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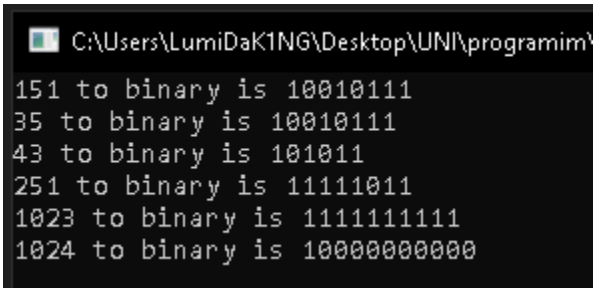
Chapter 8. Numeral Systems

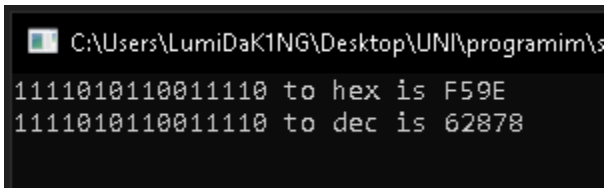
1. Convert the numbers 151, 35, 43, 251, 1023 and 1024 to the binary numeral system.

```
using System;

namespace ex1
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.WriteLine("151 to binary is {0}", Convert.ToString(151, 2));
         Console.WriteLine("35 to binary is {0}", Convert.ToString(151, 2));
         Console.WriteLine("43 to binary is {0}", Convert.ToString(43, 2));
         Console.WriteLine("251 to binary is {0}", Convert.ToString(251, 2));
         Console.WriteLine("1023 to binary is {0}", Convert.ToString(1023, 2));
         Console.WriteLine("1024 to binary is {0}", Convert.ToString(1024, 2));
         Console.ReadKey();
      }
   }
}
```



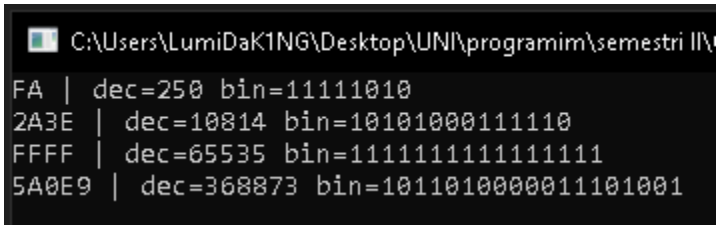
2. Convert the number 1111010110011110(2) to hexadecimal and decimal numeral systems.

```
using System;

namespace ex2
{
   class Program
   {
      static void Main(string[] args)
      {
         string hex = Convert.ToInt64("1111010110011110", 2).ToString("X");
         long dec = Convert.ToInt64("1111010110011110", 2);
         Console.WriteLine("1111010110011110 to hex is {0}", hex);
         Console.WriteLine("1111010110011110 to dec is {0}", dec);
         Console.ReadKey();
      }
   }
}
```



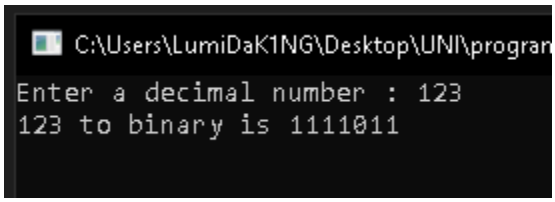
3. Convert the hexadecimal numbers FA, 2A3E, FFFF, 5A0E9 to binary and decimal numeral systems.

```
using System;

namespace ex3
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.WriteLine("FA | dec={0} bin={1}",Convert.ToInt32("FA", 16),
Convert.ToString(Convert.ToInt32("FA", 16),2));
         Console.WriteLine("2A3E | dec={0} bin={1}", Convert.ToInt32("2A3E", 16),
Convert.ToString(Convert.ToInt32("2A3E", 16), 2));
         Console.WriteLine("FFFF | dec={0} bin={1}", Convert.ToInt32("FFFF", 16),
Convert.ToString(Convert.ToInt32("FFFF", 16), 2));
         Console.WriteLine("5A0E9 | dec={0} bin={1}", Convert.ToInt32("5A0E9", 16),
Convert.ToString(Convert.ToInt32("5A0E9", 16), 2));
         Console.ReadKey();
      }
   }
}
```



