WhiteSpace

WHITESPACE OPERATIONAL CODING CHALLENGES

GAME RULES

INTRO

Thank you for your interest in our coding challenges. We hope you enjoy them!

GUIDELINES

Before jumping in, please read through the following guidelines:

- We expect you to complete all tasks using Python 3.x.
- You can use any external resources/packages you want, but understanding the results is your own responsibility.
- You are not allowed to share (any element of) these challenges with third parties, including online fora such as GitHub.
- Wherever the challenge mentions the word `print` we expect a print statement in your code with the specified output.
- Remember to include helpful comments and docstrings in your code. State any assumptions you make in your comments.
- While we value the efficiency of your code, our primary focus is on ensuring that your implementation is functional and adheres to all specified constraints. It is important to note that while an optimal solution can be achieved with a runtime under a minute, our main goal is for you to develop a high-quality, working solution within this time frame. Optimality is secondary to the functionality and adherence to the challenge requirements.

DATA

The assignments contain references to data sets. You can find these sets here:
https://tinyurl.com/92zpsv7v

CODE ORGANIZATION

- Please organize your code so your answer to each challenge is stored in a separate file.
- Please include a main method and an `if __name__ == '__main__'` block in each file. This block should be used to run the main method.
- Please store your code and data in the same folder.

DELIVERY

- Each file should be called `{your_name}_{challenge_name}.{extension}` with the extension being either .py or .ipynb
- Please combine all files in a single .zip called `{your_name}_whitespace_codingchallenges_{YYYYMMDD}.zip`
- Please e-mail your zipped results to careers@whitespacesolutions.eu
- You are expected to send your results within 3 hours of receiving this email. Late submissions will not be considered.

Enjoy! – The WhiteSpace team

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WHITE SPACE CODING CHALLENGE 1

NUANCED NAVIGATION

INTRODUCTION

- You have been given a list of 12 sites on a map.
- Your objective is to design an optimal path that connects these sites.
- The path needs to be cyclic: it can start at any site but can only visit each subsequent site once (except for the start/end site).
- Your path has an important constraint: you cannot navigate directly North. Any other direction is fine. On the map below, this means for example that travelling directly from site 2 to 8 and directly from site 4 to 6 is forbidden.
- Your task is to optimize on length: the shorter the total distance travelled, the better.

ASSIGNMENTS

- Read in the coordinates of the sites and store them in an appropriate data structure.
- Find the cycle that connects all sites and minimizes total distance travelled. Remember, each site should be visited only once (except for the start/end site), and you cannot directly travel South → North.
- `print` the *order* in which the cycle visits the path, and the *total distance* travelled.

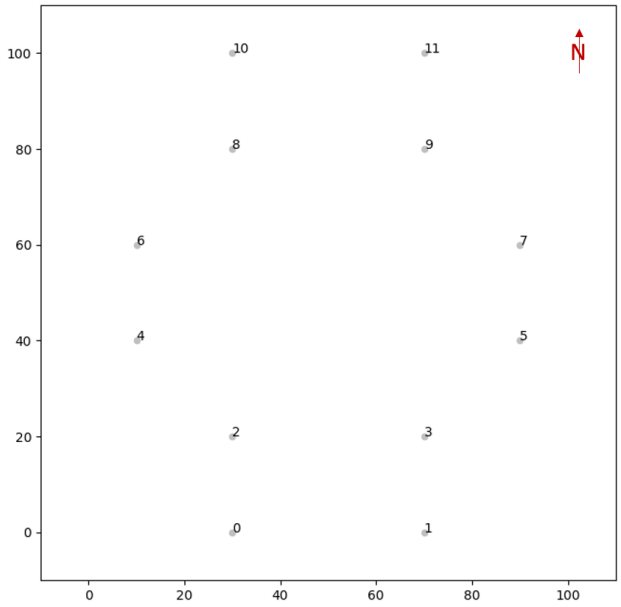

Figure: illustration of the Nuanced Navigation data. Each dot represents a site, labelled 0-11.

