Experiment 8
Butterfly Pattern

(Duration: 105 min)

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Submission Deadline**:12.30**

Purpose: The aim of this lab is to draw a butterfly pattern with user-defined size and randomly generated size. The elements of the butterfly pattern should indicate the mathematical quadrants and the function should also return its own execution time.

Lab Procedure

1. Write a function that plots a butterfly pattern (25 pts.) that meets the specifications given below and call it in main. The function should return its own execution time (20 pts.). Also, the elements on the butterfly should indicate mathematical quadrants (15 pts.). An example of a 10x10 butterfly:

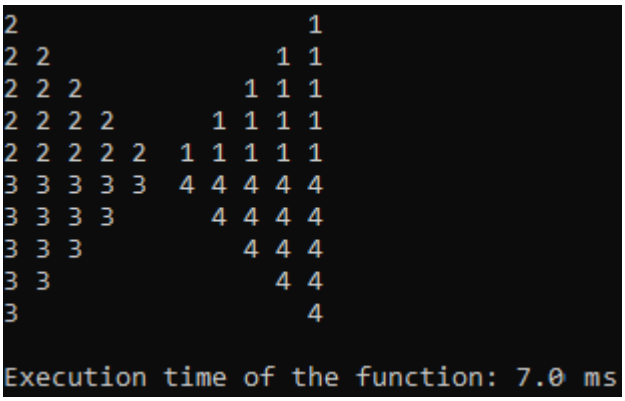

Fig. 1: An example pattern of 10x10 butterfly with indicated mathematical quadrants

```
double pattern_Butterfly(int n)// "int n" denotes the size of the n by n butterfly pattern
```

2. Your program should give the user 2 options. The first option should provide the butterfly size to be selected by the user (should be n by n). The second option is to determine the butterfly size randomly (again n by n). If the selected number is not 1 or 2, the program should return an error message. (10pts.)

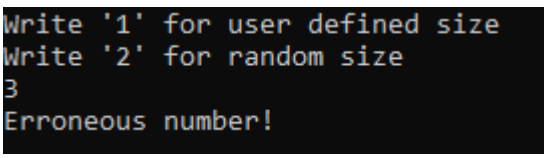

Fig. 2: The two options. The first one is the user-defined size. The second one is the randomly generated size.

3. If the user selects "1", the program should force the user to enter only **even numbers between 5 and 51** as the size of the butterfly. If the written number does not meet the requirement, error messages like the following figure should be returned. Otherwise, the function that draws the desired pattern must be called. (15 pts.)

```
Write '1' for user defined size
Write '2' for random size
1
Write the size. It should be 5<n<51 and an even number:
60

Size should be 5<n<51
```

```
Write '1' for user defined size
Write '2' for random size
1
Write the size. It should be 5<n<51 and an even number:
23

The size should be an even number!
```

Fig. 3: Error messages for the inputs out of specification

4. If the user selects "2", the randomly generated size of the butterfly pattern again should be **even numbers between 5 and 51.** The program should also print the random size and the execution time on the screen. **Use the computer's internal clock to control the choice of the seed.** (15 pts.)

```
Write '1' for user defined size
Write '2' for random size
2
Random size:14

2                         1
2 2                     1 1
2 2 2                 1 1 1
2 2 2 2             1 1 1 1
2 2 2 2 2         1 1 1 1 1
2 2 2 2 2 2     1 1 1 1 1 1
2 2 2 2 2 2 2 1 1 1 1 1 1 1
3 3 3 3 3 3 3 4 4 4 4 4 4 4
3 3 3 3 3 3     4 4 4 4 4 4
3 3 3 3 3         4 4 4 4 4
3 3 3 3             4 4 4 4
3 3 3                 4 4 4
3 3                     4 4
3                         4

Execution time of the function: 12.0 milliseconds
```

Fig. 4: An example pattern of 14x14 butterfly (the size is randomly generated)

Remind that the execution time of the function must be **calculated in the function and printed in main** (Printing the execution time in the function is forbidden).