# 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/392>.

# Numeral Types and Type Conversion

## Practice Integer Numbers

Create a new C# project and 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** |
| *(no input)* | -100  128  -3540  64876  2147483648  -1141583228  -1223372036854775808 |

### Hints

Follow the idea in the code below:



## Practice Floating Point Numbers

Create a new C# project and 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** |
| *(no input)* | 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.

## 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 | 10  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.

## Float or Integer

Write a program that checks whether a number is a **real number** or an **integer number**. If the number is an integer, just print the number. If the number is a **real number**, print **the closest integer** to it.

### Examples

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |  | **Input** | **Output** |  | **Input** | **Output** |
| 3 | 3 |  | 2.2 | 2 | 1.5 | 2 | 1.05 | 1 |

### Hints

* Use the **System.Math** class to round the result.

## Distance of The Stars

In physics, there are some well-known relative distances in Space:

* The distance from **Earth** to its **nearest star** – Proxima Centauri: **~4.22 ly (light years)**
* The distance to **the center of our galaxy** – the Milky Way: **~26 000 ly**
* The **diameter** of the **Milky Way**: **~100 000 ly**
* The distance from Earth to the edge of the observable universe: **~46 500 000 000 ly**

Write a program to calculate the aforementioned distances in **kilometers**.   
Print the result using **scientific notation** with 2 points decimal precision

Assume that **1 light year** == **9 450 000 000 000 km**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| *(no input)* | 3.99e+013  2.46e+017  9.45e+017  4.40e+023 |

### Hints

* Use the **decimal** data type for the calculations

## Increment Variable

Write a program to **increment** a **byte** variable (starting at 0) **n** **times** and print the result. If you detect an overflow (or several), print **how many times** there was an overflow alongside the variable value. Sounds simple, right?

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 50 | 50 |
| 1000 | 232  Overflowed 3 times |
| 256 | 0  Overflowed 1 times |

### Hints

* If the next number becomes 0, an overflow is detected.

## From Terabytes to Bits

Write program to enter a real number of **terabytes** and convert it to **bits**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| 1 | 8796093022208 |
| 1.5 | 13194139533312 |

### Hints

* Use an appropriate data type for the data conversion. Beware of **overflows**!
* 1TB == (1024 \* 1024 \* 1024 \* 1024 \* 8) bits

## Traveling at Light Speed

Create a program that finds for how many **weeks**, **days**, **hours**, **minutes** and **seconds** can an object fly at **light speed**

Assume that 1 light year == 9 450 000 000 000 km.

Assume that the speed of light == 300 000 km / second.

### Input

* On first line you receive – the **light years** to convert

### Output

Every number in the output **should be formatted to** **0 digits** after the floating point

* On first line – time in **weeks**
* On second line – time in **days**
* On third line – time in **hours**
* On fourth line – time in **minutes**
* On fifth line – time in **seconds**

### Examples

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |  | **Input** | **Output** |
| 14 | 729 weeks  1 days  4 hours  0 minutes  0 seconds |  | 5 | 260 weeks  3 days  22 hours  0 minutes  0 seconds |  | 0.00000005 | 0 weeks  0 days  0 hours  0 minutes  2 seconds |

### Hints

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

## \* Triangle Formations

You are given **3 integer numbers: a**, **b and c**, which will represent the **3 sides of a triangle**. Your task is to check whether the triangle is **valid**.  
  
If it is, print "**Triangle is valid.**".  
Otherwise print "**Invalid Triangle.**" and **end the program**.

If it is valid, you have to check if it is a **right triangle** (a2 + b2 == c2).  
If it is a right triangle, print "**Triangle has a right angle between sides a and b**", depending on which side forms a **right angle**. If the sides **b** and **c** form a right angle, print "**Triangle has a right angle between sides b and c**", and so on.

### Examples

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| 3  4  5 | Triangle is valid.  Triangle has a right angle between sides a and b |  | 6  10  8 | Triangle is valid.  Triangle has a right angle between sides a and c |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| 5  5  5 | Triangle is valid.  Triangle has no right angles |  | 3  1  1 | Invalid Triangle. |

### Hints

* A triangle is valid if **every** two sides’ sums are greater than the third side.
* A triangle is a right triangle if **either** of these rules apply:
  + a2 + b2 == c2
  + b2 + c2 == a2
  + c2 + a2 == b2

## \* Data Overflow

You will be given two numbers. Your task is to find the lowest one by value, find the numerical type it fits in from the following (byte, ushort, uint, ulong) and check how many times the **greater** one by value overflows the type of the **smaller** one (rounded to the **nearest whole integer**).

