

**Source File:** ~/2336/36/lab36. (C|CPP|cpp|c++|cc|cxx|cp)  
**Input:** under control of main function  
**Output:** under control of main function  
**Value:** 3

Write and test a program that fills an  $n \times n$  array with consecutive integers arranged in a spiral pattern. For example, if  $n = 6$ , the output should be

```

1  2  3  4  5  6
20 21 22 23 24  7
19 32 33 34 25  8
18 31 36 35 26  9
17 30 29 28 27 10
16 15 14 13 12 11

```

A header file containing the specification is shown in Figure 1, a sample main function for testing your implementation is shown in Figure 2, and a sample execution sequence is shown in Figure 3. To use the Makefile as distributed in class, add a target of lab36 to targets2srcfiles.

```

1  #ifndef LAB36_H
2  #define LAB36_H
3
4  #include <iostream>
5  #include <d_matrix.h>
6
7  using namespace std;
8
9  class Spiral
10 {
11     // Overloaded output operator - displays the two-dimensional matrix
12     // data of spiral row-by-row to output stream out. The columns of
13     // the display should align on the right, and there should be one
14     // space separating the columns. The columns should all be of the
15     // same width, equal to the width of the largest element.
16     friend ostream& operator<<(ostream& out, const Spiral& spiral);
17
18 public:
19     // Member function initialize resizes the two-dimensional matrix
20     // data to be n rows by n columns and then initializes each element
21     // to 0
22     void initialize(int n);
23
24     // Populates the two-dimensional matrix data as described in the lab
25     // handout
26     void build();
27
28 private:
29     matrix<uint> data;
30 };
31
32 #endif

```

Figure 1. /usr/local/2336/include/lab36.h

```

1  #include <iostream>
2  #include <lab36.h>
3
4  using namespace std;
5
6  int main()
7  {
8      Spiral spiral;
9      uint n;          // the number of columns & rows
10
11     cin >> n;
12
13     spiral.initialize(n);
14     spiral.build();
15     cout << spiral;
16
17     return EXIT_SUCCESS;
18 }

```

Figure 2. /usr/local/2336/src/lab36main.C

```

1  newuser@csunix ~> cd 2336
2  newuser@csunix ~/2336> ./getlab.ksh 36
3      * Checking to see if a folder exists for Lab 36. . .No
4      * Creating a folder for Lab 36
5      * Checking to see if Lab 36 has sample input and output files. . .Yes
6      * Copying input and output files for Lab 36
7          from folder /usr/local/2336/data/36 to folder ./36
8      * Checking to see if /usr/local/2336/src/lab36main.C exists. . .Yes
9      * Copying file /usr/local/2336/src/lab36main.C to folder ./36
10     * Checking to see if /usr/local/2336/include/lab36.h exists. . .Yes
11     * Copying file /usr/local/2336/include/lab36.h to folder ./36
12     * Copying file /usr/local/2336/src/Makefile to folder ./36
13     * Adding a target of lab36 to targets2srcfiles
14     * Touching file ./36/lab36.cpp
15     * Edit file ./36/lab36.cpp in Notepad++
16  newuser@csunix ~/2336> cd 36
17  newuser@csunix ~/2336/36> ls
18  00.out      03.out      06.out      09.out      Makefile      lab36main.C
19  01.out      04.out      07.out      10.out      lab36.cpp
20  02.out      05.out      08.out      11.out      lab36.h
21  newuser@csunix ~/2336/36> make lab36
22  g++ -g -Wall -std=c++11 -c lab36main.C -I/usr/local/2336/include -I.
23  g++ -g -Wall -std=c++11 -c lab36.cpp -I/usr/local/2336/include -I.
24  g++ -o lab36 lab36main.o lab36.o -L/usr/local/2336/lib -lm -lbits

