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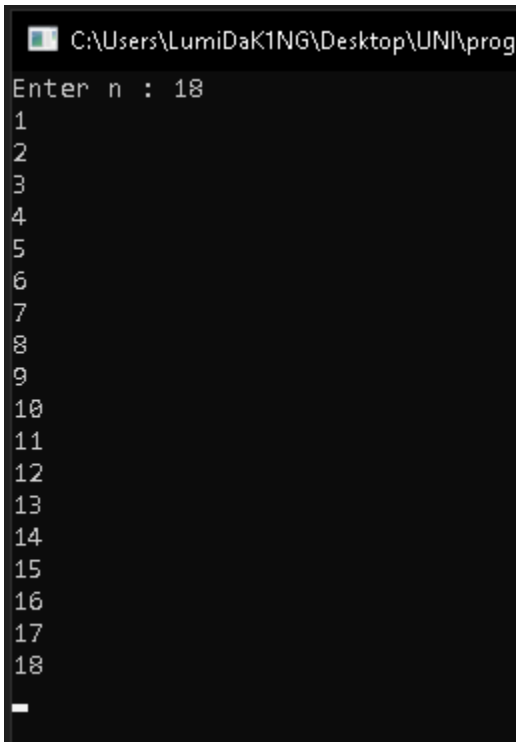
Chapter 6. Loops

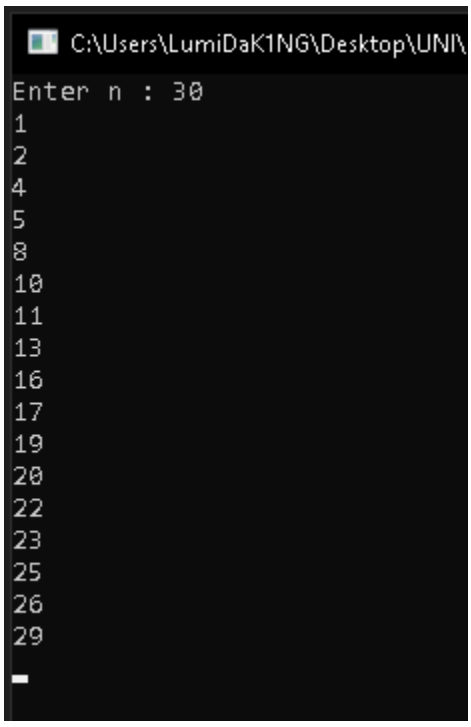
1. Write a program that prints on the **console the numbers from 1 to N**. The number **N** should be read from the standard input.

```
using System;

namespace ex1
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter n : ");
         int n = Convert.ToInt32(Console.ReadLine());
         for(int i = 1; i <= n; i++)
         {
            Console.WriteLine(i);
         }
         Console.ReadKey();
      }
   }
}
```



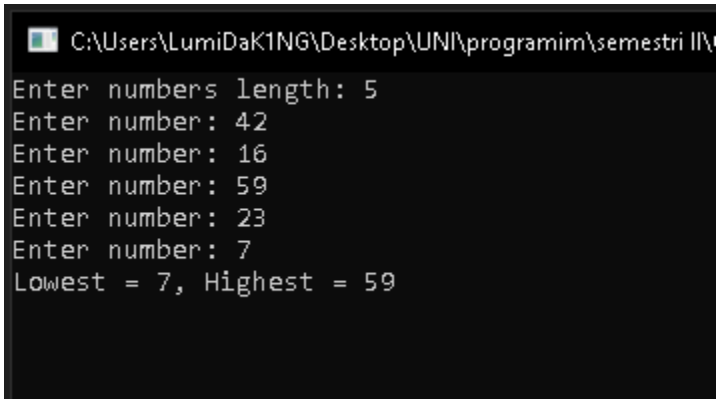
2. Write a program that prints on the console the numbers from 1 to N, which are **not divisible by 3 and 7 simultaneously**. The number N should be read from the standard input.

```
using System;

namespace ex2
{
   class Program
   {
      static void Main(string[] args)
      {

         Console.Write("Enter n : ");
         int n = Convert.ToInt32(Console.ReadLine());
         for (int i = 1; i <= n; i++)
         {
            if ((i % 3 != 0) & (i % 7 != 0))
            {
               Console.WriteLine(i);
            }
         }
         Console.ReadKey();
      }
   }
}
```



