Objective:

- To get a grip on Repetition Structure: *specifically, while loop.*
- *This practice includes both simple and nested loop.*

Note: You are not allowed to use math library functions without my permission.

Task-1
The starting point for the repetition structure in C++ is your previous practice files, Quizzes, Labs based repetition structure using pseudo code.

Task-2
Perform a statistical experiment by developing a solution to flip a coin (use rand() function) a given amount of times and then print the number of heads and the number of tails.

Task-3
Write a program, which prints the Nth terms of the Fibonacci sequence. If N = 5 then your program display 3.

Fibonacci Sequence: 0, 1, 1, 2, 3, 5, 8, 13, 21, …

Task-4
Using loops: do the task titled ABRACADABARA given in Practice-8.
When you done with this then change the problem by taking range from user instead of fixing it from 1 to 1000.

Task-5
A teacher has asked all her students to line up according to their first name. For example, in one class Amy will be at the front of the line and Yolanda will be at the end. Write a program that prompts the user to enter the number of students in the class, and then loops to read in that many names along with their ages as well (If two students have same name then the decision will be made on the basis of their age). Once all the names have been read in, it reports which student would be at the front of the line and which one would be at the end of the line.
Input Validation: Do not accept a number less than 1 or greater than 25 for the number of students and also don't accept age less than 1.

Task-6
Write a program, which calculates the sum of first 'N' term of the following series:
$$1^0 - 1^1 + 2^1 - 3^2 + 5^3 - 8^5 + 13^8 - 21^{13} + ……$$

Task-7
A long-distance carrier charges the following rates for telephone calls:

Starting Time of Call	Rate per Minute
00:00–06:59	0.12
07:00–19:00	0.55
19:01–23:59	0.35

Write a program that asks for the starting time and the number of minutes of the call and displays the charges. The program should ask for the time to be entered as a floating-point number in the form HH.MM. For example, 07:00 hours will be entered as 07.00, and 16:28 hours will be entered as 16.28.
Input Validation: The program should not accept a time value, which is greater than 23:59.
Note: Call can continue for more than one day

Task-8
The number, 197, is called a circular prime because all rotations of the digits: 197, 971, and 719, are themselves prime.

There are thirteen such primes below 100: 2, 3, 5, 7, 11, 13, 17, 31, 37, 71, 73, 79, and 97.
How many circular primes are there below one million?

Task-9
Write C++ programs to draw the following shapes.
The program should be generic: which means that your program will ask from the user about height
(N) of pyramid/triangle/square and will display the shape accordingly.

Shape-1 For N=5 ….1 …2. ..3.. .4… 5…. **Shape-2** For N=5 55555 4444 333 22 1 **Shape-3** For N=5 ____* ___** __*** _**** ***** **Shape-4** For N=5 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 **Shape-5** For N=5 1*2*3*4*5 1*2*3*4 1*2*3 1*2 1	**Shape-13** For N=5 1 1 1 1 1 2 1 1 2 2 1 1 2 2 3 **Shape-14** For N=5 1 0 1 1 0 1 0 1 0 1 1 0 1 0 1 **Shape-15** For N=5 1 4 16 36 64 1 9 25 49 1 4 16 1 9 1 **Shape-16** For N=5 1 232 34543 4567654 567898765 **Shape-17** For N=4 1*****1 12***21 123*321 1234321

Shape-6
For N=5

```
1
121
12321
1234321
123454321
1234321
12321
121
1
```

Shape-7
For N=5

```
1 1
2 1 1 2
3 2 1 1 2 3
4 3 2 1 1 234
5 4 3 2 1 1 2 3 4 5
```

