# Exercises: Data Types and Variables

Problems for exercises and homework for the [“Programming Fundamentals” course @ SoftUni](https://softuni.bg/courses/programming-fundamentals).

You can check your solutions here: <https://judge.softuni.bg/Contests/206/Data-Types-and-Variables-Exercises>.

## Practice Integer Numbers

Create a program that **assigns integer values** to **variables**. Be sure that each **value** is stored in the **correct variable type** (try to find the most suitable variable type in order to save memory). Finally, you need to **print** all variables to the console.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| -100  128  -3540  64876  2147483648  -1141583228  -1223372036854775808 | -100  128  -3540  64876  2147483648  -1141583228  -1223372036854775808 |

### Hints

Follow the idea in the code below:



**Решението:**

sbyte num1 = -100;

byte num2 = 128;

short num3 = -3540;

ushort num4 = 64876;

uint num5 = 2147483648;

int num6 = -1141583228;

long num7 = -1223372036854775808;

Console.WriteLine(num1);

Console.WriteLine(num2);

Console.WriteLine(num3);

Console.WriteLine(num4);

Console.WriteLine(num5);

Console.WriteLine(num6);

Console.WriteLine(num7);

## Practice Floating Point Numbers

Create a program that **assigns floating point values** to **variables**. Be sure that each **value** is stored in the **correct variable type** (try to find the most suitable variable type in order to save memory). Finally, you need to **print** all variables to the console.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 3.141592653589793238  1.60217657  7.8184261974584555216535342341 | 3.141592653589793238  1.60217657  7.8184261974584555216535342341 |

### Hints

Just like at the previous problem, declare several variables of appropriate **floating-point data type**, assign the above listed values and **print** them.

**Решението:**

decimal num1 = 3.141592653589793238M;

double num2 = 1.60217657;

decimal num3 = 7.8184261974584555216535342341M;

Console.WriteLine(num1);

Console.WriteLine(num2);

Console.WriteLine(num3);

## Practice Characters and Strings

Create a program that **assigns character** and **string values** to **variables**. Be sure that each **value** is stored in the **correct variable**. Finally, you need to **print** all variables to the console.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| Software University  B  y  e  I love programming | Software University  B  y  e  I love programming |

### Hints

Like at the previous problem, declare variables of type char or sting, assign the above values and **print** them.

**Решението:**

string input1 = "Software University";

char input2 = 'B';

char input3 = 'y';

char input4 = 'e';

string input5 = "I love programming";

Console.WriteLine(input1);

Console.WriteLine(input2);

Console.WriteLine(input3);

Console.WriteLine(input4);

Console.WriteLine(input5);

## Variable in Hexadecimal Format

Write a program that reads a number in **hexadecimal format** (0x##) convert it to **decimal format** and prints it.

### Examples

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |  | **Input** | **Output** |
| 0xFE | 254 | 0x37 | 55 | 0x10 | 16 |

### Hints

* Use [**Convert.ToInt32(string, 16)**](https://msdn.microsoft.com/en-us/library/1k20k614(v=vs.110).aspx).

**Решението:**

string hexValue = Console.ReadLine();

int decValue = Convert.ToInt32(hexValue, 16);

Console.WriteLine(decValue);

## Boolean Variable

Write a program that reads a **string**, converts it to **Boolean** variable and **prints** “**Yes**”if the variable is true and “**No**” if the variable is false.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| True | Yes |
| False | No |

### Hints

* Use [**Convert.ToBoolean(string)**](https://msdn.microsoft.com/en-us/library/86hw82a3(v=vs.110).aspx).

**Решението:**

bool isTrue = Convert.ToBoolean(Console.ReadLine().ToLower());

if (isTrue)

{

Console.WriteLine("Yes");

}

else

{

Console.WriteLine("No");

}

## Strings and Objects

Declare two **string variables** and assign them with “Hello” and “World”. Declare an **object variable** and assign it with the **concatenation** of the first two variables (mind adding an interval between). Declare a third **string** variable and initialize it with the value of the object variable (you should perform type **casting**).