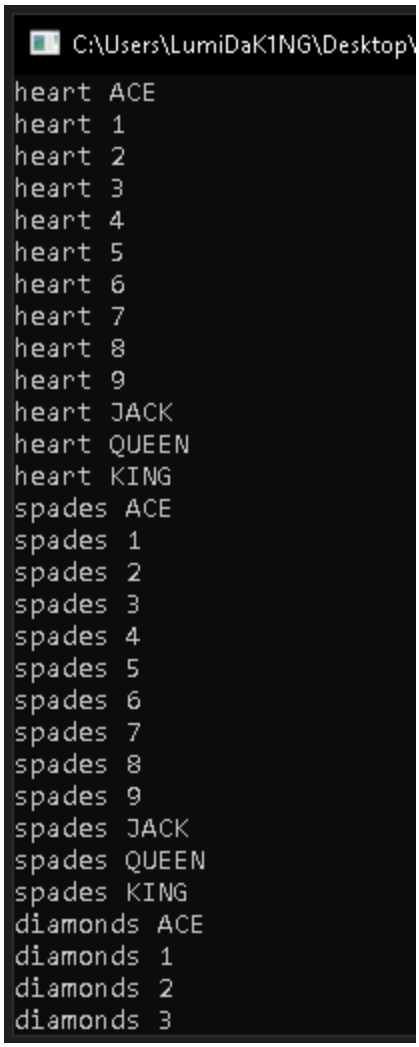
3. Write a program that reads from the console a series of integers and prints the **smallest** and **largest** of them.

```
using System;

namespace ex3
{
   class Program
   {
      static void Main(string[] args)
      {
         int lowest = 0, highest = 0, input;

         Console.Write("Enter numbers length: ");
         int lenght = Int32.Parse(Console.ReadLine());

         for (int i = 0; i < lenght; i++)
         {
            Console.Write("Enter number: ");
            input = Int32.Parse(Console.ReadLine());
            if (i == 0) lowest = highest = input;
            else
            {
               if (lowest > input) lowest = input;
               if (highest < input) highest = input;
            }
         }
         Console.WriteLine("Lowest = {0}, Highest = {1}", lowest, highest);
         Console.ReadKey();
      }
   }
}
```



4. Write a program that prints **all possible cards from a standard deck** of cards, without jokers (there are 52 cards: 4 suits of 13 cards).

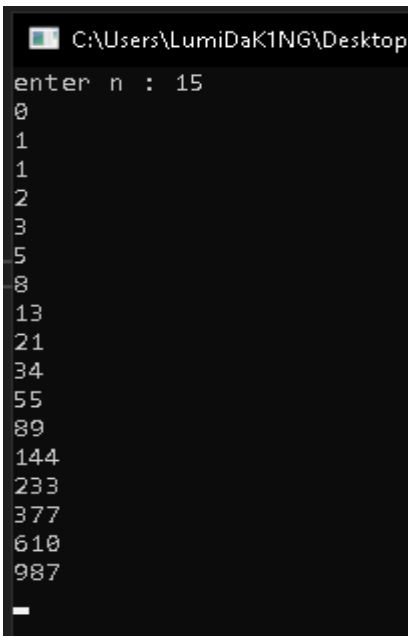
```
using System;

namespace ex4
{
   class Program
   {
      static void Main(string[] args)
      {
         for (int suits = 0; suits < 4; suits++)
         {
            for (int cards = 0; cards < 13; cards++)
            {
               switch (suits)
               {
                  case 0: Console.Write("heart "); break;
                  case 1: Console.Write("spades "); break;
                  case 2: Console.Write("diamonds "); break;
                  case 3: Console.Write("clubs "); break;
               }
               switch (cards)
               {
                  case 0: Console.WriteLine("ACE"); break;
                  case 1: Console.WriteLine("1"); break;
                  case 2: Console.WriteLine("2"); break;
                  case 3: Console.WriteLine("3"); break;
                  case 4: Console.WriteLine("4"); break;
                  case 5: Console.WriteLine("5"); break;
                  case 6: Console.WriteLine("6"); break;
                  case 7: Console.WriteLine("7"); break;
                  case 8: Console.WriteLine("8"); break;
                  case 9: Console.WriteLine("9"); break;
                  case 10: Console.WriteLine("JACK"); break;
                  case 11: Console.WriteLine("QUEEN"); break;
                  case 12: Console.WriteLine("KING"); break;
               }
            }
         }
         Console.ReadKey();
      }
   }
}
```