### Examples

|  |  |  |
| --- | --- | --- |
| **Input** | **Output** | **Explanation** |
| 100000  5 | bigger type: uint  smaller type: byte  100000 can overflow byte 392 times | uint.MinValue ≤ 100000 ≤ uint.MaxValue  bigger type 🡺 uint  byte.MinValue ≤ 5 ≤ byte.MaxValue  smaller type 🡺 byte  100000 / byte.MaxValue = 392.1568 🡺 392 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| 1200  2 | bigger type: ushort  smaller type: byte  1200 can overflow byte 5 times | 65535  131070 | bigger type: uint  smaller type: ushort  131070 can overflow ushort 2 times |

### Hints

* Rounding of the end result can be achieved by using the **Math.Round()** method.

# Text and Other Types

## Practice Characters and Strings

Create a new C# project and 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** |
| *(no input)* | Software University  B  y  e  I love programming |

### Hints

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

## 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** |
| 0xFE | 254 |
| 0x37 | 55 |
| 0x10 | 16 |

### Hints

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

## Digits with Words

Create a program that reads a **digit** in the form of a **word** and prints the **digit** as a **number**.

### Examples

|  |  |
| --- | --- |
| **Input** | **Output** |
| nine | 9 |
| two | 2 |
| zero | 0 |

### Hints

* Use the switch case.

## ASCII String

Create a program that reads a number **N**. On the next **N lines**, it reads integers from the **ASCII table**.

The task is to **concatenate** everything in **string** format.

### Examples

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| **2**  104  105 | hi | **7**  83  111  102  116  85  110  105 | SoftUni |

### Hints

* Use a for loop to read every integer on every line.
* Inside the loop, convert the integer values that you read from the console into the char data type.
* Then, add every single char to a string variable and print the result.

## Calculator

Create a program that reads 3 lines:

* An **operand**.
* An **operator**.
* A second **operand**.

And performs the operation between the operands. The left and right operands will **always** be **integers**.

### Examples

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| 2  +  2 | 2 + 2 = 4 | 2  -  4 | 2 - 4 = -2 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| 3333  \*  3 | 3333 \* 3 = 9999 | 800  /  4 | 800 / 4 = 200 |

### Hints

* Use a switch case to determine which operator you need to use.

## Tricky Strings

You are given a **delimiter**. On the next line, you will receive a number **N.** On the next **N lines**, you will receive **strings** on each line. Your task is to **print** the strings, **separated** by the **delimiter**.

Note: the delimiter and strings could be ***anything***: whitespace and empty stringsare **acceptable input**!

### Examples

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| -  5  I  Am  Five  Strings  Long | I-Am-Five-Strings-Long | \_  5  you  cannot  trick  me | you\_cannot\_\_trick\_me |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| '  7  S  o  f  t  U  n  i | S'o'f't'U'n'i | trep  8  ni  ni  ni | treptreptreptreptrepnitrepnitrepni |

### Hints

* Store the results in a string variable before you print it.
* In order to print the last string **without a delimiter**, print it outside the loop where you’ll print the rest of the strings **with delimiters**.

## \*\* Cypher Roulette

You will be given an integer **N**. On the next **N** lines, you will receive some **strings**.

The strings will be either:

* sequences of **random characters**
* or the command - "**spin**"

If they are **normal random characters**, you should **append them** to one another in the **cypher** **string**.

If the command "**spin**" is entered, every string entered after it should be **appended** at **the** **start**

of the **cypher string**, if the command "**spin**" is entered again after that, you should again begin to append

them at **the end** of the cypher string. And so, the **append direction** changes each time you enter the command "**spin**".

If two **equal strings** are entered **two consecutive times**, the cypher **resets** - emptying the **cypher string**. This rule also applies to the "**spin**" command.

Note: the "**spin**" commands **do not count** towards the **N** count.

### Examples

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| 5  Bed  Is  So  Fine  **spin**  This | ThisBedIsSoFine | 6  How  is  is  **spin**  How  **spin**  \_Are  \_You? | How\_Are\_You? |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Input** | **Output** |  | **Input** | **Output** |
| 5  That  **spin**  Spin  **spin**  Six  Shooter  Cowboy | SpinThatSixShooterCowboy | 6  Your  **spin**  Do  **spin**  Homework  Homework  Beer  **spin**  Drink | DrinkBeer |