Data Types and Variables

Exercises

1. Data types
    a. By simply looking at the variables *a*, *b* *name*, *eq* and *l*, can you identify their data types?

```
a=5
b=3.14
name='Santa Claus'
eq=5==10/2
l=[a,b,name,eq]
```

    b. How can you verify their data types? Write down these variables in your Jupyter Notebook and check their data types. Can you check the data type of all variables in just one line of code?
    c. What happens if you type *name.split()*? Assign this variable the name *name_2* and check its data type.

2. Variables
    a. In your Jupyter Notebook, import the *NumPy* library as *np*
    b. Having that the volume of a sphere is defined as $V = \frac{4}{3}\pi r^3$, find the volume of a sphere with radius $r = 2$.
    c. The mass density of a certain material is given as $\rho = 1325\ kg/m^3$. We are interested in finding the density in terms of g/cm^3 which is 1000 times less. Define a variable *d* which is $\rho/1000$.
    d. Overwrite the variable *d* by creating a new variable with the same name, but here the density is defined as $d = 1325 \cdot 10^{-3}$.
    e. A ball of massive chocolate has a radius of 1 cm and a mass density of 1325 $\cdot 10^{-3}$ g/cm^3. Find the volume and the *mass* of this chocolate ball.
    f. How much chocolate, in terms of grams, do you get if you buy a bag of 10 pieces of chocolate with each having the radius:
        i. 0.5 cm?
        ii. 1.0 cm?
        iii. 1.5 cm?

Extra: The kilo price of chocolate is given as 150 NOK. How much do the different bags of chocolates in *f.* cost?

3. Lists
    a. My wish list for Christmas is given as the following list of strings:

```
wish_list=['Nice shirt','Gift Certificate','Netflix subscription','Fine wine','Peace on Earth']
```

    Write the list down in your Notebook file. What is the first thing I wish for? Access the list using indexing.
    b. What is the last element on my wish list?
    c. Check whether
        i. 'Fine wine'
        ii. 'Woolen sweater'

Are elements of the list

Flow Control

Exercises

1. For loop
    a. In your Notebook, create a list of strings on the following form

```
family_list=['mom','dad','little sister','big brother']
```

Where you fill the names of your own relatives. Feel free to extend the list with grandparents, cousins, and children if applicable.

b. Create a *for loop* where you wish all your family members a merry Christmas or happy holidays. The printed output of your for loop should look something like this:

```
Merry Christmas, mom!
Merry Christmas, dad!
Merry Christmas, little sister!
Merry Christmas, big brother!
```

2. If statement
    a.
        i. Create two new variables named two items you wish for (e.g. *sweater* and *watch*). The assigned values of these variables are the prices of these items. You can make the prices up. Construct an if statement that prints "The sweater is more expensive than the watch" if that is the case, and vice versa. Manipulate the prices of the items and verify that the printed message changes when the most expensive item is changed.
        ii. Give the same price for both items. Add a third condition to your if statement to print the appropriate message.
    b. Santa Claus needs help to determine who's naughty or nice. We are going to help him by automating this evaluation process by combining a for loop and an if statement. The people evaluated are defined in the *family_list* variable.
        i. First, write the code such that your mother is nice, and all others are naughty, and print. The print message should look something like this:

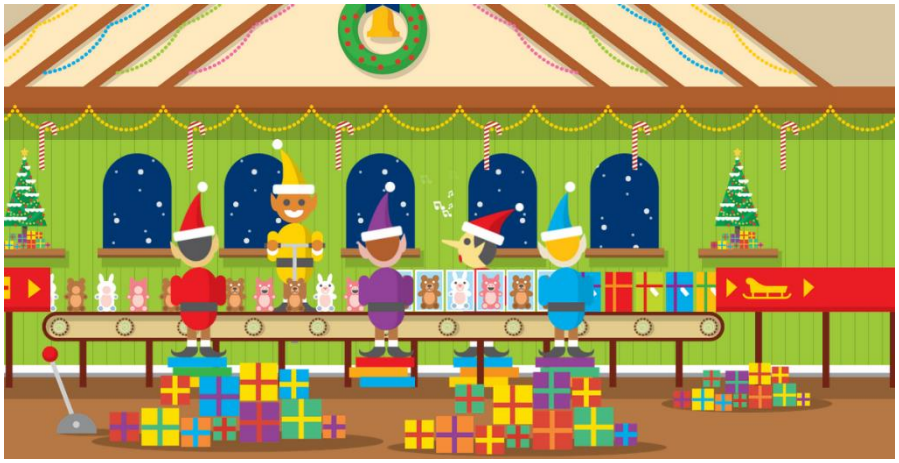
```
mom is nice
dad is naughty
little sister is naughty
big brother is naughty
```

        ii. Define all the female members of your family as nice.

3. While loop
    a. Create a while loop where you count the value of variable *i*. Its initial value is 0 and you add 1 to *i* for every loop while *i* is lower than 10. Print the current value of *i* for every iteration.
    b. The elves at Santa's sweatshop needs to clear at least 1000 packages before they can leave their shift. At the beginning of their shift, 0 packages are completed. The finished packages are counted every hour of their shift.
        i. Create a while loop with the given criteria and an estimated 100 cleared packages per hour. Print the current number of finished packages.
        ii. Format the print message such that it states:
        "x h: y packages cleared"
        Where:
            - x is the x-th working hour
            - y is the current number of cleared packages.

            Hint: you need to create a variable for x that counts the iteration number.
        iii. When the elves have reached their goal of clearing 1000 or more packages, print:
        "xh: y packages cleared. The elves are free to go!"
        This can be done by implementing an if-statement within the while loop

    Extra: Change the cleared packages per hour from 100 to 100 ± 30, i.e. a random number between 70 and 130.



Functions

Exercises

1. Looking back at *Data types and Variables: Exercise 2* the formulae working with chocolate will made into Python functions. Create functions that:
    a. Takes in radius and outputs the *volume* of a sphere. Call it *r2v*
    b. Takes in radius and outputs the *mass* of a piece of chocolate. Call it *r2m*
    c. Takes in radius and outputs the *price* of a piece of chocolate. Call it *r2p*
    d. Takes in radius and number of chocolates, and outputs the *price* of the pieces of chocolate. Call it *r2p_n*

    Use previous assumptions of density and price of chocolate. Be consistent of the units.

    e. How much do a single piece of chocolate with a radius of 0.8 cm weigh?
    f. What is the price of a single chocolate with radius: 0.5 cm, 1.0 cm, and 1.5 cm? Create a NumPy array.
    g. Given the same set of radii, find the prices for 10 pieces of chocolate.

    Make sure all answers are presentable and formatted properly.