C:\Users\LumiDaK1NG\Desktop\
heart ACE
heart 1
heart 2
heart 3
heart 4
heart 5
heart 6
heart 7
heart 8
heart 9
heart JACK
heart QUEEN
heart KING
spades ACE
spades 1
spades 2
spades 3
spades 4
spades 5
spades 6
spades 7
spades 8
spades 9
spades JACK
spades QUEEN
spades KING
diamonds ACE
diamonds 1
diamonds 2
diamonds 3


C:\Users\LumiDaK1NG\Deskto
diamonds 1
diamonds 2
diamonds 3
diamonds 4
diamonds 5
diamonds 6
diamonds 7
diamonds 8
diamonds 9
diamonds JACK
diamonds QUEEN
diamonds KING
clubs ACE
clubs 1
clubs 2
clubs 3
clubs 4
clubs 5
clubs 6
clubs 7
clubs 8
clubs 9
clubs JACK
clubs QUEEN
clubs KING

5. Write a program that reads from the console number N and print the sum of the first N members of the **Fibonacci sequence**: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, …

```
using System;

namespace ex5
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("enter n : ");
         int n = Convert.ToInt32(Console.ReadLine());

         int n1 = 0;
         int n2 = 1;
         int n3 = 0;
         Console.WriteLine(n1);
         Console.WriteLine(n2);
         for (int i = 0; i < n; i++)
         {
            n3 = n2 + n1;
            n1 = n2;
            n2 = n3;
            Console.WriteLine(n3);
         }
         Console.ReadKey();
      }
   }
}
```



6. Write a program that calculates **N!/K!** for given N and K (1<K<N).

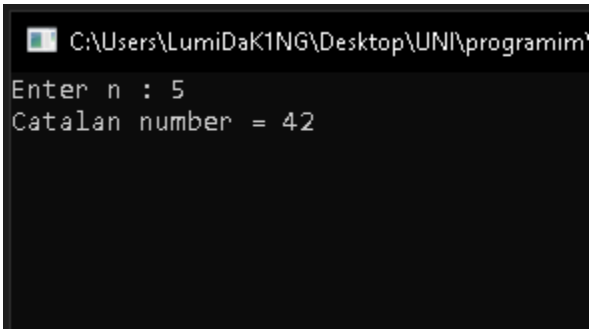
```
using System;

namespace ex6
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter n : ");
         int n = Convert.ToInt32(Console.ReadLine());
         Console.Write("Enter k(1 < k < n) : ");
         int k = Convert.ToInt32(Console.ReadLine());

         for(int i = n - 1; i > 0; i--)
         {
            n *= i;
         }
         for (int i = k - 1; i > 0; i--)
         {
            k *= i;
         }
         double dev = n /k;
         Console.WriteLine("n!/k! = {0}", dev);
         Console.ReadKey();
      }
   }
}
```

