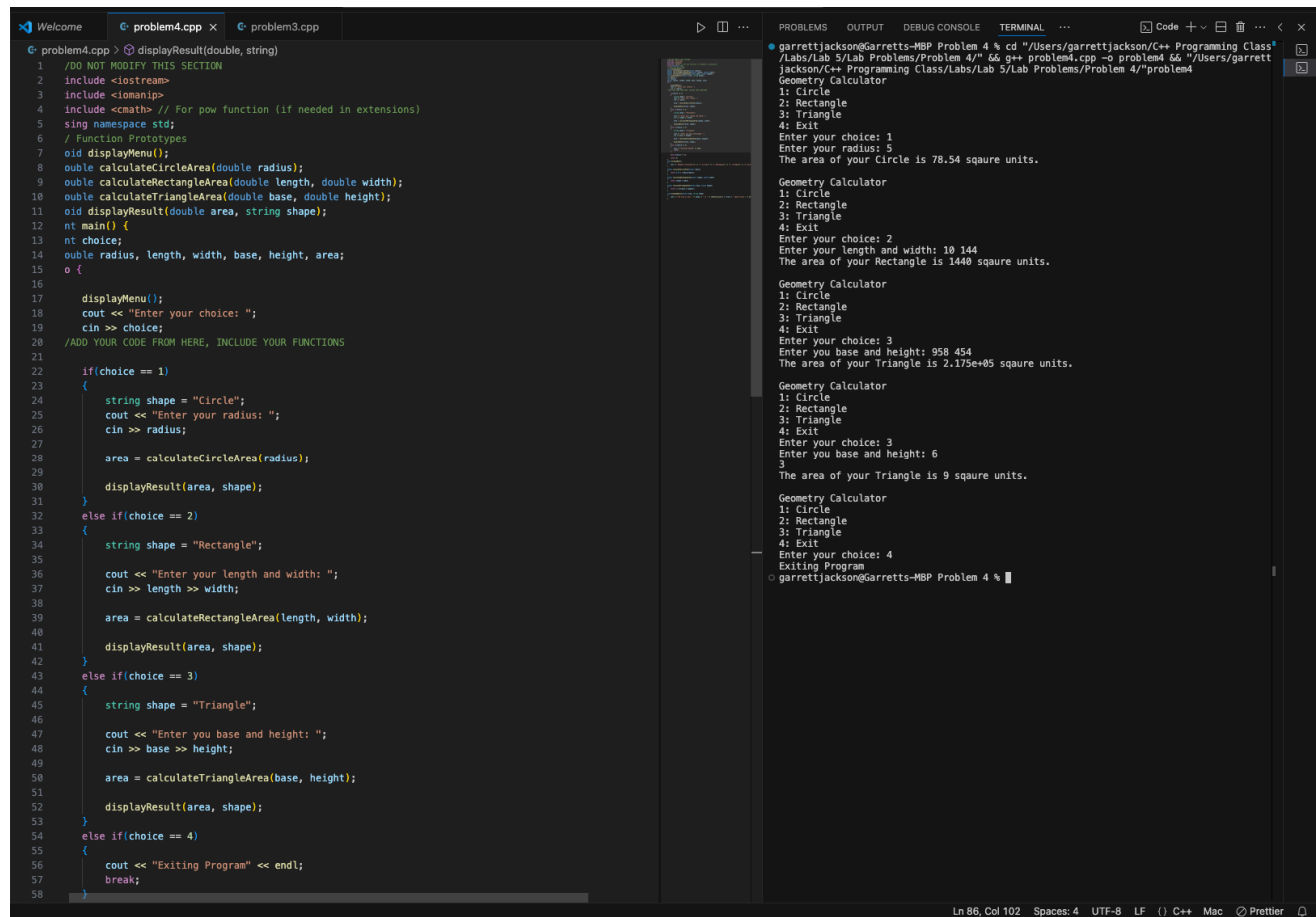
Enter the base: 6

Enter the height: 3

The area of the triangle is 9 square units.

Enter your choice: 4

Goodbye!



```
1 // DO NOT MODIFY THIS SECTION
2 #include <iostream>
3 #include <iomanip>
4 #include <cmath> // For pow function (if needed in extensions)
5 using namespace std;
6 // Function Prototypes
7 void displayMenu();
8 double calculateCircleArea(double radius);
9 double calculateRectangleArea(double length, double width);
10 double calculateTriangleArea(double base, double height);
11 void displayResult(double area, string shape);
12 int main() {
13     int choice;
14     double radius, length, width, base, height, area;
15     while (true) {
16         displayMenu();
17         cout << "Enter your choice: ";
18         cin >> choice;
19         // ADD YOUR CODE FROM HERE, INCLUDE YOUR FUNCTIONS
20         if (choice == 1) {
21             string shape = "Circle";
22             cout << "Enter your radius: ";
23             cin >> radius;
24             area = calculateCircleArea(radius);
25             displayResult(area, shape);
26         }
27         else if (choice == 2) {
28             string shape = "Rectangle";
29             cout << "Enter your length and width: ";
30             cin >> length >> width;
31             area = calculateRectangleArea(length, width);
32             displayResult(area, shape);
33         }
34         else if (choice == 3) {
35             string shape = "Triangle";
36             cout << "Enter you base and height: ";
37             cin >> base >> height;
38             area = calculateTriangleArea(base, height);
39             displayResult(area, shape);
40         }
41         else if (choice == 4) {
42             cout << "Exiting Program" << endl;
43             break;
44         }
45     }
46 }
```

garrettjackson@Garretts-MBP Problem 4 % cd "/Users/garrettjackson/C++ Programming Class"/Labs/Lab 5/Lab Problems/Problem 4/" && g++ problem4.cpp -o problem4 && ./problem4

Geometry Calculator

1: Circle
2: Rectangle
3: Triangle
4: Exit

Enter your choice: 1
Enter your radius: 5
The area of your Circle is 78.54 square units.

