

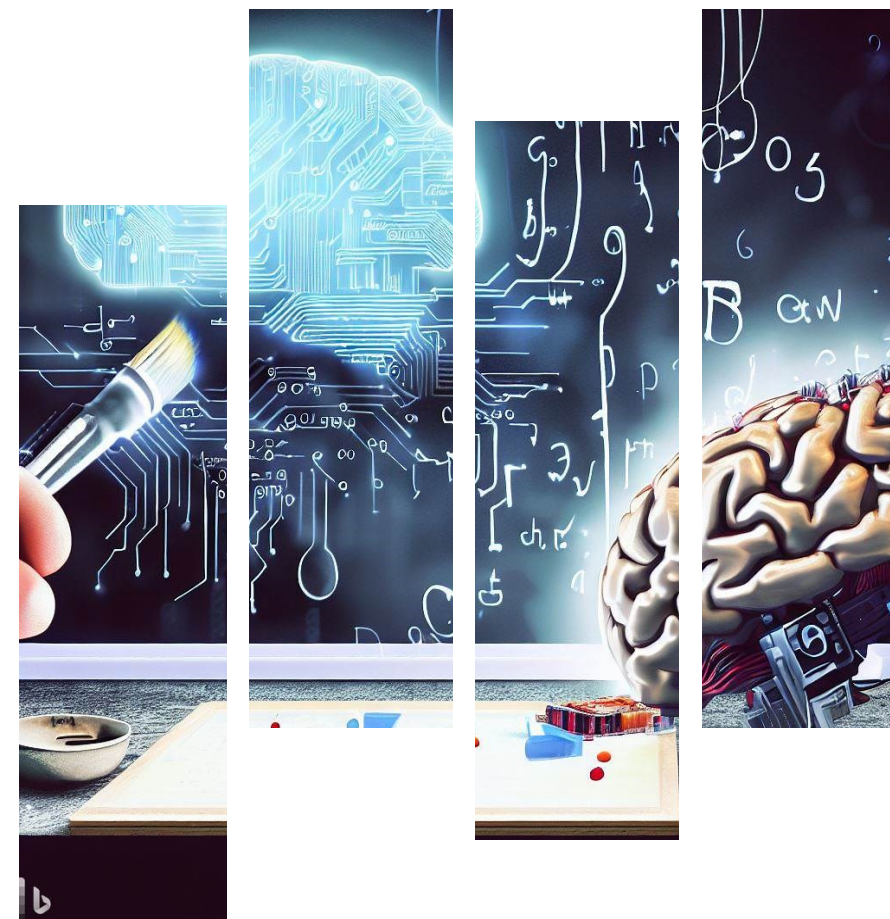
Università della Svizzera italiana (Lugano Campus west, Executive Centre)

Omar Parrini, USI Alumni, *Expert in Generative AI*

Dr. Luca Malinverno, *Data Scientist & Trainer*

Workshop on Generative AI and Teaching

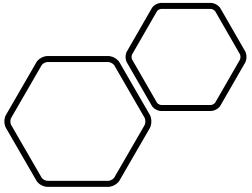
First experiences from AI projects in teaching



Agenda

- ✿ Who we are and what's our teaching experience
- ✿ Generative AI as tool for teacher: our first real-case use for exam generation
- ✿ Generative AI as tool for Students: our first requests to students to use Generative AI in an assignment
- ✿ Early noticed impact of Generative AI





Porini Education teaching experience



- Since 2017 Porini created a BU fully dedicate to education & learning.
- The BU applies ever since the Experiential Learning Approach.
- The BU counts 8 teachers, and more than 350 courses delivered
- The BU counts 6 MCT (Microsoft Certified Trainers) and all the teachers have a relevant technical background and certification about their topics

Porini Education Alumni

Total Teaching hours: > 13.000
Number of people trained: ~5000

Post-Grad Teaching

- *Total Teaching hours:* > 1500
- *PAX* ~ 2000

Business Driven teaching:

- *Total Teaching hours:* > 7000
- *PAX* > 3000

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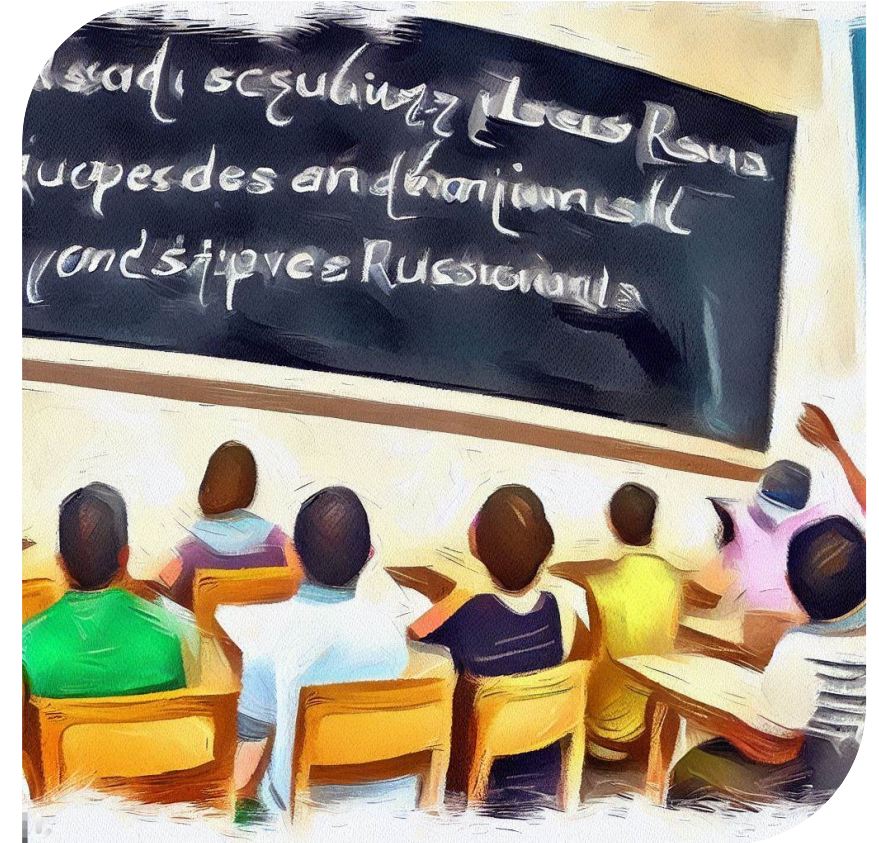
The Porini Education School

Most of the hours in class we spent @ ITS – Istituto Tecnico Superiore, a high level, post post-high school educational institution, not academic, directed by a Public-Private partnership as a No-Profit entity.

ITS are schools of excellence with high technological specialization that allow students to obtain a higher technician diploma. They represent an opportunity of absolute importance in the Italian training landscape as they are an expression of a strategy based on the connection of education, training and work policies with industrial policies: the goal is to support interventions aimed at productive sectors, with particular reference to the needs for innovation and technological transfer of small and medium-sized enterprises.

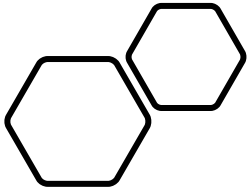
More than 50% of faculty must be industrial and business employees.

ITS diplomates are acknowledged with **V-VI EQF level** according to the total length of the course (2 or 3 years).



Among all the topics covered in ITS learning paths. Porini Education do teach in AI, Big Data and IoT related courses.

The presenters, in particular are professor of Python and Machine Learning courses.






Generative AI as tool for teacher



General Use of Generative AI for Teacher

Generative AI can be used by teacher and professors, as well as by all the professionals that need to create multimedia or technical content, to:

-  Preparare Test
-  Preparare documents
-  Preparare multimedia contents

For a Teacher, it is an **ethical obligation** to check the results of Generative AI, to clean it up from artifacts in order to deliver high quality content to students



The Exams preparation is stressful not only from student, but also from teacher perspective. In it's the requirements for final exams is to prepare at least 3 or different exam versions. The main goal is to avoid student snitch or copy, but yet to be fair with all the students.



- ❖ All the **topics** in the syllabus must be covered in all the test versions
- ❖ All the test versions must be **equal** in terms of **question** per topics, **level** per questions and general **structure**

Time Consuming!

Once the «first version» of the test is edited out, the others have little or no added value, since they **must be simple «variations»**.

Human brain generated

I, as a professor, write an entire test, with questions & answers.

This procedure allows me to **set the level**, to check the **exams fit the syllabus** and to **avoid mistakes or aliases** in the questions.

AI Generated

I passed to ChatGPT (Bing web version) the following prompt:

Prompt: *can you generate three variation to this questions? "What is the correct way to define a function in python?"*

This questions has 4 possible answers, only one is correct. The options are

- A) *def func_name(): [...] return <var>*
- B) *function func_name() [...] print <var>:*
- C) *func_name = function():*
- D) *func_name() return null:*