**Решението:**

string word1 = "Hello";

string word2 = "World";

object wordAll = word1 + " " + word2;

string word3 = (string) wordAll;

Console.WriteLine(word3);

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| Hello  World | Hello World |

## Exchange Variable Values

Declare two integer variables a and b and assign them with 5 and 10 and after that **exchange their values** by using some programming logic. Print the variable values before and after the exchange, as shown below:

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 5  10 | Before:  a = 5  b = 10  After:  a = 10  b = 5 |

### Hints

You may use a **temporary variable** to remember the old value of a, then assign the value of b to a, then assign the value of the temporary variable to b.

**Решението:**

int a = 5;

int b = 10;

int aNew = b;

int bNew = a;

Console.WriteLine($"Before:\na = 5\nb = 10\nAfter:\na = {aNew}\nb = {bNew}");

## Employee Data

A marketing company wants to keep record of its employees. Each record would have the following characteristics:

* First name
* Last name
* Age (0...100)
* Gender (m or f)
* Personal ID number (e.g. 8306112507)
* Unique employee number (27560000…27569999)

Declare the **variables** needed to keep the information for a single employee using appropriate primitive data types. Use descriptive names. **Print** the data at the console.

**Решението:**

string firstName = Console.ReadLine();

string lastName = Console.ReadLine();

int age = int.Parse(Console.ReadLine());

char gender = char.Parse(Console.ReadLine());

long personalID = long.Parse(Console.ReadLine());

int uniqueNumber = int.Parse(Console.ReadLine());

Console.WriteLine($"First name: {firstName}");

Console.WriteLine($"Last name: {lastName}");

Console.WriteLine($"Age: {age}");

Console.WriteLine($"Gender: {gender}");

Console.WriteLine($"Personal ID: {personalID}");

Console.WriteLine($"Unique Employee number: {uniqueNumber}");

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| Amanda  Jonson  27  f  8306112507  27563571 | First name: Amanda  Last name: Jonson  Age: 27  Gender: f  Personal ID: 8306112507  Unique Employee number: 27563571 |

### Hints



## Reverse Characters

Write a program to ask the user for **3 letters** and print them in **reversed order**.

**Решението:**

char input1 = char.Parse(Console.ReadLine());

char input2 = char.Parse(Console.ReadLine());

char input3 = char.Parse(Console.ReadLine());

Console.WriteLine($"{input3}{input2}{input1}");

### Examples

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |  | **Input** | **Output** |
| A  B  C | CBA |  | x  Y  z | zYx |  | G  g  n | ngG |

## Centuries to Nanoseconds

Write program to enter an integer number of **centuries** and convert it to **years, days, hours, minutes, seconds, milliseconds, microseconds, nanoseconds**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 1 | 1 centuries = 100 years = 36524 days = 876576 hours = 52594560 minutes = 3155673600 seconds = 3155673600000 milliseconds = 3155673600000000 microseconds = 3155673600000000000 nanoseconds |
| 5 | 5 centuries = 500 years = 182621 days = 4382904 hours = 262974240 minutes = 15778454400 seconds = 15778454400000 milliseconds = 15778454400000000 microseconds = 15778454400000000000 nanoseconds |

### Hints

* Use an appropriate data type for every data conversion. Beware of **overflows**!
* Assume that a year has 365.2422 days at average ([the Tropical year](https://en.wikipedia.org/wiki/Tropical_year)).

**Решението:**

int centuries = int.Parse(Console.ReadLine());

int years = centuries \* 100;

int days = (int)(years \* 365.2422);

int hours = days \* 24;

decimal minutes = hours \* 60M;

decimal seconds = minutes \* 60M;

decimal milliseconds = seconds \* 1000M;

decimal microseconds = milliseconds \* 1000M;

decimal nanoseconds = microseconds \* 1000M;

Console.WriteLine($"{centuries} centuries = {years} years = {days} days = {hours} hours = {minutes} minutes = {seconds} seconds = {milliseconds} milliseconds = {microseconds} microseconds = {nanoseconds} nanoseconds");

## Convert Speed Units

Create a program to ask the user for a **distance (in meters)** and the time taken (as three numbers: hours, minutes, seconds), and **print the speed**, in meters per second, kilometers per hour and miles per hour.

