

## Homework Assignment #3

### Reading Assignment:

Read Chapter 5 in C++ for Engineers & Scientists, 3<sup>rd</sup> Edition by Bronson

### Problem Assignment:

Submit each of the following by the assigned due date.

1. **While loops (20 pts):**

- A) Write a C++ program using a **while loop** for Exercise 5.2, Problem 4 in the text. Turn in a printout of the program and a printout of the results.
- B) Write a C++ program using a **while loop** to calculate the value of  $\pi$  accurate to 6 digits after the decimal point using the following series:  

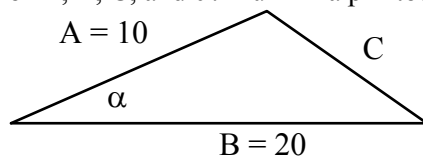
$$\pi = 4 - 4/3 + 4/5 - 4/7 + 4/9 - 4/11 + \dots$$
 Turn in a printout of the program and a printout of the results.

2. **Do while loops (20 pts):**

- A) Write a C++ program using a **do while loop** for Exercise 5.7, Problem 3 in the text. Test the program for integer inputs having 1, 2, 3, 4, and 5 digits. Turn in a printout of the program and a printout of the results.
- B) Write a C++ program to determine the smallest integer such that  $2N^3 - 6N^2 > 12500$  using a **do while loop**. Begin with  $N = 0$  and increment  $N$  until the result is found. Turn in a printout of the program and a printout of the results.

3. **For loops (30 pts):**

- A) (14 pts) Write a C++ program to display a table of values for angle  $\alpha$  (in degrees) and side  $C$  of the triangle shown. The length of side  $C$  can be calculated using the law of cosines as shown below. Use a **for loop** to calculate  $C$  as angle  $\alpha$  varies from 0 to 90 degrees in 5 degree increments. The output should be a table of values for  $A$ ,  $B$ ,  $C$ , and  $\alpha$ . Turn in a printout of the program and a printout of the results.



$$C^2 = A^2 + B^2 - 2(A)(B)\cos(\alpha)$$

- B) (14 pts) Write a C++ program that uses a **for loop** for Exercise 5.4, Problem 10 in the text. Turn in a printout of the program and a printout of the results.
- C) (14 pts) Write a C++ program to display a 12 x 12 multiplication table using **nested for loops**. The table should appear as shown below. Turn in a printout of the program and the output. (Note: only output a single value each time in the inner loop and use `setw(N)` to control the format.)

|    |    |    |    |    |    |    |    |     |     |     |     |
|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9   | 10  | 11  | 12  |
| 2  | 4  | 6  | 8  | 10 | 12 | 14 | 16 | 18  | 20  | 22  | 24  |
| 3  | 6  | 9  | 12 | 15 | 18 | 21 | 24 | 27  | 30  | 33  | 36  |
| 4  | 8  | 12 | 16 | 20 | 24 | 28 | 32 | 36  | 40  | 44  | 48  |
| 5  | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45  | 50  | 55  | 60  |
| 6  | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54  | 60  | 66  | 72  |
| 7  | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63  | 70  | 77  | 84  |
| 8  | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72  | 80  | 88  | 96  |
| 9  | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81  | 90  | 99  | 108 |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90  | 100 | 110 | 120 |
| 11 | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99  | 110 | 121 | 132 |
| 12 | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 |

(continued)

4. (30 pts) For each part below, show the output produced. Problem 0 is an example. Trace these program segments on paper (use a table) and in your head rather than using the C++ compiler.

| Prob # | Loop to trace   | Output   |
|--------|---|--|
| 0      | <pre>for (int i = 5; i &gt; 0; i--)     cout &lt;&lt; i &lt;&lt; " cubed = "         &lt;&lt; i*i*i &lt;&lt; endl;</pre>  | <pre>5 cubed = 125 4 cubed = 64 3 cubed = 27 2 cubed = 8 1 cubed = 1</pre> |
| 1      | <pre>for (int i = 10; i &gt; 0; i -=2)     cout &lt;&lt; i &lt;&lt; " squared = "         &lt;&lt; i*i &lt;&lt; endl;</pre>                                     |  |
| 2      | <pre>for (int i = 1; i &lt;= 5; i++) {     cout &lt;&lt; i &lt;&lt; endl;     for (int j = i; j &gt;= 1; j -= 2)         cout &lt;&lt; j &lt;&lt; endl; }</pre> |  |
| 3      | <pre>int k = 5; for (int i = -2; i &lt; 5; i += 2) {     cout &lt;&lt; i + k &lt;&lt; endl;     k = 1; }</pre>  |  |

|   |  |  |
|---|--|--|
| 4 | <pre>for (int i = 1; i &lt;= 3; i++)   for (int j = 1; j &lt;= i; j++)     for (int k = i; k &gt;= j; k--)       cout &lt;&lt; i &lt;&lt; j &lt;&lt; k &lt;&lt; endl;</pre>                                  |  |
| 5 | <pre>for ( int i = 1; i &lt;= 3; i++)   for (int j = 1; j &lt;= 3; j++)   {     for (int k = i; k &lt;= j; k++)       cout &lt;&lt; i &lt;&lt; j &lt;&lt; k &lt;&lt; endl;     cout &lt;&lt; endl;   }</pre> |  |
| 6 | <pre>i = 5; j = 1; for (;;) {   k = 2 * i - j;   if (k &lt; 0) break;   cout &lt;&lt; i &lt;&lt; j &lt;&lt; k &lt;&lt; endl;   j++;   i--; } cout &lt;&lt; i &lt;&lt; j &lt;&lt; k &lt;&lt; endl;</pre>      |  |

|    |  |  |
|----|--|--|
| 7  | <pre> k = 5; i = 32; while (i &gt; 0) {     cout &lt;&lt; "base-2 log of " &lt;&lt; i         &lt;&lt; " = " &lt;&lt; k &lt;&lt; endl;     i /= 2;     k--; } </pre>   |  |
| 8  | <pre> i = 1; while (i*i &lt; 10) {     j = i;     while (j*j &lt; 100)     {         cout &lt;&lt; i + j &lt;&lt; endl;         j *= 2;     }     i++; } cout &lt;&lt; "\n*****\n"; </pre>   |  |
| 9  | <pre> i = 1; do {     k = i * i * i - 3 * i + 1;     cout &lt;&lt; i &lt;&lt; k &lt;&lt; endl;     i++; } while (k &lt;= 2); </pre>  |  |
| 10 | <pre> i = 0; do {     j = i * i * i;     cout &lt;&lt; i;     do     {         k = i + 2 * j;         cout &lt;&lt; j &lt;&lt; k;         j += 2;     }     while (k &lt;= 10);     cout &lt;&lt; endl;     i++; } while (j &lt;= 5); </pre> |  |