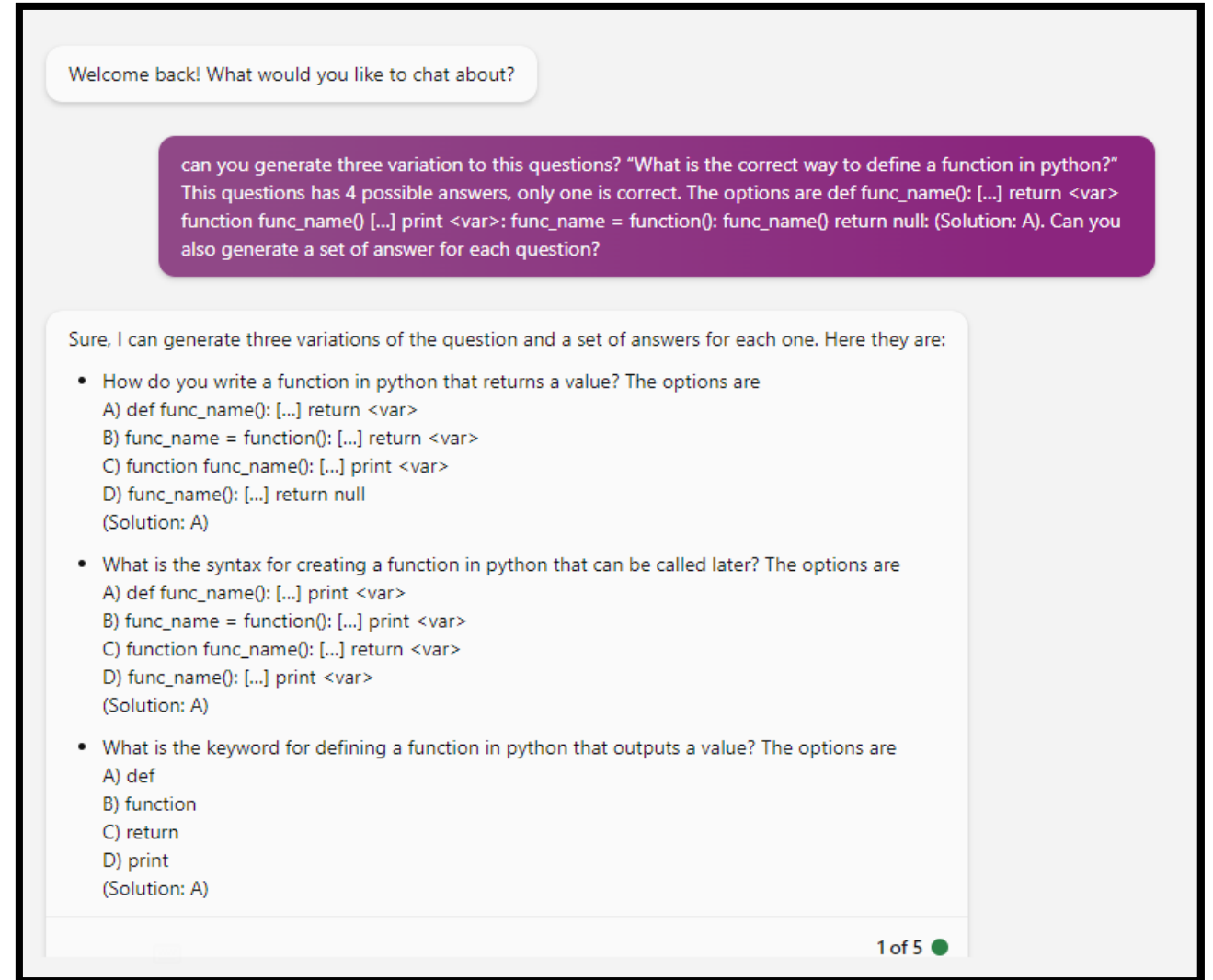
(Solution: A). Can you also generate a set of answer for each question?

Calling the general prompt:

can you generate <N> variation to this questions? <QUESTION>This questions has 4 possible answers, only one is correct. The options are: <OPTION A>, <OPTION B>, <OPTION C>, <OPTION D>, (SOLUTION: X) Can you also generate a set of answer for each question?

I can generate all N possible variations to my questions **programmatically** or I can use the **public available** generative AI engine.

Teacher can guarantee fairness, correctness and equality, and save time by just reviewing the questions



Welcome back! What would you like to chat about?

can you generate three variation to this questions? "What is the correct way to define a function in python?" This questions has 4 possible answers, only one is correct. The options are def func_name(): [...] return <var> function func_name() [...] print <var>: func_name = function(): func_name() return null: (Solution: A). Can you also generate a set of answer for each question?

Sure, I can generate three variations of the question and a set of answers for each one. Here they are:

- How do you write a function in python that returns a value? The options are
 - A) def func_name(): [...] return <var>
 - B) func_name = function(): [...] return <var>
 - C) function func_name(): [...] print <var>
 - D) func_name(): [...] return null(Solution: A)
- What is the syntax for creating a function in python that can be called later? The options are
 - A) def func_name(): [...] print <var>
 - B) func_name = function(): [...] print <var>
 - C) function func_name(): [...] return <var>
 - D) func_name(): [...] print <var>(Solution: A)
- What is the keyword for defining a function in python that outputs a value? The options are
 - A) def
 - B) function
 - C) return
 - D) print(Solution: A)

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What is the correct way to define a function in python?

- A) `def func_name(): [...] return <var>`
- B) `function func_name() [...] print <var>:`
- C) `func_name = function():`
- D) `func_name() return null:`

Human brain thought

How do you write a function in python that returns a value?

- A) `def func_name(): [...] return <var>`
- B) `func_name = function(): [...] return <var>`
- C) `function func_name(): [...] print <var>`
- D) `func_name(): [...] return null`

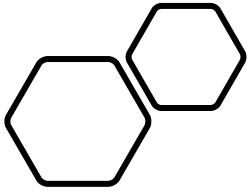
What is the syntax for creating a function in python that can be called later?

- A) `def func_name(): [...] print <var>`
- B) `func_name = function(): [...] print <var>`
- C) `function func_name(): [...] return <var>`
- D) `func_name(): [...] print <var>`

What is the keyword for defining a function in python that outputs a value?

- A) `def`
- B) `function`
- C) `return`
- D) `print`

AI Generated







Generative AI as tool for Students





General Use of Generative AI for Students



Generative AI can be a game-changer for students:





-  Generate templates, ideas, or content for essays or articles.
-  learn new skills or topics
-  inspire with new ideas of thoughts
-  Make the web search faster

But, still...