```

Figure 3. Commands to Compile, Link, &amp; Run Lab 36 (Part 1 of 2)

```

25 newuser@csunix ~/2336/36> echo 0 | ./lab36
26 newuser@csunix ~/2336/36> echo 1 | ./lab36
27 1
28 newuser@csunix ~/2336/36> echo 1 | ./lab36 > my.out
29 newuser@csunix ~/2336/36> diff 01.out my.out
30 newuser@csunix ~/2336/36> echo 2 | ./lab36
31 1 2
32 4 3
33 newuser@csunix ~/2336/36> echo 2 | ./lab36 > my.out
34 newuser@csunix ~/2336/36> diff 02.out my.out
35 newuser@csunix ~/2336/36> echo 3 | ./lab36
36 1 2 3
37 8 9 4
38 7 6 5
39 newuser@csunix ~/2336/36> echo 3 | ./lab36 > my.out
40 newuser@csunix ~/2336/36> diff 03.out my.out
41 newuser@csunix ~/2336/36> echo 4 | ./lab36
42 1 2 3 4
43 12 13 14 5
44 11 16 15 6
45 10 9 8 7
46 newuser@csunix ~/2336/36> echo 4 | ./lab36 > my.out
47 newuser@csunix ~/2336/36> diff 04.out my.out
48 newuser@csunix ~/2336/36> echo 5 | ./lab36
49 1 2 3 4 5
50 16 17 18 19 6
51 15 24 25 20 7
52 14 23 22 21 8
53 13 12 11 10 9
54 newuser@csunix ~/2336/36> echo 5 | ./lab36 > my.out
55 newuser@csunix ~/2336/36> diff 05.out my.out
56 newuser@csunix ~/2336/36> echo 6 | ./lab36
57 1 2 3 4 5 6
58 20 21 22 23 24 7
59 19 32 33 34 25 8
60 18 31 36 35 26 9
61 17 30 29 28 27 10
62 16 15 14 13 12 11
63 newuser@csunix ~/2336/36> echo 6 | ./lab36 > my.out
64 newuser@csunix ~/2336/36> diff 06.out my.out
65 newuser@csunix ~/2336/36> echo 7 | ./lab36
66 1 2 3 4 5 6 7
67 24 25 26 27 28 29 8
68 23 40 41 42 43 30 9
69 22 39 48 49 44 31 10
70 21 38 47 46 45 32 11
71 20 37 36 35 34 33 12
72 19 18 17 16 15 14 13
73 newuser@csunix ~/2336/36> echo 7 | ./lab36 > my.out
74 newuser@csunix ~/2336/36> diff 07.out my.out

75 newuser@csunix ~/2336/36> echo 8 | ./lab36
76 1 2 3 4 5 6 7 8
77 28 29 30 31 32 33 34 9
78 27 48 49 50 51 52 35 10
79 26 47 60 61 62 53 36 11
80 25 46 59 64 63 54 37 12
81 24 45 58 57 56 55 38 13
82 23 44 43 42 41 40 39 14
83 22 21 20 19 18 17 16 15
84 newuser@csunix ~/2336/36> echo 8 | ./lab36 > my.out
85 newuser@csunix ~/2336/36> diff 08.out my.out
86 newuser@csunix ~/2336/36> echo 9 | ./lab36
87 1 2 3 4 5 6 7 8 9
88 32 33 34 35 36 37 38 39 10
89 31 56 57 58 59 60 61 40 11
90 30 55 72 73 74 75 62 41 12
91 29 54 71 80 81 76 63 42 13
92 28 53 70 79 78 77 64 43 14
93 27 52 69 68 67 66 65 44 15
94 26 51 50 49 48 47 46 45 16
95 25 24 23 22 21 20 19 18 17
96 newuser@csunix ~/2336/36> echo 9 | ./lab36 > my.out
97 newuser@csunix ~/2336/36> diff 09.out my.out
98 newuser@csunix ~/2336/36> echo 10 | ./lab36
99 1 2 3 4 5 6 7 8 9 10
100 36 37 38 39 40 41 42 43 44 11
101 35 64 65 66 67 68 69 70 45 12
102 34 63 84 85 86 87 88 71 46 13
103 33 62 83 96 97 98 89 72 47 14
104 32 61 82 95 100 99 90 73 48 15
105 31 60 81 94 93 92 91 74 49 16
106 30 59 80 79 78 77 76 75 50 17
107 29 58 57 56 55 54 53 52 51 18
108 28 27 26 25 24 23 22 21 20 19
109 newuser@csunix ~/2336/36> echo 10 | ./lab36 > my.out
110 newuser@csunix ~/2336/36> diff 10.out my.out
111 newuser@csunix ~/2336/36> echo 11 | ./lab36
112 1 2 3 4 5 6 7 8 9 10 11
113 40 41 42 43 44 45 46 47 48 49 12
114 39 72 73 74 75 76 77 78 79 50 13
115 38 71 96 97 98 99 100 101 80 51 14
116 37 70 95 112 113 114 115 102 81 52 15
117 36 69 94 111 120 121 116 103 82 53 16
118 35 68 93 110 119 118 117 104 83 54 17
119 34 67 92 109 108 107 106 105 84 55 18
120 33 66 91 90 89 88 87 86 85 56 19
121 32 65 64 63 62 61 60 59 58 57 20
122 31 30 29 28 27 26 25 24 23 22 21
123 newuser@csunix ~/2336/36> echo 11 | ./lab36 > my.out
124 newuser@csunix ~/2336/36> diff 11.out my.out
125 newuser@csunix ~/2336/36>

```

Figure 3. Commands to Compile, Link, &amp; Run Lab 36 (Part 2 of 2)