**Exercises for Internship**

Dear Applicant,

Thank you for your interest in an internship at GeoKapti.

The internship will rely heavily on the use of the python programming language. Therefore we would like to assess your knowledge of the language. You will find three exercises in the next pages. Please provide a solution in a python file and send your solutions to the following email with the subject “*Exercise Solutions*”:

[internships@geokapti.nl](mailto:internships@geokapti.nl)

If you cannot answer all the exercises, please send the solution of those that you can solve.

We look forward to your response. Best of luck.

**GeoKapti B.V.**

[www.geokapti.nl](http://www.geokapti.nl)

The Hague, The Netherlads

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Exercise #1 - Distance Between Two Points

Write a python program that calculates the distance (in km) between two points in latitude and longitude. To calculate the distance, use the [haversine formula](https://en.wikipedia.org/wiki/Haversine_formula#:~:text=The%20haversine%20formula%20determines%20the,and%20angles%20of%20spherical%20triangles.).

The program should be able to be run from the command line like this and then print the answer.

python distance.py <LAT1> <LON1> <LAT2> <LON2>

<distance km>

For example:

python distance.py 13.594787 -89.827362 13.966572 -88.891292

109.216

Note:

Use the [argparse library](https://docs.python.org/3/library/argparse.html) to read command line arguments.

Answer:

Texto

Descripción generada automáticamente

Run file:

Texto

Descripción generada automáticamente



Exercise #2 - X-0 Game

A numpy array of shape (3,3) represents the game of X-0. Each position can be either “X” or “0” and the player that forms 3 in a row (including diagonals) wins. In python you can represent the game with a numpy array and a function that detects the winner.

Example:

game = np.array([[“X”, X”, “0”], [None, X”, “0”], [“0”, X”, None]])

winner = detect\_winner(game)

print(winner)

“X”

----

game = np.array([[“X”, X”, “0”], [“X”, 0”, “0”], [“0”, X”, “X”]])

winner = detect\_winner(game)

print(winner)

“0”

Write the function *detect\_winner*. We will test your function with different inputs.

Answer:

Texto

Descripción generada automáticamente

Imagen que contiene Calendario

Descripción generada automáticamente

Exercise #3 - Intersecting Polygons

The following structure represents 10 polygons:

import numpy as np

import numpy as np

from shapely import geometry

import random as rdm

polygons = np.random.randint(0,200,(10, rdm.randint(3,6) ,2))

## your code goes after this..

Write a program that prints the area of each polygon and with how many other polygons it intersects (use the [shapely](https://shapely.readthedocs.io/en/latest/manual.html) library). Example output:

(Polygon: 0) Area: 3504.5 Intersects: 7

(Polygon: 1) Area: 2520.0 Intersects: 6

(Polygon: 2) Area: 3644.5 Intersects: 8

(Polygon: 3) Area: 99.0 Intersects: 2

(Polygon: 4) Area: 1610.0 Intersects: 4

(Polygon: 5) Area: 8293.5 Intersects: 8

(Polygon: 6) Area: 1027.0 Intersects: 5

(Polygon: 7) Area: 4187.0 Intersects: 8

(Polygon: 8) Area: 1860.0 Intersects: 6

(Polygon: 9) Area: 2432.5 Intersects: 8

Answer:

Texto

Descripción generada automáticamente

Texto

Descripción generada automáticamente