-  It may generate biased content that violates human rights or regulations.
[not always have the right tools to judge]
-  By relying too much on it without reviewing its outputs, output can be a disaster.




As data science teacher, I always suggest student to look for answers on the web, and get inspired by the tremendous amount of code and content available for free (on GitHub, Kaggle etc.. For example)... **Why not use Generative AI as a source of inspiration?**

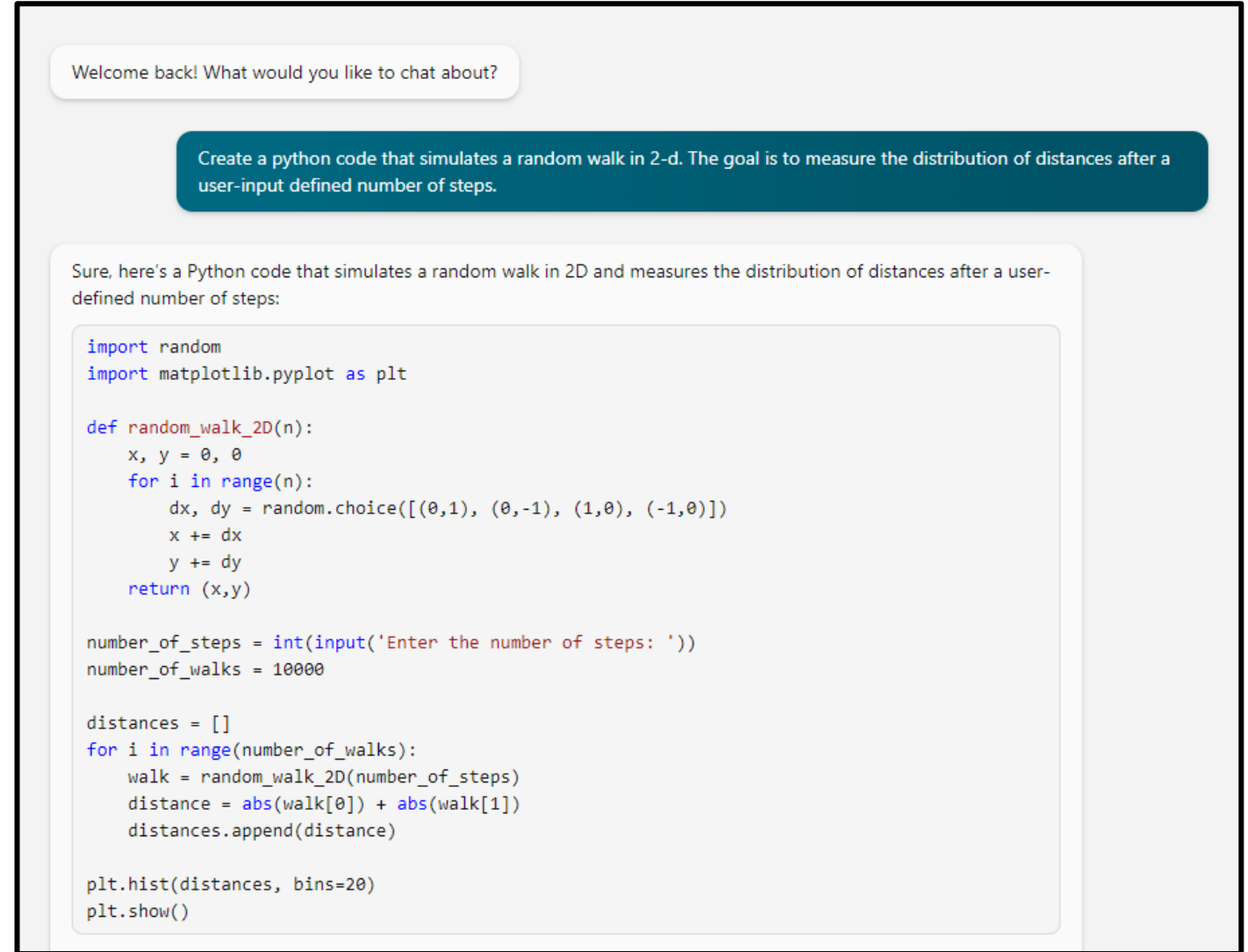
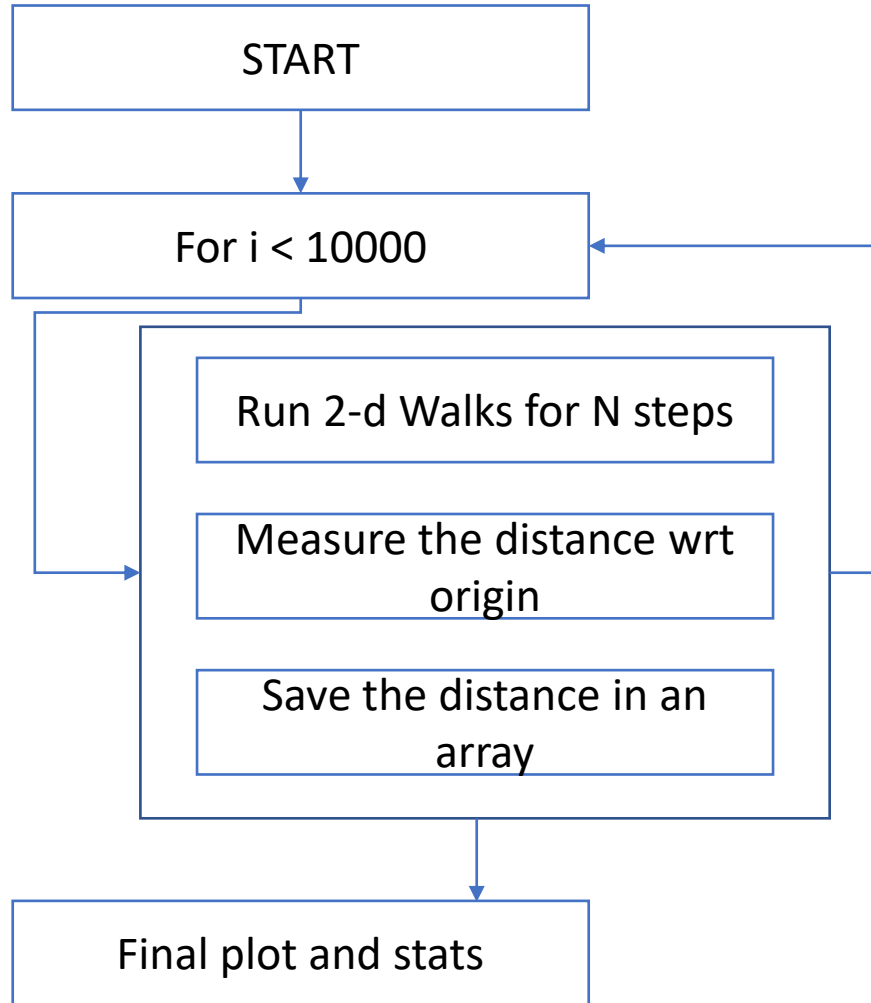
Create an algorithm that simulates a random walk in 2-d. The goal is to measure the distribution of distances after a user-input defined number of steps. Student Must

