Functions

Objectives: Using functions in python. Reinforcement of loops. More input/output. Automatic checking.

1. Try the following program that uses a function to compute a weighted average of three grades as final grade.

```
def compute_grade(test1, test2, exercises):
    return test1*0.35 + test2*0.35 + exercises*0.3

print(compute_grade(7.5, 8.5, 7))
print(compute_grade(4.7, 7.2, 6.8))
```

2. Observe how the following program, beside using a function which encapsulates the input operation, that function returns three grades given by the user:

```
def ask_for_grades():
    exam1 = float(input("Grade 1. exam: "))
    exam2 = float(input("Grade 2. exam: "))
    exercises = float(input("Grade exercises: "))
    return exam1, exam2, exercises

def show_grades(test1, test2, exercises):
    final = test1*0.35 + test2*0.35 + exercises*0.3
    print("Grade final: {:.2f}".format(final))

grade1, grade2, grade3 = ask_for_grades()
show_grades(grade1,grade2,grade3)
```

3. The following program asks for new input and visualizes the grades until the user indicates to finish.

```
def ask_for_grades():
    exam1 = float(input("Grade 1ª exam: "))
    exam2 = float(input("Grade 2ª exam: "))
    exercises = float(input("Grade exercises: "))
    return exam1, exam2, exercises

def show_grades(test1, test2, exercises):
    final = test1*0.35 + test2*0.35 + exercises*0.3
    print("Final grade: {:.2f}".format(final))
```

```
repeat = "yes"
while (repeat != "no"):
    grade1, grade2, grade3 = ask_for_grades()
    show_grades(grade1,grade2,grade3)
    repeat = input("keep going? (yes/no) ")
    repeat = repeat.lower()
else:
    print("\nEnd of program")
```

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4. Modify the previous program such that any negative input terminates implicitly the input loop (clearly, this last entry should not participate in the average).
5. Modify the function `show_grades()` such that it accepts weights as default parameters. Make experiments with your function.
6. Write a function to compute the Collatz sequence of a positive integer number a_0, where for such a sequence we have $a_{n+1} = 1/2 \cdot a_n$, if a_n is even, and $a_{n+1} = 3 \cdot a_n + 1$, if a_n is odd. The sequence terminates whenever we arrive at the number 1. For instance, for $a_0 = 3$ we obtain the sequence: 3, 10, 5, 16, 8, 4, 2, 1. (Note: no one knows whether we reach 1 for all positive integer numbers. Collatz conjecture.)
7. Write a function that computes the factorial of a number and check your function in a program.
8. Write a function to check whether a year is a leap year and check your function in a program.
9. Write a program to play the game stone-paper-scissors. The program should generate a random value and ask the user for his or her choice. Declare as winner who first has won three rounds.
10. Write a program with functions that finds the roots of a polynomial of degree 2 ($ax^2 + bx + c = 0$). Asks the user for the coefficients as floating point numbers.
11. Write a program that uses a function to convert polar coordinates to rectangular coordinates.
12. Write a program that uses functions to convert cylindric coordinates to rectangular coordinates and the other way round. Use your functions to check whether your implementation is correct, as we have $cyl2rec(rec2cyl(x,y,z)) = (x,y,z)$, don't we?