7. Write a program that calculates **N!*K!/(N-K)!** for given N and K (1<K<N).

```
using System;

namespace ex7
{
  class Program
  {
    static void Main(string[] args)
    {
      Console.Write("Enter n : ");
      int n = Convert.ToInt32(Console.ReadLine());
      Console.Write("Enter k(1 < k < n) : ");
      int k = Convert.ToInt32(Console.ReadLine());

      int sub = n - k;
      for (int i = n - 1; i > 0; i--)
      {
        n *= i;
      }
      for (int i = k - 1; i > 0; i--)
      {
        k *= i;
      }
      for(int i = sub - 1; i > 0; i--)
      {
        sub *= i;
      }

      double A = (n*k)/sub;
      Console.WriteLine("n!*k!/(n-k)! = {0}", A);
      Console.ReadKey();
    }
  }
}
```

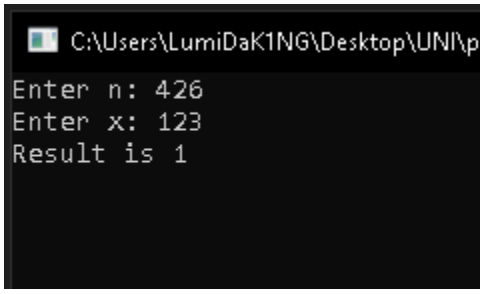
8. In combinatorics, the **Catalan numbers** are calculated by the following formula: $C_n = \frac{1}{n+1}\binom{2n}{n} = \frac{(2n)!}{(n+1)!n!}$, for n ≥ 0. Write a program that calculates the n^{th} Catalan number by given n.

```
using System;

namespace ex8
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter n : ");
         int n = Convert.ToInt32(Console.ReadLine());

         int TWOn = 2 * n;
         int nPlus1 = n + 1;
         for (int i = n - 1; i > 0; i--)
         {
            n *= i;
         }
         for (int i = TWOn - 1; i > 0; i--)
         {
            TWOn *= i;
         }
         for (int i = nPlus1 - 1; i > 0; i--)
         {
            nPlus1 *= i;
         }

         double A = TWOn / (nPlus1 * n);
         Console.WriteLine("Catalan number = {0}", A);
         Console.ReadKey();
      }
   }
}
```



9. Write a program that for a given integers **n** and **x**, **calculates the sum**: $S = 1 + 1!/x + 2!/x^2 + \ldots + n!/x^n$

```
using System;

namespace ex9
{
   class Program
   {
      static void Main(string[] args)
      {
         int sum = 1, temp = 1;
         Console.Write("Enter n: ");
         int n = Int32.Parse(Console.ReadLine());
         Console.Write("Enter x: ");
         int x = Int32.Parse(Console.ReadLine());

         for (int i = 1; i <= n; i++)
         {
            temp *= i / x;
            sum += temp;
         }

         Console.WriteLine("Result is {0}", sum);
         Console.ReadKey();
      }
   }
}
```



10. Write a program that reads from the console a **positive integer number N** (N < 20) and prints a **matrix** of numbers as on the figures below:

N = 3

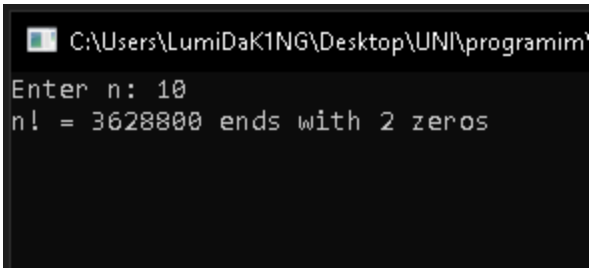
1	2	3
2	3	4
3	4	5

N = 4

1	2	3	4
2	3	4	5
3	4	5	6
4	5	6	7

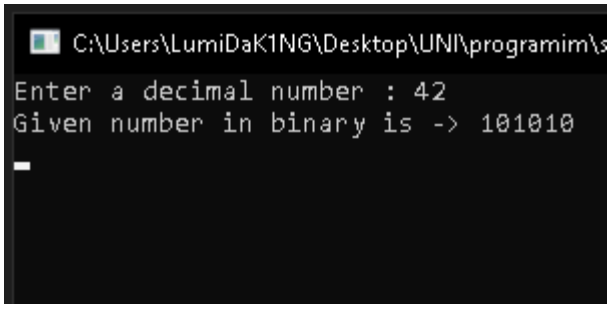
11. Write a program that calculates with **how many zeroes the factorial of a given number ends**. Examples:
    N = 10 -> N! = 3628**800** -> 2
    N = 20 -> N! = 2432902008176640**000** -> 4

```
using System;

namespace ex11
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter n: ");
         int n = Convert.ToInt32(Console.ReadLine());
         int zero = 0;
         for (int i = n - 1; i > 0; i--)
         {
            n *= i;
         }
         Console.Write("n! = {0}", n);
         do
         {
            n /= 10;
            zero++;
         } while (n % 10 == 0);
         Console.WriteLine(" ends with {1} zeros",n,zero)
;         Console.ReadKey();
      }
   }
}
```



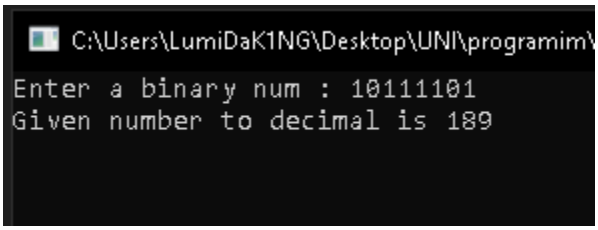
12. Write a program that converts a given number **from decimal to binary notation** (numeral system).

```
using System;

namespace ex12
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter a decimal number : ");
         int num = Convert.ToInt32(Console.ReadLine());
         string numDec = Convert.ToString(num, 2);
         Console.WriteLine("Given number in binary is -> {0}", numDec);
         Console.ReadKey();
      }
   }
}
```



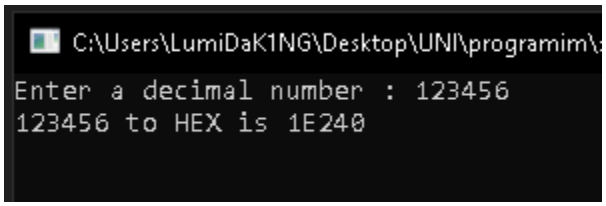
13. Write a program that converts a given number **from binary to decimal notation**.

```
using System;

namespace ex13
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter a binary num : ");
         string bin = Convert.ToString(Console.ReadLine());

         Console.WriteLine("Given number to decimal is {0}", Convert.ToInt32(bin, 2));
         Console.ReadKey();
      }
   }
}
```



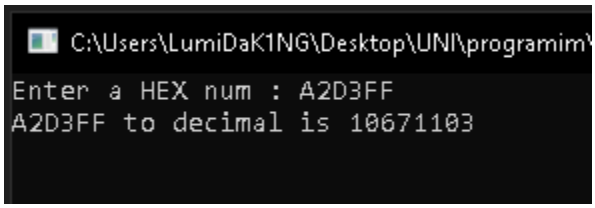
14. Write a program that converts a given number **from decimal to hexadecimal notation**.

```
using System;

namespace ex14
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter a decimal number : ");
         int dec = Convert.ToInt32(Console.ReadLine());

         Console.WriteLine("{0} to HEX is {1}", dec, dec.ToString("X"));
         Console.ReadKey();
      }
   }
}
```



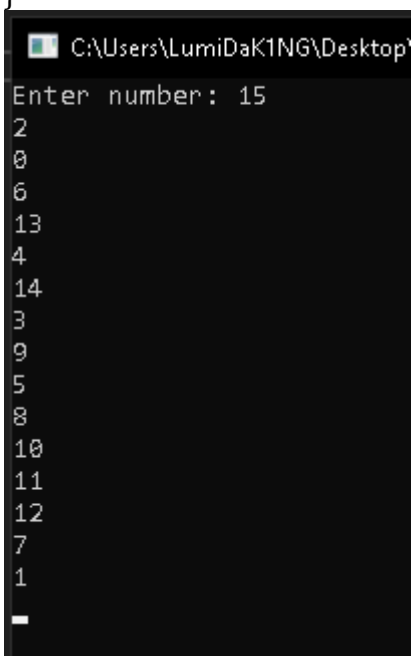
15. Write a program that converts a given number **from hexadecimal to decimal notation**.

```
using System;

namespace ex15
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter a HEX num : ");
         string hex = Convert.ToString(Console.ReadLine());

         Console.WriteLine("{0} to decimal is {1}", hex, Convert.ToInt32(hex, 16));
         Console.ReadKey();
      }
   }
}
```