-  Provide the workflow for the 2-D random walk algorithm
-  Create a loop to evaluate several random walks and save the distance wrt the origin
-  Make plots and statistical analysis about the collected data
-  Create a report to show your results to the classroom with special attention two potential application and extension of the random walk simulation

The use of generative I is not forbidden but in fact, **it is encouraged**

As a teacher more than the correctness of the code I will evaluate several other elements

-  Workflow
-  code optimization and integration
-  critical thinking about obtained results



Welcome back! What would you like to chat about?

Create a python code that simulates a random walk in 2-d. The goal is to measure the distribution of distances after a user-input defined number of steps.

Sure, here's a Python code that simulates a random walk in 2D and measures the distribution of distances after a user-defined number of steps:

```
import random
import matplotlib.pyplot as plt

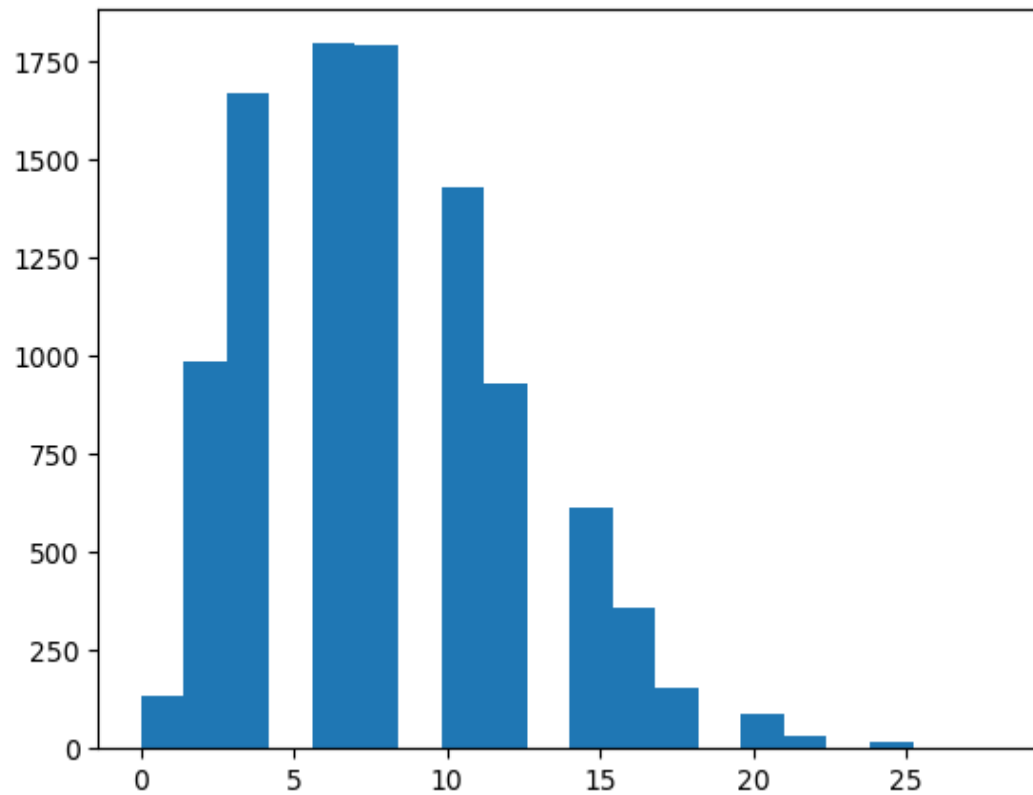
def random_walk_2D(n):
    x, y = 0, 0
    for i in range(n):
        dx, dy = random.choice([(0,1), (0,-1), (1,0), (-1,0)])
        x += dx
        y += dy
    return (x,y)

number_of_steps = int(input('Enter the number of steps: '))
number_of_walks = 10000

