

Exercises about control structures

Solve them in Visual Studio or use <https://dotnetfiddle.net/>.

Exercise 06.01: Can you divide by 5?

- Loop asking a number, no decimals.
- If it is not a number, ask again.
- So, you have a number.
- Show some text on the console.
- If number is divisible by 5.
 - Show the text “Divisible by 5”.
- If not.
 - Show the text “Not divisible by 5”.



You can use Modulo (%) to check if it is divisible.

- $15 \% 5$ has a result 0, so it is divisible.
- $10 \% 6$ has a result 4, so it is not divisible.

Exercise 06.02: If then else with a question mark

- Same exercise as 06.01.
- Use the ? operator.

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Exercise 06.03: Can x be divided by y ?

- Similar to 06.01, but some extra tasks.
- Loop asking a number, no decimals.
 - If it is not a number, ask again, after showing an error message.
- So, at the end, you have a number.
- Loop asking a second number, no decimals.
 - If it is not a number, ask again, after showing an error message.
- So, at the end, you have a second number.
- Show some text on the console.
- If number is divisible by second number.
 - Show the text “Divisible by x ”. (x is the second number)
- If not.
 - Show the text “Not divisible by x ”. (x is the second number)



You can use Module (%) to check if it is divisible.

- $15 \% 5$ has a result 0, so it is divisible.
- $10 \% 6$ has a result 4, so it is not divisible.

Exercise 06.04: Multiply 5 numbers

- Ask 5 numbers.
- Multiply them all.
- Show on the console if the result is negative or positive.

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Exercise 06.05: Ask for an age and take some action

- Ask for an age.
- Only positive numbers lower than 100 are allowed.
- If not correct.
 - Ask again after showing an error message.
- Depending on the age you show a different message on the console.
 - Younger than 13 → You are a child.
 - Younger than 18 → You can't drive a car yet.
 - Younger than 66 → You are an adult.
 - Other situations → You are an elder.

Exercise 06.06: C# if

- https://www.w3schools.com/cs/exercise.asp?filename=exercise_conditions1
 - Exercise 1.
 - Exercise 2.
 - Exercise 3.
 - Exercise 4.
 - Exercise 5.

Exercise 06.07: C# switch

- https://www.w3schools.com/cs/exercise.asp?filename=exercise_switch1
 - Exercise 1.
 - Exercise 2.

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Exercise 06.08: C# while

- https://www.w3schools.com/cs/exercise.asp?filename=exercise_while_loop1
 - Exercise 1.
 - Exercise 2.
 - Exercise 3.
 - Exercise 4.
 - Exercise 5.

Exercise 06.09: Nested ifs

- Ask for country code.
 - Depending on given code (use switch)
 - "B" or "b", show "Belgium" and "Brussels".
 - "N" or "n", show "Netherlands" and "Amsterdam".
 - "F" or "f", show "France" and "Paris".
 - "G" or "g", show "Germany" and "Berlin".
 - All other cases, show "Unknown" and "Unknown".
- Call a method "NestedIfs". (You have to create this in the next steps)



Think "Karel the robot".

Look how the method "Main()" is set up.

- Create a new method "AskForAnAge".



```
static void AskForAnAge()  
{  
    Here you do your stuff  
}
```

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- Ask for an age in that method.
 - Depending on given age (use if)
 - Lower than 18, show text “You are too young”).
 - Larger than 80, show text “You are too old”).
 - All other cases, show text “Welcome”).

Exercise 06.10: Quit the sequence

- Ask for texts.
 - As long as the text is not “quit”.
 - Continue asking texts.
- The moment you have typed “quit”.
 - Show all the entered texts, every text on a new line in the console.

Exercise 06.11: Doing stuff with 10 numbers

- Ask for 10 numbers.
- Show in the console the biggest number.
- Show in the console the smallest number.
- Show in the console the average.

Example

- When the numbers are 10, 8, 6, 4, 2, 1, 3, 5, 7 and 9.
 - Largest: 10.
 - Smallest: 1.
 - Average: 5,5.



Exercise 06.12: Loop thru 1000 numbers

- Show in the console all numbers that are divisible by 3 and lower than 1000.
 - All on the same line (if possible) with a comma and a space between them.

Example

0, 3, 6, 9, 12, 15, 18, 21, ... 993, 996, 999



Can you do it backwards?

999, 996, 993, ..., 6, 3, 0

Exercise 06.13: Become rich while you are sleeping

- You start with an amount of 2500 euro.
- You invest this amount and you gain 7% every year.
- Show me the current amount for every year.

How to calculate the correct amount?

- You have your start capital. In this example 2500 euro.
- You multiply this with:
 - $(1 + \text{gain in percentage})$ to the power year.

So, for the second year you have:

$$2.862,25 = 2.500 * (1 + 0,07)^2$$

Example

The fourth year you have around 3.277 euro. This number is rounded.

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Exercise 06.14: Reading backwards

- You ask for a text.
- Show every letter of the text in reversed order.



Use a for loop.

This resembles on the exercise 0006-p Declaration.zip.

