

## Homework Assignment #4 - Functions

### Reading Assignment:

Read Chapter 6 in C++ for Engineers & Scientists, 3<sup>rd</sup> Edition, by Bronson

### Problem Assignment:

Submit each of the following by the assigned due date. In each case turn in a printout of the main program, any functions, and the output for any test cases indicated. In general, you don't need to protect against illegal inputs for homework problems unless specifically noted.

1. Function with a single output: Write a C++ program for Exercise 6.2 – Problem 6. The main program should prompt the user for inputs and display the output. Use a global constant for the value of  $\pi$ . Test the program for  $r = 10$  and  $L = 20$ . Also test it for two additional cases that you select.
2. Function with a single output: Write a C++ function, CUBES, that will calculate the following summation. The function should have one input (N) and should return the summation. Also write a main program to prompt the user for the value of N, call the function, and display the result. Test the program for  $N = 1, 5,$  and  $10$ .

$$Sum = \sum_{i=1}^N i^3$$

3. Reference Parameters (returning multiple values): Write a C++ program for Exercise 6.3 – Problem 5. Note that function time has 1 input and 3 outputs. The call statement has the form:

**Time(seconds, hours, mins, secs);**

Example:

**Seconds = 9630;**

**Time(seconds, hours, mins, secs);**

**// The result should be hours = 2, mins = 40, secs = 30.**

Write function Time as described.

Write a main program that prompts the user for time in seconds, calls the function, then displays the time in hours, minutes, and seconds. The entered time must not be negative.

Test the program for the case above as well as for 2 other cases that you select. Show by hand that the results are correct.

4. Reference Parameters (returning multiple values): Write a C++ function with inputs equal to four integers and outputs equal to the smallest two of the four integers. The function call might look like:

**Smallest2(Num1, Num2, Num3, Num4, Small1, Small2);**

Also write a main program to prompt the user for four integer inputs, call the function, and display the outputs. Test the program with the following 4 integers: -4, 32, 1, 8. Also test it with two additional cases where the integers are not in increasing or decreasing order.

5. Default arguments: Write a C++ function **Poly** that will return the value of a 1<sup>st</sup> – 5<sup>th</sup> order polynomial of the form:

$$y = A_0 + A_1x + A_2x^2 + A_3x^3 + A_4x^4 + A_5x^5$$

Inputs to the function should include x and the polynomial coefficients,  $A_0 - A_5$ .

The function should use default values of 0 for  $A_2 - A_5$  so that it will work with polynomials that are 1<sup>st</sup> order, 2<sup>nd</sup> order, 3<sup>rd</sup> order, 4<sup>th</sup> order, or 5<sup>th</sup> order and unused higher-order coefficients do not need to be listed in the function call.

Examples: Function Poly could be used to evaluate 1<sup>st</sup>, 2<sup>nd</sup>, and 5<sup>th</sup> order polynomials as follows:

$$y = \mathbf{Poly(1,2,3)}; \quad (\text{answer: } y = 2+3x = 2+3(1) = 5)$$

$$y = \mathbf{Poly(2,5,4,3)}; \quad (\text{answer: } y = 5+4x+3x^2 = 5+4(2)+3(2)^2 = 25)$$

$$y = \mathbf{Poly(2,3,4,5,6,7,8)}; \quad (\text{answer: } y = 3+4x+5x^2+6x^3+7x^4+8x^5 = 447)$$

- Write function Poly as described above.
- Write a main function that prompts the user to enter the order (1-5) and then prompts the user to enter the correct number of coefficients and the value of x. The main program should then call function Poly to calculate the output and display the result.
- Test the program for the 3 cases above as well as for 3<sup>rd</sup> and 4<sup>th</sup> order polynomials for any values you choose. Check the values by hand (show the calculations) to insure that they are correct.

(continued on next page)

6. Determine the output for each part below by hand (do not compile the programs).

<pre>// Problem 5A #include &lt;iostream&gt; #include &lt;cmath&gt; using namespace std; // Function declarations double Square(double); double Cube(double); // Main function int main ( void ) { double x = 2.0, y = 3.0;   x = Square(x);   y = Cube(x);   cout &lt;&lt; "x = " &lt;&lt; x &lt;&lt; endl;   cout &lt;&lt; "y = " &lt;&lt; y &lt;&lt; endl;   system("Pause");   return 0; } // Function definitions double Square(double y) { double x = pow(y,2);   return x;} double Cube(double x) { double y = pow(x,3);   return y;}</pre>	<p>x = _____</p> <p>y = _____</p>
<pre>// Problem 5B #include &lt;iostream&gt; #include &lt;cmath&gt; using namespace std; // Function declarations void F2(int,int,int,int&amp;,int&amp;,int&amp;); // Main function int main ( void ) { int X=1,Y=2,Z=3,A=4,B=5,C=6,A1=7,A2=8,A3=9;   F2(X,Y,Z,A,B,C);   cout &lt;&lt; "X = " &lt;&lt; X &lt;&lt; " Y = " &lt;&lt; Y &lt;&lt; endl;   cout &lt;&lt; "Z = " &lt;&lt; Z &lt;&lt; " A = " &lt;&lt; A &lt;&lt; endl;   cout &lt;&lt; "B = " &lt;&lt; B &lt;&lt; " C = " &lt;&lt; C &lt;&lt; endl;   cout &lt;&lt; "A1 = " &lt;&lt; A1 &lt;&lt; " A2 = " &lt;&lt; A2 &lt;&lt; endl;   cout &lt;&lt; "A3 = " &lt;&lt; A3 &lt;&lt; endl;   system("Pause");   return 0; } // Function definitions void F2(int X, int Y, int Z, int&amp; A1, int&amp; A2, int&amp; A3) { X = X+5;   A1 = A1*A1;   A2 = (Y + Z)/2;   A3 = (Y - Z)/2;   return;}</pre>	<p>X = _____</p> <p>Y = _____</p> <p>Z = _____</p> <p>A = _____</p> <p>B = _____</p> <p>C = _____</p> <p>A1 = _____</p> <p>A2 = _____</p> <p>A3 = _____</p>