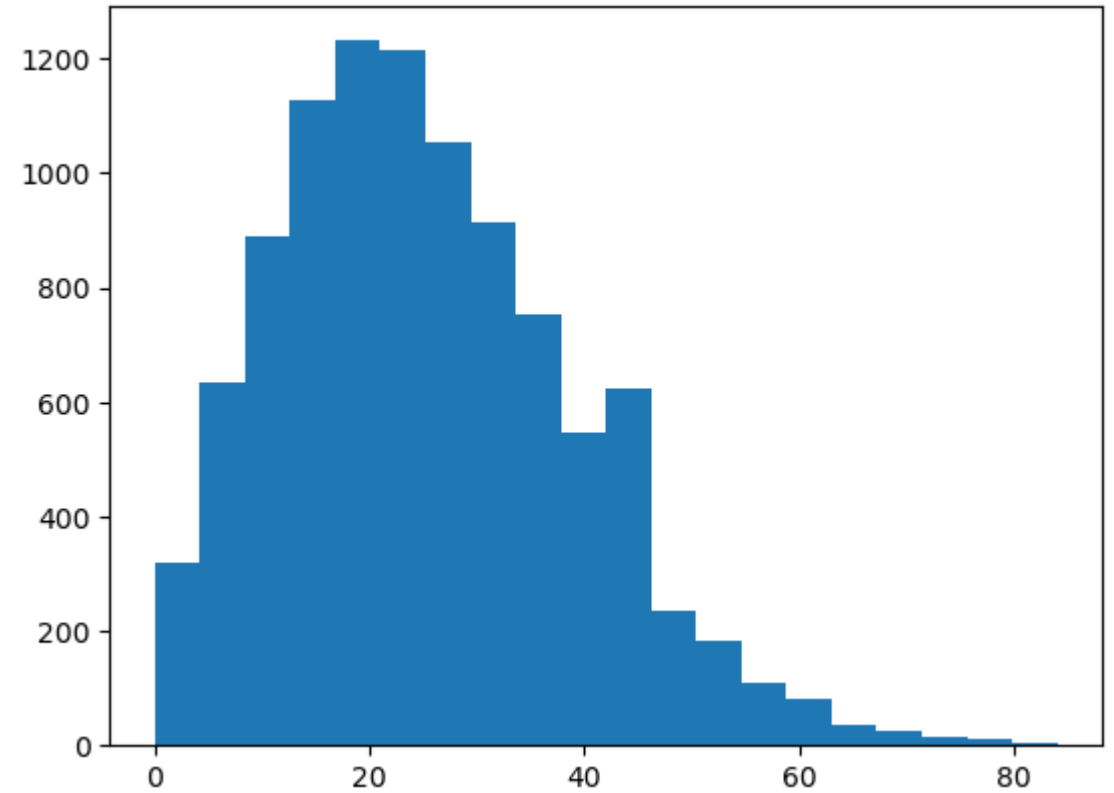
distances = []
for i in range(number_of_walks):
    walk = random_walk_2D(number_of_steps)
    distance = abs(walk[0]) + abs(walk[1])
    distances.append(distance)

plt.hist(distances, bins=20)
plt.show()
```

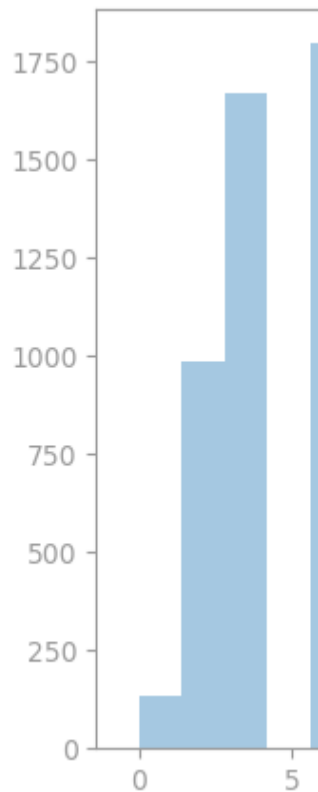

By running the code, and using 50 as number of steps, the resulting histogram will be something like:



By running the code, and using 500 as number of steps, the resulting histogram will be something like:



By running the code, and using 50 as number of steps, the resulting histogram will be something like:



By running the code, and using 500 as number of steps, the resulting histogram will be something like:

The goal is achieved, but the results is not usable or readable.

The student shall add:

- dynamic binning,
- labels,
- math analysis etc.

Student can focus on the **math** and on the **results**, by having the **Generative AI** to create the core of the algorithm.

B.C.: Complex algorithms will request better and well organized prompt. A result achievable only if the student got the problem right at his core.

Welcome back! What would you like to chat about?

Create a python code that simulates a random walk in 2-d. The goal is to measure the distribution of distances after a user-input defined number of steps.