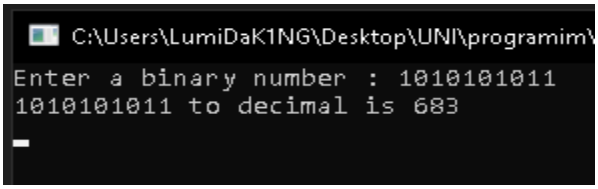
4. Write a program that converts a decimal number to binary one.

```
using System;

namespace ex4
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter a decimal number : ");
         int num = Convert.ToInt32(Console.ReadLine());

         string bin = Convert.ToString(num, 2);
         Console.WriteLine("{0} to binary is {1}", num, bin);
         Console.ReadKey();
      }
   }
}
```



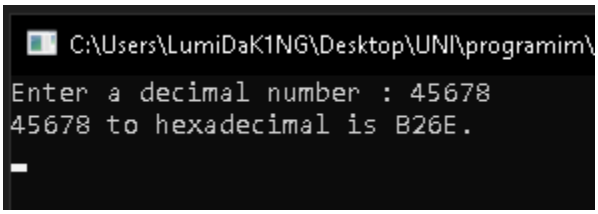
5. Write a program that converts a binary number to decimal one.

```
using System;

namespace ex5
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter a binary number : ");
         string num = Console.ReadLine();

         long dec = Convert.ToInt64(num, 2);
         Console.WriteLine("{0} to decimal is {1}", num, dec);
         Console.ReadKey();
      }
   }
}
```



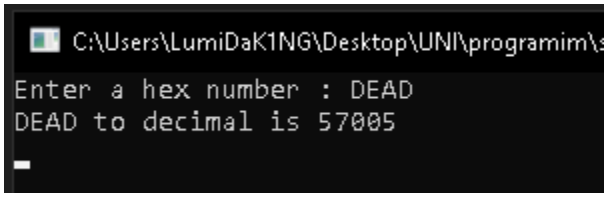
6. Write a program that converts a decimal number to hexadecimal one.

```
using System;

namespace ex6
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter a decimal number : ");
         int dec = Convert.ToInt32(Console.ReadLine());
         Console.WriteLine("{0} to hexadecimal is {1}.", dec, dec.ToString("X"));
         Console.ReadKey();
      }
   }
}
```



7. Write a program that converts a hexadecimal number to decimal one.

```
using System;

namespace ex7
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter a hex number : ");
         string hex = Convert.ToString(Console.ReadLine());

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



8. Write a program that converts a hexadecimal number to binary one.

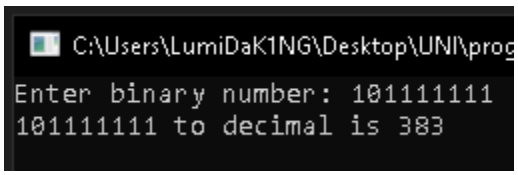
```
using System;

namespace ex8
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter a hex number : ");
         string hex = Convert.ToString(Console.ReadLine());

         Console.WriteLine("{0} to binary is {1}", hex, Convert.ToString(Convert.ToInt32(hex,16),2));
         Console.ReadKey();
      }
   }
}
```

9. Write a program that converts a binary number to hexadecimal one.

```
using System;

namespace ex9
{
   class Program
   {
      static void Main(string[] args)
      {
         Console.Write("Enter a binary number : ");
         string bin = Convert.ToString(Console.ReadLine());

         Console.WriteLine("{0} to hex is {1}", bin, Convert.ToInt32(bin,2).ToString("X"));
         Console.ReadKey();
      }
   }
}
```

10. Write a program that converts a binary number to decimal using the Horner scheme.

```
using System;

namespace ex10
{
   class Program
   {
      static void Main(string[] args)
      {
         int dec = 0;

         Console.Write("Enter binary number: ");
         string bin = Console.ReadLine();
         int length = bin.Length;
         int power = length - 1;

         for (int i = 0; i < length; i++)
         {
            dec += (int)(int.Parse(bin[i].ToString()) * Math.Pow(2, power));
            power--;
         }

         Console.WriteLine("{0} to decimal is {1}", bin, dec);
         Console.ReadKey();
      }
   }
}
```

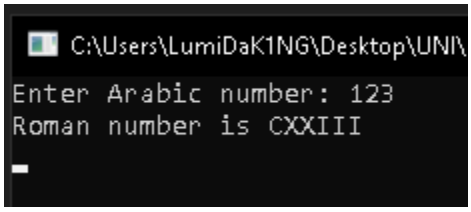


11. Write a program that converts Roman digits to Arabic ones.

12. Write a program that converts Arabic digits to Roman ones.

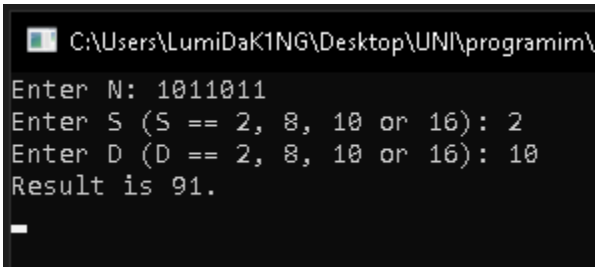
```
using System;