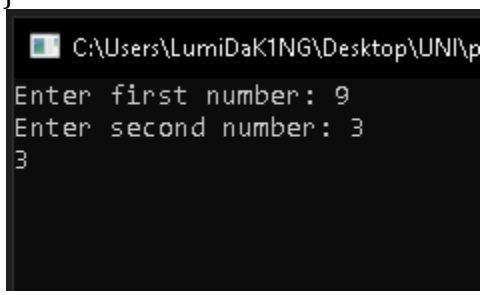
16. Write a program that by a given integer **N** prints the numbers from 1 to N in **random order**.

```
using System;

namespace ex16
{
   class Program
   {
      static void Main(string[] args)
      {
         Random rnd = new Random();
         int temp, randomNumber;
         Console.Write("Enter number: ");
         int n = Int32.Parse(Console.ReadLine());
         int[] arr = new int[n];
         for (int i = 0; i < arr.Length; i++)
         {
            arr[i] = i;
         }
         foreach (int i in arr)
         {
            randomNumber = rnd.Next(0, n);
            temp = arr[i];
            arr[i] = arr[randomNumber];
            arr[randomNumber] = temp;
         }
         foreach (int i in arr) Console.WriteLine(arr[i]);
         Console.ReadKey();
      }
   }
}
```



17. Write a program that given two numbers finds their **greatest common divisor (GCD)** and their **least common multiple (LCM)**. You may use the formula **LCM(a, b) = |a*b| / GCD(a, b)**.

```
using System;

namespace ex17
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter first number: ");
         int a = Convert.ToInt32(Console.ReadLine());
         Console.Write("Enter second number: ");
         int b = Convert.ToInt32(Console.ReadLine());

         while (a != 0 && b != 0)
         {
            if (a > b) a %= b;
            else b %= a;
         }

         if (a == 0) Console.WriteLine(b);
         else Console.WriteLine(a);
         Console.ReadKey();
      }
   }
}
```



18. * Write a program that for a given number n, outputs a matrix in the form of a **spiral**:

1	2	3	4
12	13	14	5
11	16	15	6
10	9	8	7

Example for n=4:

```
using System;

namespace ex18
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter N: ");
         int n = Int32.Parse(Console.ReadLine());
         int[,] matrix = new int[n, n];
         int row = 0, col = 0, direction = 0;

         for (int i = 1; i <= n * n; i++)
         {
            switch (direction)
            {
               case 0:
                  if (col > n - 1 || matrix[row, col] != 0)
                  {
                     direction = 1;
                     col--;
                     row++;
                  }
                  break;
               case 1:
                  if (row > n - 1 || matrix[row, col] != 0)
                  {
                     direction = 2;
                     row--;
                     col--;
                  }
                  break;
               case 2:
                  if (col < 0 || matrix[row, col] != 0)
                  {
                     direction = 3;
                     col++;
                     row--;
```

```
                }
                break;
            case 3:
                if (row < 0 || matrix[row, col] != 0)
                {
                    direction = 0;
                    row++;
                    col++;
                }
                break;
        }

        matrix[row, col] = i;

        switch (direction)
        {
            case 0: col++; break;
            case 1: row++; break;
            case 2: col--; break;
            case 3: row--; break;
        }
      }
      for (int i = 0; i < n; i++)
      {
        for (int j = 0; j < n; j++)
        {
          if (matrix[i, j] < 10) Console.Write("{0}  ", matrix[i, j]);
          else Console.Write("{0} ", matrix[i, j]);
        }
        Console.WriteLine();
        Console.ReadKey();
      }
    }
  }
}
```