Geometry Calculator

1: Circle
2: Rectangle
3: Triangle
4: Exit

Enter your choice: 2
Enter your length and width: 18 144
The area of your Rectangle is 1440 square units.

Geometry Calculator

1: Circle
2: Rectangle
3: Triangle
4: Exit

Enter your choice: 3
Enter you base and height: 958 454
The area of your Triangle is 2.175e+05 square units.

Geometry Calculator

1: Circle
2: Rectangle
3: Triangle
4: Exit

Enter your choice: 3
Enter you base and height: 6
3
The area of your Triangle is 9 square units.

Geometry Calculator

1: Circle
2: Rectangle
3: Triangle
4: Exit

Enter your choice: 4
Exiting Program

garrettjackson@Garretts-MBP Problem 4 %

```

12 int main() {
13     int choice;
14     do {
15         displayMenu();
16         if(choice == 1)
17             calculateCircleArea(radius);
18         else if(choice == 2)
19             calculateRectangleArea(length, width);
20         else if(choice == 3)
21             calculateTriangleArea(base, height);
22         else if(choice == 4)
23             break;
24     } while(choice != 4);
25     return 0;
26 }
27
28 void displayMenu()
29 {
30     cout << "Geometry Calculator\n" << "1: Circle\n" << "2: Rectangle\n" << "3: Triangle\n" << "4: Exit\n";
31 }
32
33 double calculateCircleArea(double radius)
34 {
35     return M_PI * (radius*radius);
36 }
37
38 double calculateRectangleArea(double length, double width)
39 {
40     return length * width;
41 }
42
43 double calculateTriangleArea(double base, double height)
44 {
45     return ((.5)*(base * height));
46 }
47
48 void displayResult(double area, string shape)
49 {
50     cout << "The area of your " << shape << " is " << setprecision(4) << area << " square units." << endl;
51 }

```

Terminal Output:

```

Geometry Calculator
1: Circle
2: Rectangle
3: Triangle
4: Exit
Enter your choice: 1
Enter your radius: 5
The area of your Circle is 78.54 square units.

Geometry Calculator
1: Circle
2: Rectangle
3: Triangle
4: Exit
Enter your choice: 2
Enter your length and width: 10 144
The area of your Rectangle is 1440 square units.

Geometry Calculator
1: Circle
2: Rectangle
3: Triangle
4: Exit
Enter your choice: 3
Enter your base and height: 958 454
The area of your Triangle is 2.175e+05 square units.

Geometry Calculator
1: Circle
2: Rectangle
3: Triangle
4: Exit
Enter your choice: 4
Exiting Program

```

//DO NOT MODIFY THIS SECTION

```

#include <iostream>
#include <iomanip>
#include <cmath> // For pow function (if needed in extensions)
using namespace std;
// Function Prototypes
void displayMenu();
double calculateCircleArea(double radius);
double calculateRectangleArea(double length, double width);
double calculateTriangleArea(double base, double height);
void displayResult(double area, string shape);
int main() {
    int choice;
    double radius, length, width, base, height, area;
    do {

```

```

        displayMenu();
        cout << "Enter your choice: ";
        cin >> choice;

```

//ADD YOUR CODE FROM HERE, INCLUDE YOUR FUNCTIONS

```

        if(choice == 1)
        {

```

```
    string shape = "Circle";
    cout << "Enter your radius: ";
    cin >> radius;

    area = calculateCircleArea(radius);

    displayResult(area, shape);
}
else if(choice == 2)
{
    string shape = "Rectangle";

    cout << "Enter your length and width: ";
    cin >> length >> width;

    area = calculateRectangleArea(length, width);

    displayResult(area, shape);
}
else if(choice == 3)
{
    string shape = "Triangle";

    cout << "Enter you base and height: ";
    cin >> base >> height;

    area = calculateTriangleArea(base, height);

    displayResult(area, shape);
}
else if(choice == 4)
{
    cout << "Exiting Program" << endl;
    break;
}
} while(choice != 4);

return 0;
}
void displayMenu()
{
    cout << "Geometry Calculator\n" << "1: Circle\n" << "2: Rectangle\n" << "3: Triangle\n" << "4:
Exit\n";
}

double calculateCircleArea(double radius)
{
```

```
    return M_PI * (radius*radius);
}

double calculateRectangleArea(double length, double width)
{
    return length * width;
}

double calculateTriangleArea(double base, double height)
{
    return ((.5)*(base * height));
}

void displayResult(double area, string shape)
{
    cout << "The area of your " << shape << " is " << setprecision(4) << area << " square 31units." <<
endl << endl;
}
```