Sure, here's a Python code that simulates a random walk in 2D and measures the distribution of distances after a user-defined number of steps:

```
import random
import matplotlib.pyplot as plt

def random_walk_2D(n):
    x, y = 0, 0
    for i in range(n):
        dx, dy = random.choice([(0,1), (0,-1), (1,0), (-1,0)])
        x += dx
        y += dy
    return (x,y)

number_of_steps = int(input('Enter the number of steps: '))
number_of_walks = 10000

distances = []
for i in range(number_of_walks):
    walk = random_walk_2D(number_of_steps)
    distance = abs(walk[0]) + abs(walk[1])
    distances.append(distance)

plt.hist(distances, bins=20)
plt.show()
```

The code uses Manhattan distance and a sub-optimal binning strategy. Student shall modify it with Euclidean distance (more realistic in a 2-D scenario) and with dynamic binning that will not create artifacts.

can you make the binning to be dynamical and adaptable to the distribution of distances? and also, can you add text and labels to the plot?

```
# Dynamic binning
binwidth = 1.5 * np.std(distances) * len(distances) ** (-1/3)
bins = np.arange(min(distances), max(distances) + binwidth, binwidth)

plt.hist(distances, bins=bins)
plt.xlabel('Distance')
plt.ylabel('Count')
plt.title(f'Random Walk {number_of_steps} Steps')
plt.show()
```

With additional prompt student
can correct the code

can you use in the code the euclidean distance?

```
distances = []
for i in range(number_of_walks):
    walk = random_walk_2D(number_of_steps)
    distance = np.sqrt(walk[0]**2 + walk[1]**2)
    distances.append(distance)
```

And also have **explanation** and dive deep into topic **to learn more** and be prepared to defend the choices made in the code, **while discussing it with the teacher.**

Can you explain how dynamic binning works?

Sure! Dynamic binning is a method for choosing the number of bins in a histogram based on the data itself. The goal is to choose a bin width that accurately represents the underlying distribution of the data.

In the code I provided, I used the Freedman-Diaconis rule to calculate the optimal bin width. This rule calculates the bin width as:

```
binwidth = 2 * IQR(distances) / (len(distances) ** (1/3))
```

where `IQR(distances)` is the interquartile range of the data and `len(distances)` is the number of data points. The interquartile range is a measure of the spread of the data and is calculated as the difference between the 75th and 25th percentiles.

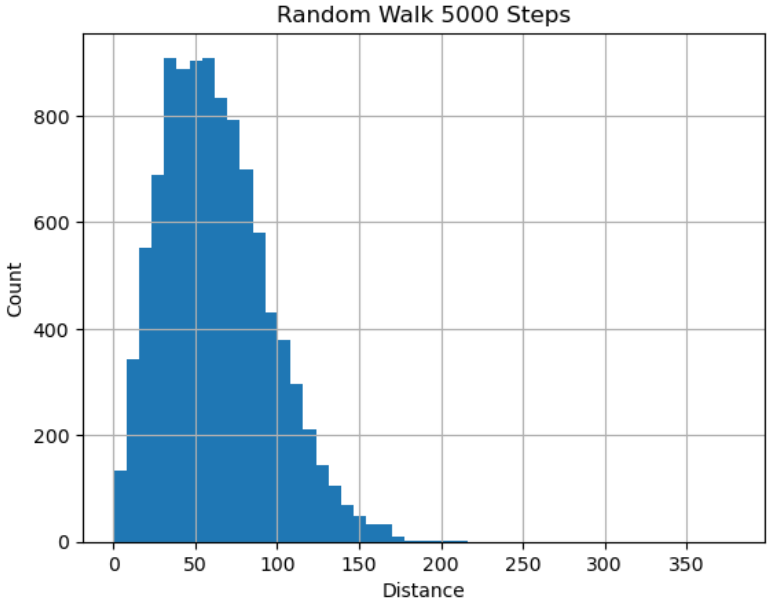
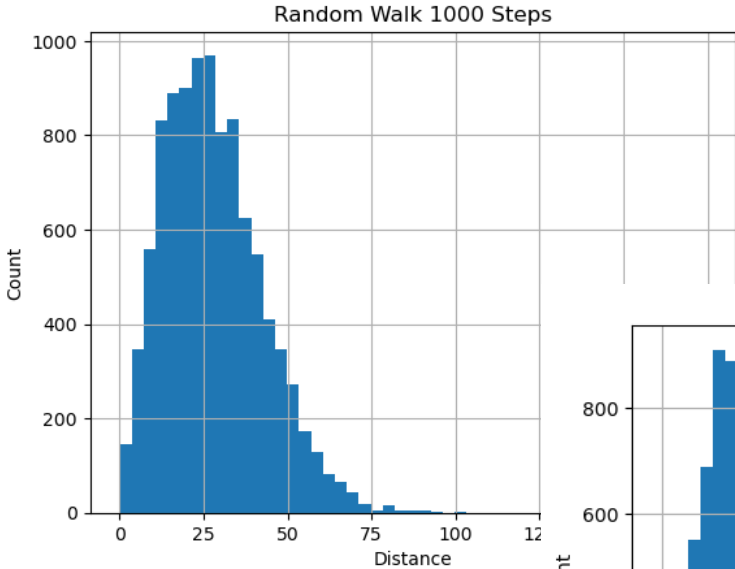
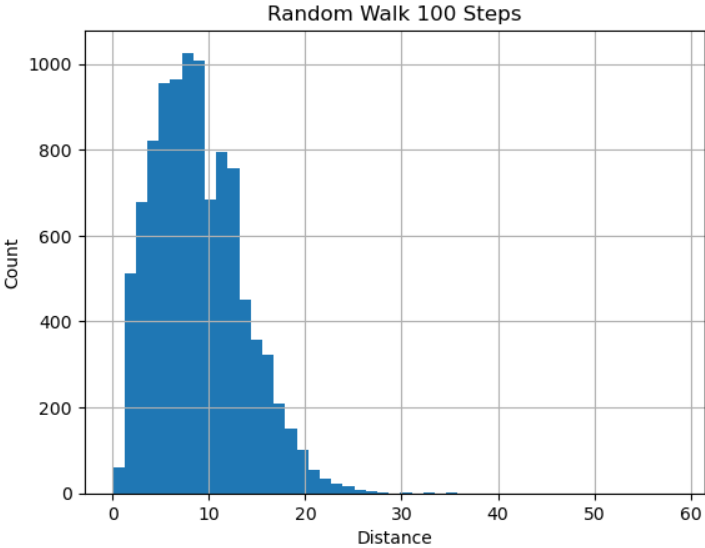
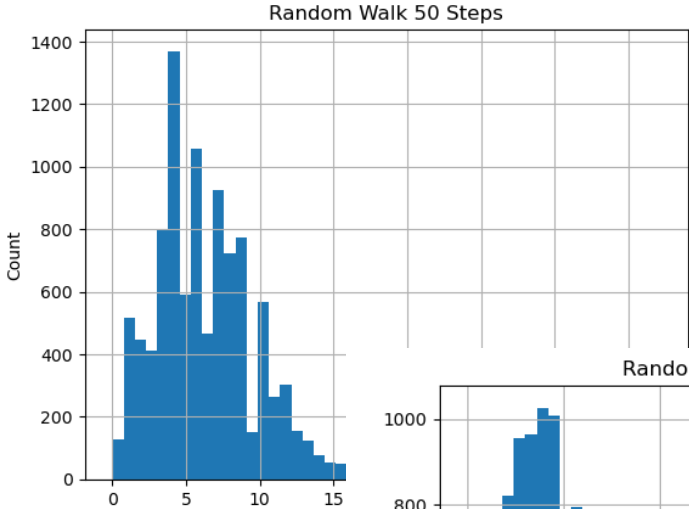
Once the bin width is calculated, the number of bins can be determined by dividing the range of the data by the bin width. In the code, I used `np.arange` to create an array of bin edges with a step size equal to the calculated bin width.

