Python Programming

Hellenic Mediterranean University

Lecture 8

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Lecture Roadmap

- Plotting with lists
- Writing and reading files
- Complex numbers
- Lists vs Tuples
- Introduction to NumPy

Creating Data for Plot

```
def f(x):
    return x**2 + 2*x + 1

x_values = []
y_values = []

x = -5
while x <= 5:
    x_values.append(x)
    y_values.append(f(x))
    x = x + 0.1
```

Plot Example

```
import matplotlib.pyplot as plt

plt.plot(x_values, y_values)
plt.show()
```

More Plot Examples

```
def f(x):
    return x**3

def g(x):
    return x**2

x_vals = []
y1 = []
y2 = []

x = -3
while x <= 3:
    x_vals.append(x)
    y1.append(f(x))
    y2.append(g(x))
    x += 0.1

import matplotlib.pyplot as plt
plt.plot(x_vals, y1)
plt.plot(x_vals, y2)
plt.show()
```

Writing to File

```
f = open("data.txt", "w")

for i in range(len(x_values)):
    line = str(x_values[i]) + " " + str(y_values[i]) + "\n"
    f.write(line)

f.close()
```

Reading from File

```
f = open("data.txt", "r")

for line in f:
    print(line)

f.close()
```

File Processing Example

```
f = open("data.txt", "r")

sum_val = 0
count = 0

for line in f:
    parts = line.split()
    y = float(parts[1])
    sum_val += y
    count += 1

print("Average:", sum_val / count)

f.close()
```

Complex Numbers

```
z = 3 + 4j

print(z.real)
print(z.imag)
print(abs(z))
```

Complex Operations

```
z1 = 2 + 3j
z2 = 1 - 4j

print(z1 + z2)
print(z1 * z2)
```

Lists vs Tuples

```
A = [1, 2, 3]
A[0] = 10

B = (1, 2, 3)
# B[0] = 10 -> ERROR
```

- Lists: mutable
- Tuples: immutable

Tuple Example

```
point = (3, 5)

x = point[0]
y = point[1]

print(x, y)
```

Why Tuples?

- Cannot change by mistake
- Faster
- Used for fixed data

NumPy Introduction

NumPy is used for:

- arrays
- numerical computations
- engineering applications

NumPy Example

```
import numpy as np

A = np.array([1, 2, 3])
print(A + 2)
```

NumPy vs List

```
A = [1, 2, 3]
# A + 2 -> ERROR

import numpy as np
B = np.array([1, 2, 3])
print(B + 2)
```

Mini Project

Create a program that:

- computes a function
- plots it
- saves results to file
- reads file and computes average