UNIVERSITY OF
LIVERPOOL

CMIT Summer Research Internship 2023: Python Basics 2

Author: Hang Yu

June 19, 2023

Contents

Fibonacci Sequence

- Sequence
  $0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, ...$

- ratio $a_{n-1} : a_n$

- $0.0, 1.0, 0.5, 0.667, 0.6, 0.625, 0.615, 0.619, 0.618, 0.618, 0.618, ...$

- ration tending to golden ratio

- $a_n = \frac{\phi^n - \psi^n}{\sqrt{5}}$

- $\phi, \psi = \frac{1 \pm \sqrt{5}}{2}$

Elliptic Integral

- $K(k) = \int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{1-k^2\sin^2(\theta)}}$

- Independent variables: θ and k

- Define 2-variable function

- Nested for loop

Similar Matrices

- Sufficient condition
- Same eigenvalue and same eigenvalue multiplicity
- $(\lambda - 5)^2(1 - \lambda)^3 = 0$
- Eigenvalues are 5 and 1, but there multiplicities are 2 and 3
- Numpy gives $2, 2, 1, 1, 1$, but may also be like $1, 2, 1, 1, 2$
- They are the same and hence similar
- Sort both before comparing

Various ways of printing

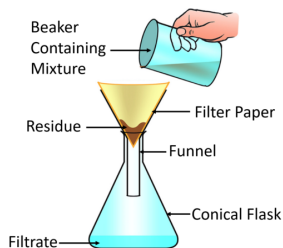Print is powerful for checking the intermediate codes.
Last time:

- convert everything into string format
- for integers, floats on their own, no need converting

Format Printing

- placeholders
- %s: string, %d integer
- Look some examples

Reading files by filtering

- In reality, many files contains impurity
- e.g. strings and floats mix together
- Or, only part of the file is needed

Python OpenCV

- cv2.imread function
- Like the text file, collecting data from image
- shape, colours (RGB, CMYK, Grayscale, etc.) etc.
- further processing