

## **TEXAS TEACHERS LESSON PLAN FORMAT**

**NAME:** Ernest Antwi

**SUBJECT:** Computer Science (Chapter 2: Finance and Python)

**GRADE LEVEL:** 10–12

### **TEKS:**

- **Standard II:** All teachers collaborate and communicate both locally and globally using digital tools and resources to reinforce and promote learning.
- **Standard IV:** All teachers make informed decisions by applying critical-thinking and problem-solving skills.
- **Competency 007:** The computer science teacher correctly and efficiently uses data types, data structures, and functions in the development of code.
- **Competency 009:** The computer science teacher knows how to construct, compare, and analyze various algorithms.

### **LEARNING OBJECTIVE(S):**

Students will be able to apply Python programming concepts to model basic financial scenarios, including variable assignment, data types, and vector operations, using NumPy arrays to represent uncertain stock prices and option payoffs.

### **ASSESSMENT:**

Students will complete a **project-based assessment** in which they:

- Write Python code to model stock prices and option payoffs.
  - Use NumPy to perform vectorized calculations.
  - Present their code and explain their modeling approach in small groups.
  - Submit their code via Google Classroom or a shared repository.
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<b>MATERIALS and SETTING</b>	Windows machines with Python installed, Visual Studio Code or online IDE ( <a href="http://finpy.pqp.io">http://finpy.pqp.io</a> ), projector, whiteboard, handouts with code examples, Google Classroom for submission.
<b>KEY VOCABULARY and ACADEMIC LANGUAGE</b>	Finance, Python, variable, float, array, NumPy, vector, stock price, strike price, option payoff, modeling, computational finance.
<b>FOCUS ACTIVITY</b>	Quick review of Python variables and data types using financial examples (e.g., <code>vu = 1.5</code> , <code>vd = 3.75</code> ).
<b>CONNECTION TO PRIOR LEARNING</b>	Students have previously learned basic Python syntax, variable assignment, and simple arithmetic operations.
<b>OBJECTIVE STATEMENT</b>	“Today, we will learn how to use Python and NumPy to model financial concepts like stock prices and option payoffs.”
<b>PURPOSE OF LEARNING</b>	This helps us understand how programming can be used to solve real-world financial problems and make data-driven decisions.

## INSTRUCTIONAL STEPS

### 1. Review (10 mins)

- Recap Python basics: variables, data types (`int`, `float`), and arithmetic.
- Introduce financial context: stock prices, options, and why we model them computationally.

### 2. Focus Activity (10 mins)

- Students type and run:

`python`

`vu = 1.5`

`vd = 3.75`

```
print(vu + vd)
```

- Discuss: What is the data type? Why use floats in finance?

### 3. Activity: Introduction to NumPy (15 mins)

- Demonstrate:

```
python
```

```
import numpy as np
```

```
v = np.array((vu, vd))
```

```
print(v + v)
```

```
print(3 * v)
```

- Explain: arrays, vectorized operations, and why they are efficient for financial modeling.

### 4. Station Work (30 mins)

- **Station 1:** Variable and Data Type Practice
  - Define financial variables (`S`, `K`) and explore types.
- **Station 2:** NumPy Array Creation
  - Create arrays for stock prices and perform basic vector math.
- **Station 3:** Modeling Option Payoffs
  - Use `np.maximum()` to calculate option payoffs based on stock price arrays.

### 5. Station Completion & Review (10 mins)

- Groups share one takeaway from each station.
- Clarify misconceptions about array shapes, dtypes, and vector operations.

### 6. Assessment (15 mins)

- Students write a short script that:
  - Defines an array of stock prices.
  - Calculates European call option payoffs.
  - Explains their code in comments.

### 7. Closure (5 mins)

- Recap: Why use arrays in finance? How does Python help model uncertainty?
- Preview: Next lesson will introduce Black-Scholes modeling.

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## STUDENT USE OF TECHNOLOGY

- Python IDEs (VS Code or [finpy.pqp.io](https://finpy.pqp.io))

- NumPy for array operations
  - Google Classroom for submission and collaboration
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## QUESTIONS FOR UNDERSTANDING (Bloom's Levels)

- **Pre-Questions:**
    - What is a variable in Python? (Remember)
    - How might we represent multiple stock prices in code? (Apply)
  - **Post-Questions:**
    - How does using NumPy improve financial modeling? (Analyze)
    - How would you modify the code for a put option? (Create)
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## MODIFICATIONS/ACCOMMODATIONS

- **IEP/ELL:** Provide sentence stems for code comments, visual aids for array structures.
  - **504:** Allow typed responses, extended time, or verbal explanations.
  - **Advanced:** Introduce stochastic interest rates or volatility modeling using SciPy.
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## RETEACH/EXTENSION

- **Reteach:** Small-group session on array indexing and `np.maximum()`.
  - **Extension:** Students research and implement a simple Black-Scholes calculator using SymPy.
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## REVIEW & CONNECT TO FUTURE LEARNING

- Review: Key terms—array, vector, option payoff.
- Future: Introduce stochastic models and Monte Carlo simulations in finance.