Assume 1 mile = 1609 meters.

### Input

* On first line, you receive – **distance in meters**
* On second – **hours**
* On third – **minutes**
* On fourth – **seconds**

### Output

Every number in the output should be precise up to 6 digits after the floating point

* On first line – speed in **meters per second** (m/s)
* On second line – speed in **kilometers per hour** (km/h)
* On third line – speed in **miles per hour** (mp/h)

### Examples

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |  | **Input** | **Output** |
| 1000  1  1  0 | 0.2732241  0.9836066  0.6113155 |  | 10000  0  20  30 | 8.130081  29.26829  18.19036 |  | 200000  2  5  0 | 26.66667  96  59.66439 |

### Hints

* Search in internet how to convert units.
* The type float is big enough for the calculations.

**Решението:**

int distanceInMeters = int.Parse(Console.ReadLine());

byte hoursForDistance = byte.Parse(Console.ReadLine());

byte minutesForDistance = byte.Parse(Console.ReadLine());

byte secondsForDistance = byte.Parse(Console.ReadLine());

int totalTimeInSeconds = hoursForDistance \* 3600 + minutesForDistance \* 60 + secondsForDistance;

float totalTimeInHours = (float)totalTimeInSeconds / 3600;

float distanceInKilometers = (float)distanceInMeters / 1000;

float distanceInMiles = (float)distanceInMeters / 1609;

float metersPerSecound = (float)distanceInMeters / totalTimeInSeconds;

float kilometersPerHour = distanceInKilometers / totalTimeInHours;

float milesPerHour = distanceInMiles / totalTimeInHours;

Console.WriteLine(metersPerSecound);

Console.WriteLine(kilometersPerHour);

Console.WriteLine(milesPerHour);

## Rectangle Properties

Create a program to calculate rectangle’s **perimeter**, **area** and **diagonal** by given its **width** and **height**.

### Examples

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| 10  5 | 30  50  11.1803398874989 |  | 22.1  10.2 | 64.6  225.42  24.3402958075698 |

### Hints

* Use Math.Sqrt() to calculate square root for calculating the diagonal (c2 = a2 + b2). See <http://www.mathopenref.com/rectanglediagonals.html>.

**Решението:**

double width = double.Parse(Console.ReadLine());

double height = double.Parse(Console.ReadLine());

double perimeter = 2 \* (width + height);

double area = width \* height;

double diagonal = Math.Pow(width, 2) + Math.Pow(height, 2);

Console.WriteLine(perimeter);

Console.WriteLine(area);

Console.WriteLine(Math.Sqrt(diagonal));

## Vowel or Digit

Create a program to check if given symbol is **digit**, **vowel** or any **other symbol**.

**Решението:**

char input = char.Parse(Console.ReadLine());

if (input == 'a' || input == 'o' || input == 'u' || input == 'e' || input == 'i')

{

Console.WriteLine("vowel");

}

else if (input >= '0' && input <= '9')

{

Console.WriteLine("digit");

}

else

{

Console.WriteLine("other");

}

### Examples

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |  | **Input** | **Output** |
| a | vowel |  | 9 | digit |  | g | other |

## Integer to Hex and Binary

Create a program to convert a **decimal number** to **hexadecimal** and **binary** number and print it.

### Examples

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |  | **Input** | **Output** |
| 10 | A  1010 |  | 420 | 1A4  110100100 |  | 256 | 100  100000000 |

### Hints

* Use [**Convert.ToString(number, base)**](https://msdn.microsoft.com/en-us/library/14kwkz77(v=vs.110).aspx)and [**string.ToUpper()**](https://msdn.microsoft.com/en-us/library/ewdd6aed(v=vs.110).aspx).