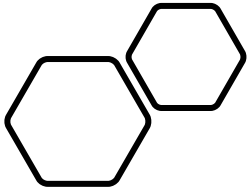
This method for choosing the number of bins is just one of many possible methods. Other methods include Sturges' rule, Scott's rule, and the square-root rule. Each method has its own strengths and weaknesses and may work better or worse depending on the specific data set.

I hope this helps! Let me know if you have any more questions.

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Code can now deal with a range of steps, and the focus with the student can be on the evaluation of the result with an argumentative analysis of the code





What are the early impacts of
Generative AI in teaching?



From the teacher point of view...

The good

- Increased Efficiency for teaching materials, exercise and explanations sheets creation
- Improved Personalization to respond to tailored needs
- Enhanced creativity and innovation

The bad

- Adaptation challenges:
 - How to design assignments that support students' critical thinking?
 - How to assess students' originality and academic integrity when using AI tools?

From the student point of view...

The good

- ✿ Enhanced engagement with tailored experiences
- ✿ Improved feedback and assessment

The bad

- ✿ Less motivation in learning or passive learning
- ✿ Difficulties on confronting with fellow students (especially for tailored labs and exercise)

In order to gain a deeper understanding of the influence on students, it would be advantageous to observe and comprehend their experiences. Consequently, our plan involves enhancing our end-of-course survey to better encompass (or as prof. Antonietta Mira would put it, "to make it statistically robust") the emotions and perceptions that emerge during class sessions.

From the workplace point of view...

The good

- ❖ Companies are rolling out GenAI Tools (because they really help the margin 😊)
- ❖ Younger employee are demanding Generative AI Tools

The bad

- ❖ Accountability of the content
- ❖ Employee are using Generative AI Tools without critical thinking so they are progressing slower

...but in our vision, the primary goal of the education system is to foster critical thinking skills among students.

The emergence of generative AI presents both challenges and opportunities in achieving this objective. To ensure its proper application, it is imperative that we focus on educating the educators themselves.

... last thought

To ensure the effective functioning of Generative AI, it is crucial to pose appropriate inquiries that yield the desired responses.

... so basically we are saying that Socrate was the first prompt engineer!



Thank you for your attention

Let's Keep in touch:

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All the images in the ppt have been created with Generative AI.
A good bunch of text have been reviewed, translated and corrected in first place with Generative AI.
Speakers reviewed and checked the content, the translation and did the original work to produce this speech.