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WHITE SPACE CODING CHALLENGE 2

PARTITIONED POINTS

INTRODUCTION

You have been given a large set of 2D points that visually resemble a yin yang symbol. Your objective is to count how many points fall in the yin region.

ASSIGNMENTS

- First, read in the coordinates of all points and store them in an appropriate data structure.
- Next, write an algorithm to label each point to indicate what region (yin or yang) it belongs to (see figure below).
- `print` the *number of points* in the yin region.

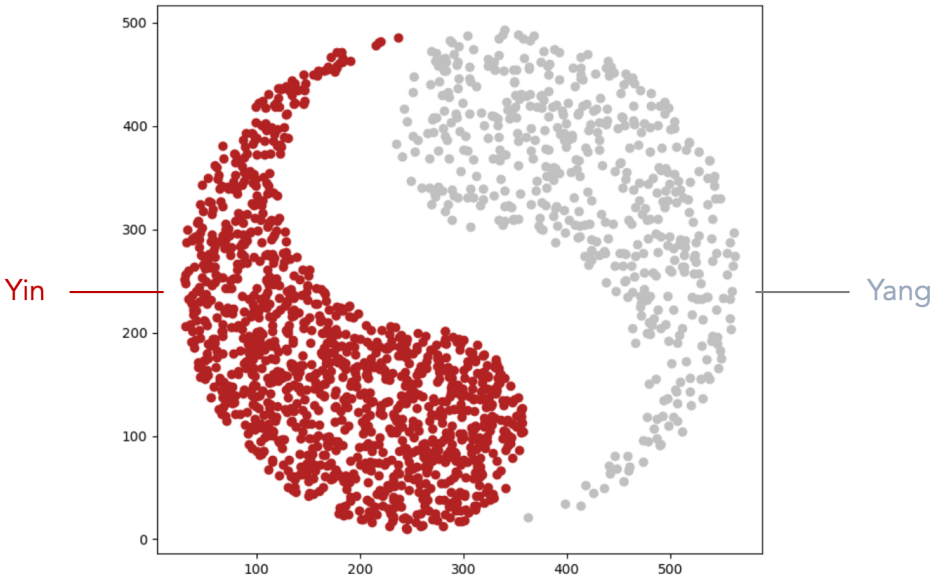

Figure: illustration of the Partitioning Points data. The yin points are shown in red, the yang points in grey.

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WHITE SPACE CODING CHALLENGE 3

WILD WAVES

INTRODUCTION

You have been given two time series:

- one with predicted wave height (in meters) versus time (in hours).
- one with the wave height *threshold* (in meters) versus time (in hours).

Your objective is to find the longest uninterrupted period during which the predicted wave height is at least 1 meter and below the threshold.

ASSIGNMENTS

- Read in both data sets into an appropriate data structure.
- Interpolate both time series to a 1-hour sampling.
- Determine the longest uninterrupted window during which the wave height is at least 1 meter and below the threshold.
- `print` the *starting time* and *duration* (in whole hours) of the that window.