**Решението:**

int input = int.Parse(Console.ReadLine());

string hex = Convert.ToString(input, 16).ToUpper();

string binary = Convert.ToString(input, 2);

Console.WriteLine(hex);

Console.WriteLine(binary);

## Fast Prime Checker - Refactor

You are given a program that checks if numbers in a given range [2...N] are prime. For each number is printed "{number} -> {True or False}". The code however, is not very well written. Your job is to modify it in a way that is **easy to read and understand.**

### Code

|  |
| --- |
| **Sample Code** |
| int \_\_\_Do\_\_\_ = int.Parse(Console.ReadLine());  for (int DAVIDIM = 0; DAVIDIM <= \_\_\_Do\_\_\_; DAVIDIM++)  { bool TowaLIE = true;  for (int delio = 2; delio <= Math.Sqrt(DAVIDIM); delio++)  {  if (DAVIDIM % delio == 0)  {  TowaLIE = false;  break;  }  }  Console.WriteLine($"{DAVIDIM} -> {TowaLIE}");  } |

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 5 | 2 -> True  3 -> True  4 -> False  5 -> True |

### Hints

* Search how to check if a number is prime
* Rename all variables such as to be clear what is their role in the algorithm

**Решението:**

int input = int.Parse(Console.ReadLine());

for (int i = 2; i <= input; i++)

{

bool isPrime = true;

for (int j = 2; j <= Math.Sqrt(i); j++)

{

if (i % j == 0)

{

isPrime = false;

break;

}

}

Console.WriteLine($"{i} -> {isPrime}");

}

## \* Comparing Floats

Write a program that **safely compares floating-point numbers** (double) with precision eps = 0.000001. Note that we cannot directly compare two floating-point numbers a and b by a==b because of the nature of the floating-point arithmetic. Therefore, we assume two numbers are equal if they are more closely to each other than some fixed constant **eps**.

You will receive **two** lines, each containing a **floating-point** number. Your task is to **compare** the **values** of the two **numbers**.

**Решението:**

double number1 = double.Parse(Console.ReadLine());

double number2 = double.Parse(Console.ReadLine());

double epsilon = 0.000001;

if (Math.Abs(number1 - number2) < epsilon)

{

Console.WriteLine("True");

}

else

{

Console.WriteLine("False");

}

### Examples

|  |  |  |  |
| --- | --- | --- | --- |
| **Number a** | **Number b** | **Equal (with precision eps=0.000001)** | **Explanation** |
| 5.3 | 6.01 | False | The difference of 0.71 is too big (> eps) |
| 5.00000001 | 5.00000003 | True | The difference 0.00000002 < eps |
| 5.00000005 | 5.00000001 | True | The difference 0.00000004 < eps |
| -0.0000007 | 0.00000007 | True | The difference 0.00000077 < eps |
| -4.999999 | -4.999998 | False | Border case. The difference 0.000001 == eps. We consider the numbers are different. |
| 4.999999 | 4.999998 | False | Border case. The difference 0.000001 == eps. We consider the numbers are different. |

## Print Part of the ASCII Table

Find online more information about [ASCII](http://www.ascii-code.com/) (American Standard Code for Information Interchange) and write a program that **prints part of the ASCII table** of characters at the console. On the first line of input you will receive **the char index you should start with** and on the **second line - the index of the last character** you should print.

**Решението:**

sbyte start = sbyte.Parse(Console.ReadLine());

sbyte end = sbyte.Parse(Console.ReadLine());

for (int i = start; i <= end; i++)

{

Console.Write((char) i + " ");

}

Console.WriteLine();

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 60  65 | < = > ? @ A |
| 69  79 | E F G H I J K L M N O |
| 97  104 | a b c d e f g h |
| 40  55 | ( ) \* + , - . / 0 1 2 3 4 5 6 7 |

## \* Different Integers Size

Given an input integer, you must **determine which primitive data types** are capable of properly storing that input.

### Input

* You receive **N** – integer which can be arbitrarily large or small

### Output

You must determine if the given primitives are capable of storing it. If yes, then print:

|  |
| --- |
| {N} can fit in:  \* dataType |

If there is more than one appropriate data type, print each one on its own line and order them by size  
(sbyte **<** byte **<** short **<** ushort **<** int **<** uint **<** long).