Exercise 06.15: Paying with bills and coins

- You ask an amount of the type “decimal”. So, digits after the decimal symbol are allowed.
- This amount can’t be negative.
 - If it is, re-ask.
- If the input is not an amount.
 - Re-ask.
- You round that amount towards the second decimal.
 - 100,123 → 100,12.
 - 100,567 → 100,57.



Use decimal.Round(variable, 2)

- Now you have to calculate how you can pay this amount, always with the less paper and coins possible.
- Show on the console the following text, but only if it is needed.
 - xx times 500 (xx must be larger than 0 to be shown).
 - xx times 200.

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- ...
- The possible amounts are $500 - 200 - 100 - 50 - 20 - 10 - 5 - 2 - 1 - 0,5 - 0,2 - 0,1 - 0,05 - 0,02 - 0,01$.

Example

- When the amount is 645,54 this should be the result.
 - 1 time 500
 - 1 time 100
 - 2 times 20
 - 1 time 5
 - 1 time 0,5
 - 2 times 0,02

Exercise 06.16: A lot of ones and zeros



Take your time for this exercise.

Try to estimate before you start in how long it will take you.

Make post-its (tasks) of the steps that you want to execute.

Do the exercise first manually to see what the asked routine is.

You will be forced to work in a structured way. If you don't, you will have a lot of troubles. Do also small steps and test every time the result you have at the moment.

Working code is not good enough, it must also be maintainable.

- You ask a text that is a series of “0”s and “1”s.
 - E.g., 00110101
- As long you have other characters in the text, you re-ask the text.
- The moment you have a good starting point, you do this.
 - Loop thru the text and create another text.
 - When the character is “1”, you add “10”.
 - When the character is “0”, you add “01”.

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- So, the example 00110101 results in during the looping.
 - 0 (first character) → 01.
 - 0 (second character) → 0101.
 - 1 (third character) → 010110.
 - 1 (fourth character) → 01011010.
 - And so on.
 - End result: 0101101001100110.
- With that end result, you do the same routine again.
 - Loop thru the text and create another text.
 - When the character is “1”, you add “10”.
 - When the character is “0”, you add “01”.
- You should now have a text of 32 symbols.
- With this result you do this.
 - Every second occurrence of a 0, you remove it.
 - Every second occurrence of a 1, you remove it.
- In other words:
 - The second, fourth, sixth, and so on ‘zero’ will be removed.
 - The second, fourth, sixth, and so on ‘one’ will be removed.
- Let’s assume that the result is 1101010000.
 - This will result in ~~1+010+0000~~.
 - The end result will be 10100.
- What do you notice if you do this for the given start example 00110101?



The goal is first to write all the code in the Main method.

Later on, we will divide this code in different methods and routines.

The goal of the exercise is to compare the way of solutions. One with only one method, the other with several methods.

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Does your routine work if you type nothing?

Does your routine work if you type 0?

Does your routine work if you type 1?

Does your routine work if you type 00?

Does your routine work if you type 01?

Does your routine work if you type 10?

Does your routine work if you type 11?

Does your routine work if you type abc?

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Exercise 06.17: Adding a lot of numbers (very fast)

- You ask for a number, no decimals.
 - 12.548.
- You count the sum of all numbers from 1 till the number that was entered.
- Try to measure how long this routine takes to find a solution.
 - Use `DateTime.Now` at the start and end of your routine.

Example

- When you enter 12.548, your result should be 78.732.426.
- When you enter 12.345.678 your result should be 76.207.888.812.681.
- When you enter 123.456.789 your result should be 7.620.789.436.823.655.
- When you enter 1.234.567.890 your result should be 762.078.938.126.809.995.



How did you solve this?

Ask Vincent for the fastest way.

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Exercise 06.18: Heron's method to square a number

This algorithm is a technique to calculate the square root of a given positive integer. It is called Heron's method.

- You ask for a number, no decimals.
 - E.g. 15.
- Let your pc do an estimate. Take a random number between 2 and 10. This is your (current) guess.
- Loop the steps below:
 - Divide the original number (15) by your current guess.
 - Take that result and add your current guess to it.
 - Divide this into 2.
 - This result is your new current guess.
- When do you stop with the loop?
 - When the absolute value of the difference between the two last guesses is less than 0,0000000001.



The absolute value.

The absolute values of a number is the same number without the negative symbol.

Absolute value of -0,536 is 0,536.

So you will create a sequence of results in your loop that corresponds with the formula below.

X_n is the current guess, x_{n+1} is the next guess and R is your number where you want to calculate the square root from.

$$x_{n+1} = \frac{1}{2} \left(x_n + \frac{R}{x_n} \right)$$

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Exercise 06.19: Adding a lot of square numbers (very fast)

- You ask for a number, no decimals.
 - 9.
- You count the sum of all first 9 squared numbers from 1 till the number that was entered.
 - So in this example you sum the first 9 squared numbers $1 + 2 + 4 + 8 + 16 + 32 + 64 + 128 + 256 = 511$.
- This number becomes very fast, very large, so use the data type Big Integer.
- Try to measure how long this routine takes to find a solution.
 - Use `DateTime.Now` at the start and end of your routine.

Example

- When you enter 49, your result should be 562.949.953.421.311.



How did you solve this?

Ask Vincent for the fastest way.

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