Shape-8
For N=5

```
123456789
 2345678
  34567
   456
    5
```

Shape-9
For N=5

```
123456789
_2345678
__34567
___456
____5
```

Shape-10
For N=5

```
5
654
76543
8765432
987654321
```

Shape-11
For N=6

```
100000
010000
001000
000100
```

Shape-18
For N=5

```
* * * * *
*       *
*       *
*       *
* * * * *
```

Shape-19
For N=6

```
*
**
*
***
*
****
```

Shape-20
For N=8

```
*+++
**++
***+
****
+***
++**
+++*
++++
```

Shape-21
For N=7

```
13579
35791
57913
79135
91357
```

Shape-22
For N=4

```
A C E G
A C E
A C
A
```

Shape-23
For N=7

```
ABCDEFGFEDCBA
ABCDEF FEDCBA
ABCDE   EDCBA
ABCD     DCBA
ABC       CBA
```

000010
000001
 	
Shape-12
For N=8
 	
00000000
00000001
00000010
00000011
00000100
00000101
00000110
00000111
	AB BA
	A A
	
	Shape-24
	For N=7
	
	    *
	  * *
	 * *
	* *
	 * *
	  * *
	   *	

Shape-25
For N=4

1	2	3	4	5
10	9	8	7	6
11	12	13	14	15
20	19	18	17	16
21	22	23	24	25

Task-10

A number is Sparse if there are no two adjacent 1's in its binary representation. For example 5 (binary representation: 101) is sparse, but 6 (binary representation: 110) is not sparse.
Given a number x, find the smallest Sparse number which is greater than or equal to x.
Examples:

Input: x = 6
Output: Next Sparse Number is 8

Input: x = 4
Output: Next Sparse Number is 4

Input: x = 38
Output: Next Sparse Number is 40

Input: x = 44
Output: Next Sparse Number is 64

Task-11

A right triangle can have sides that are all integers. A set of three integer values for the sides of a right triangle is called a Pythagorean triple. These three sides must satisfy the relationship that the sum of the squares of two of the sides is equal to the square of the hypotenuse. Find and display all primitive Pythagorean triples for side1, side2 and hypotenuse all no larger than 500.

Example:

There are 16 primitive Pythagorean triples with $c \le 100$:

(3 , 4 , 5)	(5, 12, 13)	(7, 24, 25)	(8, 15, 17)
(9, 40, 41)	(11, 60, 61)	(12, 35, 37)	(13, 84, 85)
(16, 63, 65)	(20, 21, 29)	(28, 45, 53)	(33, 56, 65)
(36, 77, 85)	(39, 80, 89)	(48, 55, 73)	(65, 72, 97)

A Pythagorean triplet is a set of three natural numbers, $a < b < c$, for which,
$$a^2 + b^2 = c^2$$

For example, $3^2 + 4^2 = 9 + 16 = 25 = 5^2$.

A primitive Pythagorean triple is a Pythagorean triple (a, b, c) such that GCD (a, b, c) = 1

Task-12
Given a number 'N', find the smallest number 'P' such that if we multiply all digits of 'P', we get 'N'. The result 'P' should have at least two digits.
Examples:

      Input: n = 36
      Output: p = 49
      // Note that 4*9 = 36 and 49 is the smallest such number

      Input: n = 100
      Output: p = 455
      // Note that 4*5*5 = 100 and 455 is the smallest such number

      Input: n = 1
      Output:p = 11
      // Note that 1*1 = 1

      Input: n = 13
      Output: Not Possible

Task-14
Given an integer, find the most occurring digit in it. If two or more digits occur same number of times, then return the highest of them. Input integer is given as an int variable.
Example:

      Input: x = 12234
      Output: The most frequent digit is 2

      Input: x = 1223377
      Output: The most frequent digit is 7

      Input: x = 5
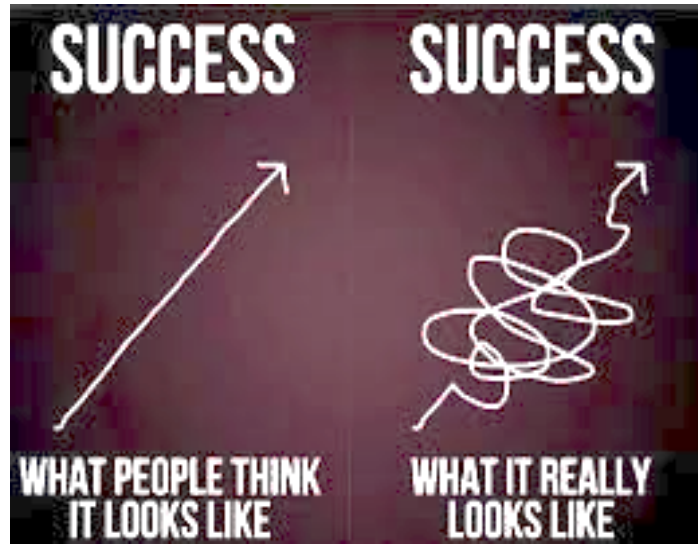   Output: The most frequent digit is 5

      Input: x = 1000
      Output: The most frequent digit is 0

Even the Ghalib was interested in loops ☺

ہزاروں خواہشیں ایسی کہ ہر خواہش پہ دم نکلے

بہت نکلے مرے ارمان لیکن پھر بھی کم نکلے

It's not that I am so smart; it's just that
I stay with problems longer.
--Albert Einstein