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**Section: A**

**Reg No.: AU/2022/0007018**

**Semester: V**

**Subject: Introduction to Python**

**(Q.1.) Perform a Fast Fourier Transform (FFT) on a sine wave signal and visualize both the original signal and its frequency spectrum.**

**Ans.** To execute this: -

**Source Code: -**

import numpy as np

import matplotlib.pyplot as plt

sampling\_rate=1000

frequency=5

amplitude=1

time=1

t=np.linspace(0, duration, sampling\_rate\*time)

SineWave=amplitude\*np.sin(2\*np.pi\*frequency\*t)

magnitude\_fft=np.abs(np.fft.fft(sine\_wave))

frequency\_fft=np.fft.fftfreq(len(magnitude\_fft), 1/sampling\_rate)

plt.figure(figsize=(12, 6))

plt.subplot(2, 1, 1)

plt.plot(t, sine\_wave, color='pink')

plt.title('Original Sine Wave')

plt.xlabel('Time [s]')

plt.ylabel('Amplitude')

plt.grid()

plt.subplot(2, 1, 2)

plt.plot(frequency\_fft[:len(frequency\_fft)//2], magnitude\_fft[:len(magnitude\_fft)//2], color='green')

plt.title('Frequency Spectrum')

plt.xlabel('Frequency [Hz]')

plt.ylabel('Magnitude')

plt.grid()

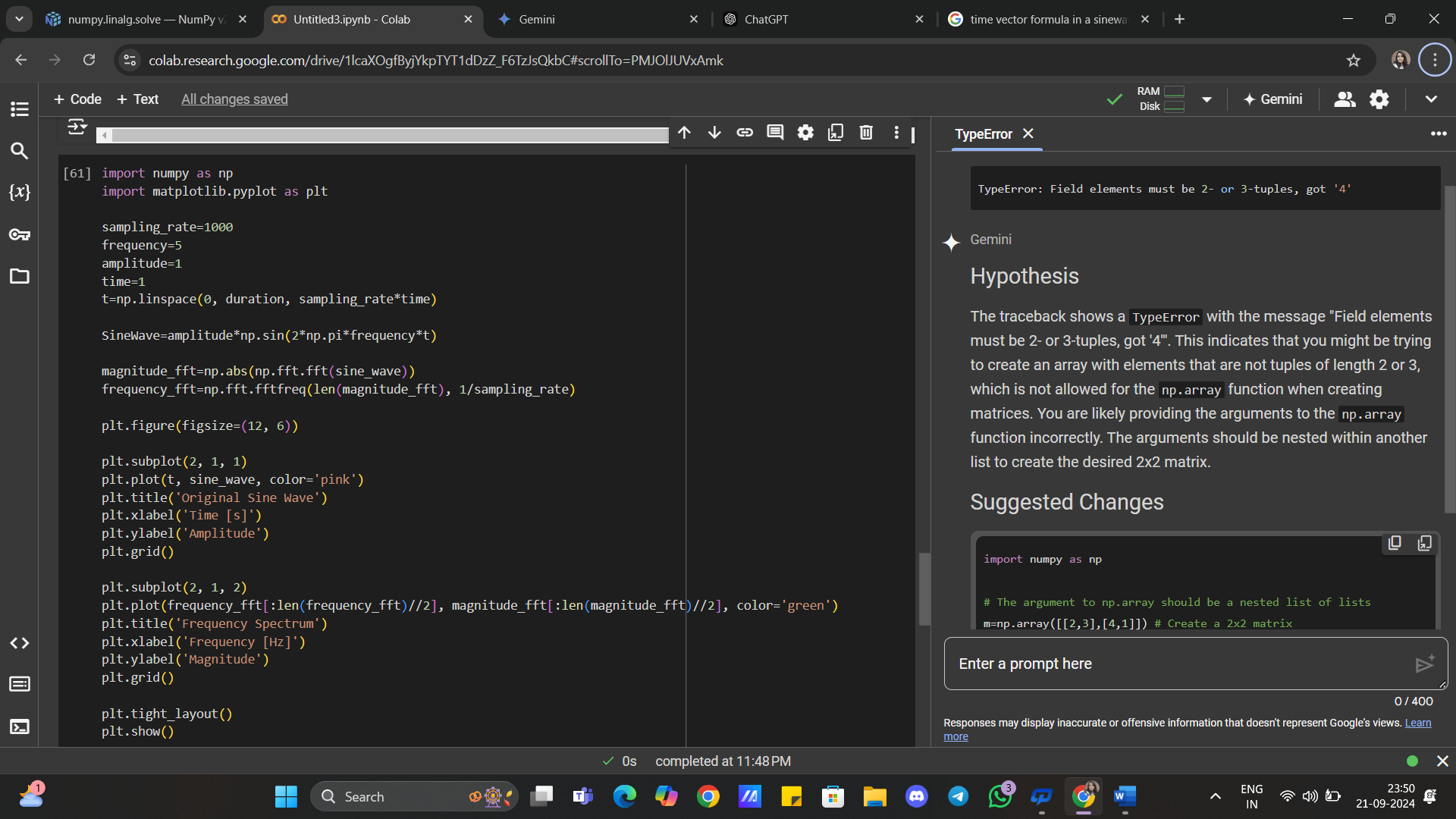
plt.tight\_layout()

