- An example tutorial (involving UDF, IF-structures, VLOOKUP):

a) Write a user-defined function which computes the body mass index according to the formula

body mass index = weight in kilograms /(height in meters)^2.

Declare all your variables. Write two types of functions one using the function ROUND giving an answer to a precision of one digit and one returning an integer value.

- How to start? Think first about the general structure.
- How many and which input variables do you need?
  Two: weight and height
- Program first the rough structure: (Do not progam all at once)

```
Function bmi(weight, height)
    bmi = weight / (height) ^ 2
End Function
```

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- Test the rough structure on the Excel sheet:
  =bmi(70, 1.71) → 23.93898977

· What if nothing happens or something strange?
Check if you typed in the correct place, i.e. the module.
Check your spelling and other possible typos, e.g.

```
Function bmi(weight, height)
    bm = weight / (height) ^ 2
End Function
```

=bmi(70, 1.71) → 0

```
Function bmi(w, h)
    bmi = v / (h) ^ 2
End Function
```

=bmi(70, 1.71) → 0

```
Function bmi(weight height)
    bmi = weight / (height) ^ 2
End Function
```

=bmi(70, 1.71) → crash

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- Implement the other tasks:
  · Declare the variables:
    weight and height are of type Single
    bmi is of type Double when working with ROUND
    bmi is of type Integer when working to integer precision

```
Function bmi(weight as Single, height as Single) as Single
    bmi = weight / (height) ^ 2
End Function
```

Test your function
=bmi(70, 1.71) → 23.93898964
there is a small difference in the last two digits 77 → 64

```
Function bmi(weight as Single, height as Single) as Double
    bmi = Round( weight / (height) ^ 2 ,1)
End Function
```

=bmi(70, 1.71) → 23.9 =bmi(70, 1.71) → 23.9 69

- Now integer precision:

```
Function bmi(weight as Single, height as Single) as Integer
    bmi = Round( weight / (height) ^ 2 )
End Function
```

or

```
Function bmi(weight as Single, height as Single) as Integer
    bmi = weight / (height) ^ 2
End Function
```

=bmi(70, 1.71) → 24

- Test your function with some more values to make sure that the answer was not accidental.
- Try to judge whether the output makes sense at all. Do you expect very small numbers 0.1, 0.0001 or very large numbers 653542.2? This information is not given yet. 70

b) Write a user-defined function which gives a meaningful interpretation for the body mass index according to the table:

male	female	
<20	<19	underweight
20-24.9	19-23.9	normal weight
25-29.9	24-28.9	overweight
30-39.9	29-38.9	obese
≥40	≥ 39	extreme obese

- How many and which input variables do you need?
  Two: the gender and the body mass index
- What should be the output?
  The meaning of the bmi, that is an entry from the last column of the table depending on the value of bmi.
- Think first about the general outline, draw a flow chart.

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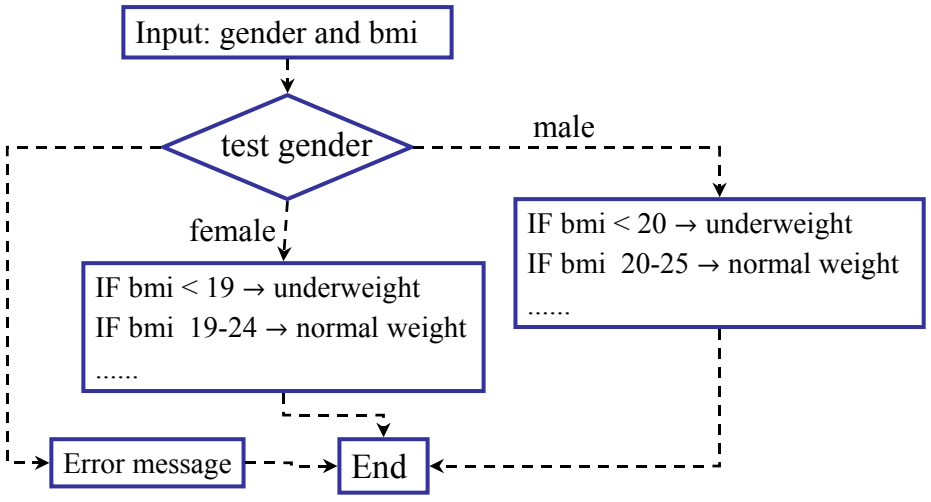

- You don´t have to be more specific.
- Start again with the rough structure.
- Program first the outer IF-structure.

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```
Function bmimean(bmin, mf)
   If mf = "male" Then
      If (bmin < 20) Then
         bmimean = "underweight"
      ElseIf (bmin >= 20 And bmin < 25) Then
         bmimean = "normal weight"
      .....
      Else
         bmimean = "extreme obese"
      End If
   ElseIf mf = "female" Then
      If (bmin < 19) Then
         bmimean = "underweight"
      ElseIf (bmin >= 19 And bmin < 24) Then
         bmimean = "normal weight"
      .....
      Else
         bmimean = "extreme obese"
      End If
   Else
      bmimean = "Specify gender!"
   End If
End Function
```

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- Test your function:

=bmimean(19.5, "male") → underweight

=bmimean(19.5, "female") → normal weight

=bmimean(19.5, "e-mail") → Specify gender!

There are 11 cases to be tested.

c) Use a VLOOKUP table to produce the same function as in b).

Enter the following table into the Excel WS:

	A	B	C	D	E
1		male	female		
2		0	0	underweight	
3		20	19	normal weight	
4		25	24	overweight	
5		30	29	obese	
6		40	39	extreme obese	

On the WS we could produce for instance:

=VLOOKUP(23,B2:D6,3) → normal weight

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d) The ideal body mass index is 21 and 22 for female and male, respectively. Given the height of a person in meters and the gender write a UDF which computes the ideal weight in kilograms to a precision of one digit. Declare all your variables.

```
Function Idealweight(height As Single, mf As String) As Double
    If mf = "male" Then
        Idealweight = Round(22 * height ^ 2, 1)
    ElseIf mf = "female" Then
        Idealweight = Round(21 * height ^ 2, 1)
    Else
        Idealweight = "Specify gender!"
    End If
End Function
```

Formula:
- BMI= w/h^2
- BMI = 21 (22)
⇒ w = 21(22) h^2

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- keep the "outer" If-structure

```
Function bmitab(bmin, mf)
    If mf = "male" Then
        bmitab = WorksheetFunction.VLookup(bmin,[b2:d6], 3)
    ElseIf mf = "female" Then
        bmitab = WorksheetFunction.VLookup(bmin, [c2:d6], 2)
    Else
        bmitab = "Specify gender!"
    End If
End Function
```

· Note the change of the range for the two tables.

· Note that ranges in VBA are of the format [c2:d6].
Using c2:d6 or (c2:d6), as possible on the WS, will not work.

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