

## Structured Programs

A program is referred to as a “structured program” if main has a minimum of code, primarily to loop and call other functions. Each function has one clearly defined purpose. Advantage of structured programs include:

- It is easier to write a program if it is broken into steps;
- The program can be written by several programmers;
- A function that works can be used in other programs;
- If the program has to be modified, the modification may be restricted to just one function.

**Example:** The program below uses a menu to offer the user a choice of circle, square or triangle. Separate functions are used to get the necessary information and print the area for each shape. Each item can be added to the menu one at a time and tested. Try adding triangle. The area of a triangle is  $\frac{1}{2}$  base\*height.

```

0 // Find area of different shapes
1 #include <iostream.h>
2 char menu(void); // display choices, return selection
3 void respond(char); // execute selection
4 void doCircle(void); // get radius, print area
5 void doRectangle(void); // get length, width, print area
6 void doSquare(void); // get side, print area
7
8 int main() // Loop to get and respond to menu choice
9 { char choice;
10 do
11 { choice=menu(); // display menu return uppercase choice
12 respond(choice); // execute requested choice
13 } while (choice !='Q' && choice !='q'); // choice will be
14 uppercase
15 return 0;
16 } // main
17
18 char menu() // display choices return choice as uppercase */
19 { char ch;
20 cout<<"Please select a shape: \n";
21 cout<<" C: Circle \n";
22 cout<<" R: Rectangle \n";
23 cout<<" S: Square \n";
24 cout<<" Q: QUIT \n\n";
25 cout<<"Your selection: ";
26 cin>>ch;
27 return ch;
28 } // Menu
29
30 void doCircle() // get radius, print area
31 { int radius;
32 cout<<"Enter the radius of the circle:";
33 cin>>radius;
34 cout<<"The area is "<<3.14*radius*radius<<"\n";

```

```

35 } // doCircle
36
37 void doRectangle()// get length and width, print area
38 { int length, width;
39   cout<<"Enter the length of the rectangle: ";
40   cin>>length;
41   cout<<"Enter the width of the rectangle: ";
42   cin>>width;
43   cout<<"The area of a rectangle is "<<length*width<<"\n";
44 } // doRectangle
45
46 void doSquare() // get side, print area
47 { int side;
48   cout<<"Enter the side of the square:";
49   cin>>side;
50   cout<<"The area is "<<side*side<<"\n";
51 } // doSquare
52
53 void respond(char ch) // execute function indicated by ch
54 { switch (ch)
55   { case 'C': case 'c': doCircle(); break;
56     case 'R': case 'r': doRectangle(); break;
57     case 'S': case 's': doSquare(); break;
58     case 'Q': case 'q': break; // break to avoid default
59     default: cout<<"Not a valid choice, please retry. \n";
60   } // switch ch
61 } // respond

```

**Output:**

```

Please select a shape:
  C: Circle
  R: Rectangle
  S: Square
  Q: QUIT
Your selection: c
Enter the radius of the circle: 5
The area of a circle with a radius of 5 is 78.50000.
Please select a shape:
  C: Circle
  R: Rectangle
  S: Square
  Q: QUIT
Your selection: r
Enter the length of the rectangle: 12
Enter the width of the rectangle: 3
The area of a rectangle 12X3 is 36.
Please select a shape:
  C: Circle
  R: Rectangle
  S: Square
  Q: QUIT
Your selection: s
Enter the side of the square:8
The area of a square with a side of 8 is 64.

```

```
Please select a shape:  
  C: Circle  
  R: Rectangle  
  S: Square  
  Q: QUIT  
Your selection: q
```

**Explanation:** There is almost nothing in main except calls to other functions and a loop. Each of the functions can be written and tested one at a time. Each of the functions has its own local variables for the dimensions. The only variable main needs is a variable used to end the loop. *(PS: There is really no point in having main call a function to do the loop. )*