plt.show()

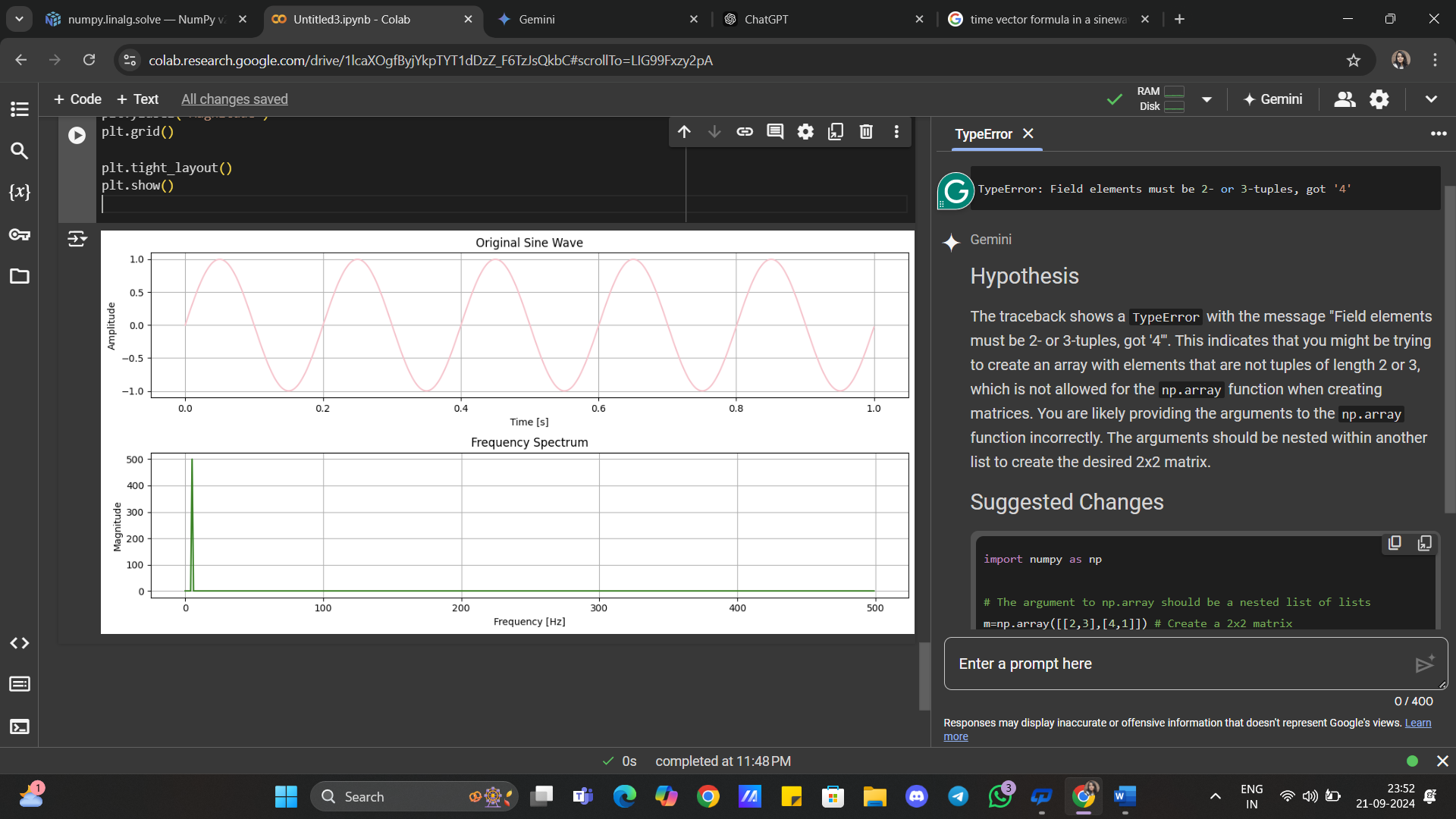
**Output: -**

The code is executed

**Code Snippet: -**



**Output: -**



**(Q.2.) Using scipy in python integrate a function f(x)=x^2 in range [0,5] from scipy import integrate**

**Ans.** To execute this: -

**Source Code: -**

def f(x):

  return x\*\*2

result,error=integrate.quad(f,0,5)

print ("The Integration value is: ",result)

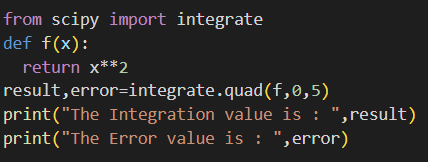
print ("The Error value is: ",error)

**Output: -**

The Integration value is : 41.66666666666666

The Error value is: 4.625929269271485e-13

**Code Snippet: -**



**Output:-**



**(Q.3.)** **Solve a simple optimization problem where you need to minimize the function f(x)=(x-3)²+2 using scipy.optimize**

**Ans.** To execute this:-

**Source Code:-**

 import numpy as np

 from scipy.optimize import minimize

 def f(x):

  return (x-3)\*\*2+2

result=minimize(f,0)

print("The Optimized value is : ",result.fun)

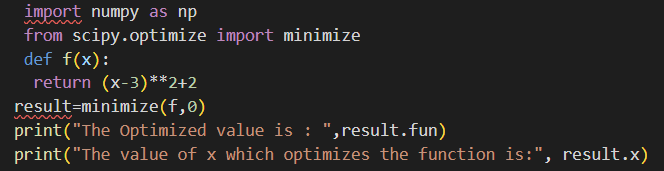
print("The value of x which optimizes the function is:", result.x)

**Output:-**

The Optimized value is : 2.000000000000001

The value of x which optimizes the function is: [3.00000003]

**Code Snippet:-**



**Output:-**



**(Q.4.)** **Solve a system of linear equations using numpy. Given the system**

**2x+3y=5**

**4x+y=6**

**Solve for x and y**

**Ans.** To execute this:-

**Source Code:-**

import numpy as np

m=np.array([[2,3],[4,1]])

n=np.array([5,6])

result=np.linalg.solve(m,n)

