Solving simple problems with Python

Objectives

Working with Python Shell and IDLE to solve simple problems

- Implement simple programs using Python IDLE and execute them
- Solve simple problems using conditional statements and loops

Deadline

During **lab 2**: present 2 functions.

Beginning of **lab 3**: upload **all** functions implemented.

Requirements

Solve 5 exercises from the ones defined below.

Use your registration number ($\boldsymbol{n_{reg}}$) to define the number of exercises you have to solve: $\boldsymbol{n_{reg}}$ $\mathbf{mod\ 20 + 1}$ is the number of the first exercise, then increase it by 4 till you get 5 numbers.
e.g. my registration number is 1491
$1491\ mod\ 20 + 1 = \ 11 + 1 = 12$
⇒ I have to solve exercises: **12, 16, 20, 4, 8**

You should present at least two solved exercises during lab.

Problem specification

1. Compute the control digit of an integer by summing up its digits, then summing up the digits of the sum, so on, until a sum of only one digit is obtained.
   e.g. The control digit of integer number 1971 is 9 ($1971 \rightarrow 18 \rightarrow 9$).

Input	*Output*
year = 1971	9

2. Determine a date (as day, month, year) starting from two integer numbers that represent the year and the number of the day in that year.
   e.g.

Input	*Output*
year = 2004 days = 68	8.03.2004

3. Print all powers less than $\boldsymbol{k}$ of a given integer number $\boldsymbol{n}$.
   e.g.

Input	*Output*
n = 5	1, 5, 25

k = 100	

4. Determine the smallest number that can be formed with the digits of a number read from keyboard.
e.g.

Input	*Output*
n = 32007	20037

5. Determine the value of the element at index $\boldsymbol{k}$ in the array 1, 2, 2, 3, 3, 3, 4, 4, 4, 4,… without reading or effectively creating the array.
e.g.

Input	*Output*
k = 35	8

6. Given the current date (day, month, year) and the birthdate of a person (day, month, year) compute the age of the person in number of years.
e.g. If the current date is 4.3.2002 and the person birthdate is 5.9.1980 than the person is 21 years old.

7. Generate in ascending order the first $\boldsymbol{n}$ numbers from the set M defined as:
   a. Number 1 belongs to M
   b. If $\boldsymbol{x}$ belongs to M then $2\boldsymbol{x}+1$ and $3\boldsymbol{x}+1$ also belong to M
   c. M does not contain any other elements

e.g.

Input	*Output*
n = 10	1, 3, 4, 7, 9, 10, 13, 15, 19, 21

8. Consider an integer number $\boldsymbol{n}$. Print the nearest prime number to $\boldsymbol{n}$.
e.g.

Input	*Output*
n = 22	23
n = 20	19

9. Print all numbers with maximum 2 digits of form $\boldsymbol{xy}$ with the property that the last digit of $(\boldsymbol{xy})^2$ is $\boldsymbol{y}$.
e.g. $5^2=25$ or $10^2=100$ or $76^2=5776$.

10. Read integers numbers until number 0 is read. Print the number of pairs $\boldsymbol{n1}$ and $\boldsymbol{n2}$ of numbers read consecutively with the property that the number of digits 5 from $\boldsymbol{n1}$ is strictly higher than the number of digits 5 from $\boldsymbol{n2}$.
e.g. If the numbers read are 182, 457,341, 497, 5597, 1335, 15, 38, 5, 0 than the result is 3 (as the pairs 457-341, 5597-1335, 15-38 satisfy the required property).

11. Generate all prime numbers having $\boldsymbol{n}$ digits with the property that all its prefixes are also prime.
e.g. For n=2 the first number is 23 (2, 23 are primes).

12. Determine if two natural numbers have the following property: the same digits are necessary to write them in base 10.
e.g. 2113 and 31221 have this property, whereas 12521 and 11551 do not.

13. Read a natural number $\boldsymbol{n}$. Form another number from its digits found at odd positions (from left to right).
e.g.

Input	*Output*
1234	13

14. Read a natural number $\boldsymbol{n}$. Print the number of 1s from the binary representation of $\boldsymbol{n}$.
e.g. 547 has 4 digits equal to 1 in its binary representation.

15. Determine the age of a person in number of days. The current date and the birthdate are known.
e.g. If the birthdate is 1.1.2009 and the current date is 28.9.2009 than the person has 271 days.

16. Read numbers having minimum 2 digits until number 0 is given. Print how many numbers have the unit figure smaller than the tens figure.
e.g. If numbers read are 25, 653, 2965, 211, 154, 1256, 0 value 3 will be displayed.

17. A number $\boldsymbol{n}$ is special if there is a natural number $\boldsymbol{m}$ such that $n = m + S(m)$ where $S(m)$ is the sum of digits of $\boldsymbol{m}$. Verify if a given number is special.
e.g. 1235 is special (1235=1225+10)

18. Print the number of common digits of two numbers, as well as the digits.
e.g.

Input	*Output*
first number: 21348 second number: 14513	3 1, 3, 4

19. Print the numbers of $\boldsymbol{n}$ digits equal to $\boldsymbol{k}$ multiplied by their product. Numbers $\boldsymbol{n}$ and $\boldsymbol{k}$ $(1 \leq \boldsymbol{n} \leq 9, 1 \leq \boldsymbol{k} \leq 100)$ are given.
e.g. For n=3 and k=5 the only number that satisfies the requested properties is 175 (5*(1*7*5)).

20. Given a natural number $\boldsymbol{n}$, determine the greatest number $\boldsymbol{p}$ having the property that $2^{\boldsymbol{p}}$ is smaller or equal to $\boldsymbol{n}$.
e.g. For n=133, the result is p=7 (27=128, 28=256).

Note: don't forget about leap years! A year is leap year if 4 is its divisor and 100 isn't or 400 is its divisor.

1964 leap year
1900 NOT leap year
2000 leap year

Submission

Total points: **10**
You need to submit an **archive** (e.g. .zip, .rar, etc) with the source code (5 $.py$ files with the implementation for each problem) to the assignment on **Teams** before the deadline. Please use the following convention to name the archive file:
$sfmie1234\_A1.zip$, where s – first letter of your surname
f – first letter of your first name

mie – stand for mathematics informatics in English
1234 – is your registration number
$A1$ – number of the assignment

If something is not clear, please ask me.

Key

1p Default
2p Work during Lab2
5p Correct implementation of the 5 problems (1p per problem)
1p Clarity of code
1p Documentation