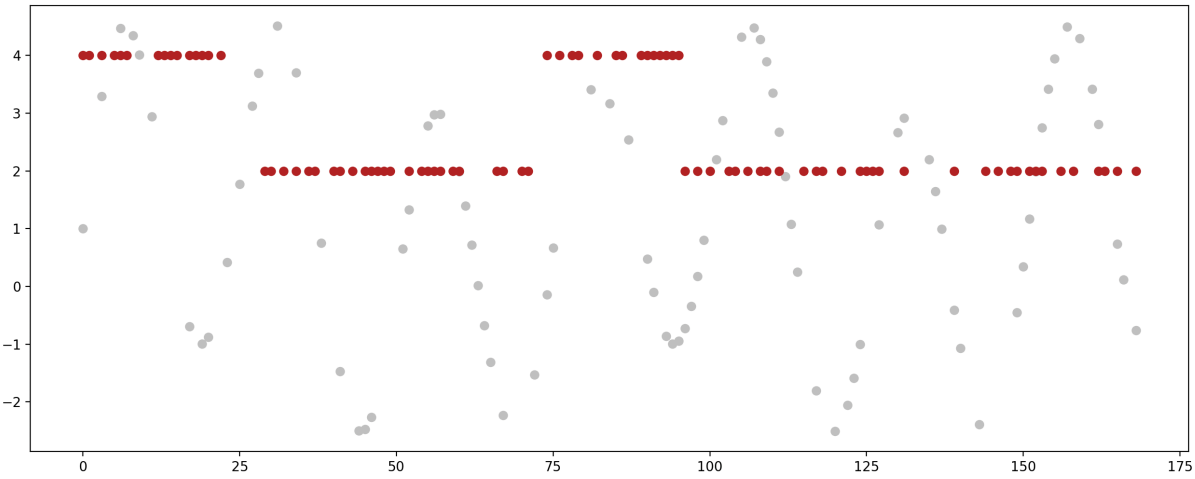

Figure: illustration of the Wild Waves data. The wave height is shown in grey, the threshold in red.

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WHITE SPACE CODING CHALLENGE 4

STICKY STICKS

INTRODUCTION

You have been given a collection of 2D line segments, referred to as 'sticks'. Some of these sticks cross each other. Your objective is to find the largest subset of sticks from this set such that no two sticks cross.

ASSIGNMENTS

- Read in the stick set and store it in an appropriate data structure.
- Find the largest subset of sticks such that no two sticks cross.
- `print` *the number of sticks* in your subset.

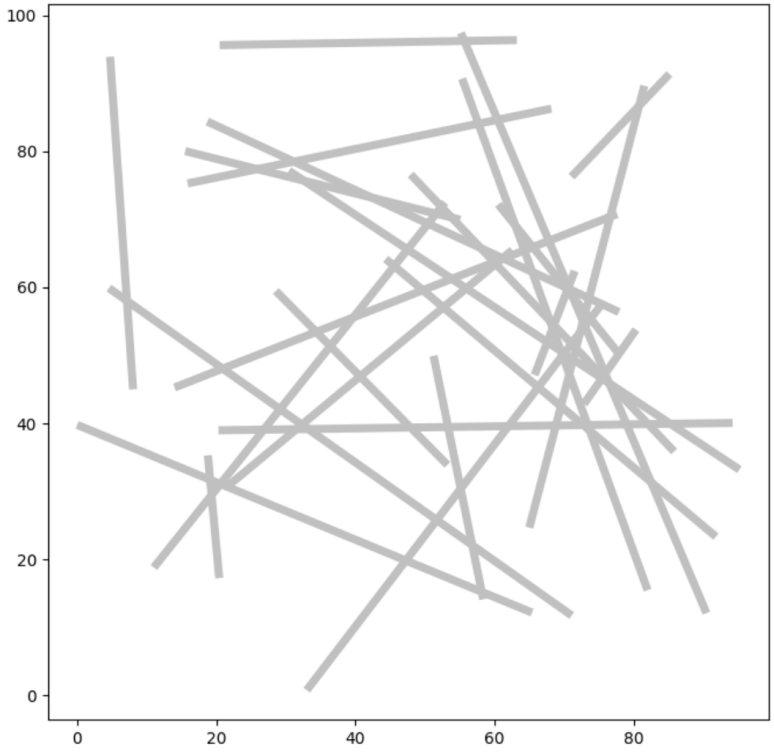

Figure: illustration of the Sticky Sticks data.

WHITE SPACE CODING CHALLENGES

POTENTIALLY RELEVANT LINKS

- https://developers.google.com/optimization
- https://matplotlib.org/stable/index.html
- https://numpy.org/doc/
- https://pandas.pydata.org/docs/
- https://pypi.org/project/utm/
- https://scipy.org/
- https://shapely.readthedocs.io/en/stable/manual.html