If the number cannot be stored in one of the four aforementioned primitives, print the line:

|  |
| --- |
| {N} can't fit in any type |

### Examples

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| -150 | -150 can fit in:  \* short  \* int  \* long | 150000 | 150000 can fit in:  \* int  \* uint  \* long |

|  |  |
| --- | --- |
| **Input** | **Output** |
| 1500000000 | 1500000000 can fit in:  \* int  \* uint  \* long |

|  |  |
| --- | --- |
| **Input** | **Output** |
| 213333333333333333333333333333333333 | 213333333333333333333333333333333333 can't fit in any type |

### Hints

* Use the **try … catch** construction.

string N = Console.ReadLine();

bool match = false;

string dataType = null;

try

{

Convert.ToSByte(N);

dataType += "\* sbyte\n";

match = true;

}

catch (Exception)

{

}

try

{

Convert.ToByte(N);

dataType += "\* byte\n";

match = true;

}

catch (Exception)

{

}

try

{

Convert.ToInt16(N);

dataType += "\* short\n";

match = true;

}

catch (Exception)

{

}

try

{

Convert.ToUInt16(N);

dataType += "\* ushort\n";

match = true;

}

catch (Exception)

{

}

try

{

Convert.ToInt32(N);

dataType += "\* int\n";

match = true;

}

catch (Exception)

{

}

try

{

Convert.ToUInt32(N);

dataType += "\* uint\n";

match = true;

}

catch (Exception)

{

}

try

{

Convert.ToInt64(N);

dataType += "\* long\n";

match = true;

}

catch (Exception)

{

}

if (match)

{

Console.WriteLine($"{N} can fit in:");

Console.WriteLine(dataType);

}

else

{

Console.WriteLine($"{N} can't fit in any type");

}

## \* Thea the Photographer

***This problem is from the Programming Fundamentals Retake Exam (11 September 2016).***

Thea is a photographer. She takes pictures of people on special events. She is a good friend and you want to help her.

She wants to inform her clients when their pictures will be ready. Since the number of pictures is big and it requires time for editing (#nofilter, #allnatural) **every** single picture - you decide to write a program in order to help her.

Thea follows this pattern: first she takes **all** pictures. Then she goes through every single picture to **filter** these pictures that are considered "good". Then she needs to upload every single **filtered** picture to her cloud. She is considered ready when all **filtered** pictures are **uploaded** in her picture storage.

You will receive the **number** of pictures she had taken. Then the approximate **time** in **seconds** for every picture to be filtered. Then a **filter factor** – a **percentage** (integer number) of the **total photos** (rounded to the nearest **bigger** **integer** value e.g. 5.01 -> 6) that are good enough to be given to her clients (Photoshop may do miracles but Thea does not). Approximate **time** for every picture to be uploaded will be given again in **seconds**. Your task is: based on this input to display total time needed for her to be ready with the pictures in given below format.

### Input

On the first line, you will receive an integer **N** – the number of pictures Thea had taken.

On the second line, you will receive an integer **FT** – the amount of time (filter time) in seconds that Thea will require to filter every single picture.

On the third line, you will receive an integer **FF** – the filter factor or the percentage of the total pictures that are considered “good” to be uploaded.

On the fourth line, you will receive an integer **UT** – the amount of time needed for every **filtered** picture to be uploaded to her storage.

The input will be in the described format, there is no need to check it explicitly.

### Output

Print the amount of time Thea will need in order to have her pictures ready to be sent to her client in given format:

d:HH:mm:ss

d - days needed – starting from 0.

HH – hours needed – from 00 to 24.

mm – minutes needed – from 00 to 59.

ss – minutes needed – from 00 to 59.

### Constraints

The number of total pictures Thea will have taken is range [0 … 1 000 000]

The seconds for both filtering and uploading will be in range [0 … 100 000]

The filter factor will be an integer number between [0 … 100].

### Examples

|  |  |  |
| --- | --- | --- |
| **Input** | **Output** | **Comments** |
| 1000  1  50  1 | 0:00:25:00 | Total pictures = 1 000, 50% of them are useful -> Filtered pictures = 500  Total pictures \* filter time = 1000 s  Filtered pictures \* upload time = 500 s  Total time = 1500 s |
| 5342  2  82  3 | 0:06:37:07 | Total pictures = 5342 - 82% of them are useful -> 4380.44-> 4381 filtered. |