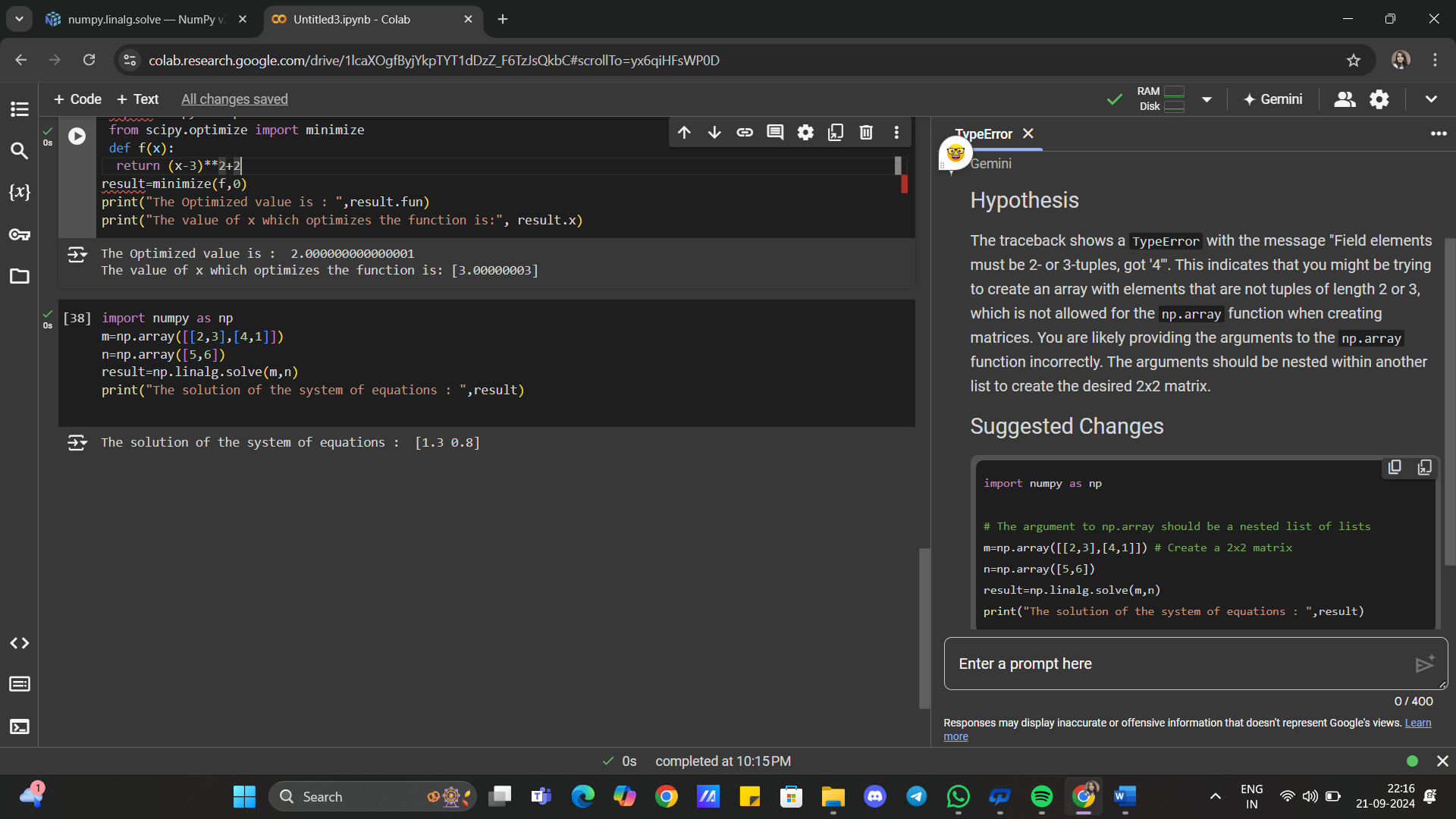
print(“The solution of the system of equations : “,result)

**Output:-**

The Integration value is : 41.66666666666666

The Error value is : 4.625929269271485e-13

**Code Snippet:-**



**Output:-**