namespace ex12
{
   class Program
   {
      static void Main(string[] args)
      {
         String result = "";
         Console.Write("Enter Arabic number: ");
         int i = Convert.ToInt32(Console.ReadLine());
         int thousands = i / 1000, hundreds = (i / 100) % 10, tens = (i / 10) % 10, ones = i % 10;

         switch (thousands)
         {
            case 1: result += "M"; break;
            case 2: result += "MM"; break;
            case 3: result += "MMM"; break;
         }

         switch (hundreds)
         {
            case 1: result += "C"; break;
            case 2: result += "CC"; break;
            case 3: result += "CCC"; break;
            case 4: result += "CD"; break;
            case 5: result += "D"; break;
            case 6: result += "DC"; break;
            case 7: result += "DCC"; break;
            case 8: result += "DCCC"; break;
            case 9: result += "CM"; break;
         }

         switch (tens)
         {
            case 1: result += "X"; break;
            case 2: result += "XX"; break;
            case 3: result += "XXX"; break;
            case 4: result += "XL"; break;
            case 5: result += "L"; break;
            case 6: result += "LX"; break;
            case 7: result += "LXX"; break;
```

```
            case 8: result += "LXXX"; break;
            case 9: result += "XC"; break;
        }

        switch (ones)
        {
            case 1: result += "I"; break;
            case 2: result += "II"; break;
            case 3: result += "III"; break;
            case 4: result += "IV"; break;
            case 5: result += "V"; break;
            case 6: result += "VI"; break;
            case 7: result += "VII"; break;
            case 8: result += "VIII"; break;
            case 9: result += "IX"; break;
        }

        Console.WriteLine("Roman number is " + result);
        Console.ReadKey();
    }
  }
}
```



13. Write a program that by given N, S, D (2 ≤ S, D ≤ 16) converts the number N from an S-based numeral system to a D based numeral system.

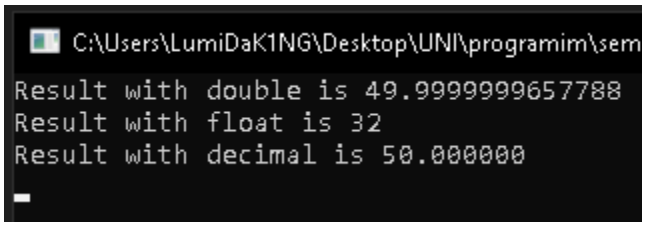
```
using System;

namespace ex13
{
   class Program
   {
      static void Main(string[] args)
      {
         int s, d;

         Console.Write("Enter N: ");
         string n = Console.ReadLine();

         do
         {
            Console.Write("Enter S (S == 2, 8, 10 or 16): ");
            s = Int32.Parse(Console.ReadLine());
         } while (s != 2 && s != 8 && s != 10 && s != 16);

         do
         {
            Console.Write("Enter D (D == 2, 8, 10 or 16): ");
            d = Int32.Parse(Console.ReadLine());
         } while (d != 2 && d != 8 && d != 10 && d != 16);

         n = Convert.ToString(Convert.ToInt32(n, s), d);

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



14. Try adding up 50,000,000 times the number 0.000001. Use a loop and addition (not direct multiplication). Try it with float and double and after that with decimal. Do you notice the huge difference in the results and speed of calculation? Explain what happens.

```
using System;

namespace ex14
{
   class Program
   {
      static void Main(string[] args)
      {
         double a = 0;
         float b = 0;
         decimal c = 0;
         for(int i = 0; i < 50000000; i++)
         {
            a += 0.000001;
            b += 0.000001f;
            c += 0.000001m;
         }
         Console.WriteLine("Result with double is {0}", a);
         Console.WriteLine("Result with float is {0}", b);
         Console.WriteLine("Result with decimal is {0}", c);
         Console.ReadKey();
      }
   }
}
```

Double variable was the quickest in calculating but the decimal one took more longer to execute the calculate.



15. * Write a program that prints the value of the mantissa, the sign of the mantissa and exponent in float numbers (32-bit numbers with a floating-point according to the IEEE 754 standard). Example: for the number -27.25 should be printed: sign = 1, exponent = 10000011, mantissa = 10110100000000000000000.