

PYTHON PROGRAMMING FOR BEGINNERS LEARN THE BASICS Online PDF

python programming for beginners learn the basics is an essential guide for anyone interested in diving into the world of coding. Whether you're a complete novice or someone looking to enhance your technical skills, learning Python can open doors to numerous opportunities in software development, data analysis, artificial intelligence, and more. Python is renowned for its simplicity and readability, making it an ideal programming language for beginners. This comprehensive article will walk you through the fundamental concepts of Python programming, providing a solid foundation to start your coding journey.

Why Choose Python for Beginners?

Python's popularity among beginners stems from several key advantages:

- **Easy to Learn:** Python's syntax resembles natural language, reducing the learning curve for new programmers.
- **Versatile:** Python supports various programming paradigms, including procedural, object-oriented, and functional programming.
- **Wide Community and Resources:** A large community means abundant tutorials, forums, and libraries to assist your learning.
- **High-Level Language:** Python abstracts many complex details, allowing you to focus on solving problems rather than managing hardware specifics.

Getting Started with Python

Before diving into coding, ensure you have Python installed on your computer. You can download the latest version from the official Python website (python.org). Installation is straightforward and available for Windows, macOS, and Linux.

Setting Up Your Environment

Once installed, you can write Python code using various tools:

- **Python IDEs:** Integrated Development Environments like PyCharm, Visual Studio Code, or Thonny provide user-friendly interfaces for coding.

- **Online Interpreters:** Platforms like Replit or Google Colab allow you to code directly in your browser without any local setup.
- **Python Shell:** The built-in interactive shell (REPL) lets you execute Python commands line-by-line for quick testing.

Basic Concepts and Syntax

Understanding the core concepts and syntax is vital for writing effective Python programs.

Variables and Data Types

Variables are containers for storing data. Python supports various data types:

- **Numbers:** Integers (`int`) and floating-point numbers (`float`).
- **Strings:** Text data enclosed in quotes.
- **Booleans:** Logical values: `True` and `False`.
- **Lists, Tuples, and Dictionaries:** Collections of data.

Example:

```
```python
```

```
name = "Alice" String
```

```
age = 25 Integer
```

```
height = 5.6 Float
```

```
is_student = True Boolean
```

```
```
```

Operators

Operators perform operations on variables and values:

- Arithmetic: `+`, `-`, `*`, `/`, `%`, `**` (exponentiation)
- Comparison: `==`, `!=`, `>`, `=`, `<`
- Logical: `and`, `or`, `not`

Control Structures

Control structures help your program make decisions and repeat actions.

If Statements

```
```python
if age > 18:
 print("Adult")
else:
 print("Minor")
```
```

Loops

- For Loop: Iterates over a sequence

```
```python
for i in range(5):
 print(i)
```
```

- While Loop: Repeats while a condition is true

```
```python
count = 0

while count
 print(count)
```

```
count += 1
```

```
'''
```

## Functions and Modules

Functions are blocks of reusable code. Modules are files containing Python code that can be imported.

### Defining Functions

```
```python
```

```
def greet(name):
```

```
    return f"Hello, {name}!"
```

```
print(greet("Alice"))
```

```
'''
```

Importing Modules

Python has a rich standard library. For example, to generate random numbers:

```
```python
```

```
import random
```

```
print(random.randint(1, 10))
```

```
'''
```

## Working with Data Structures

Data structures organize data efficiently.

### Lists

Ordered, mutable collections.

```
```python
```

```
fruits = ["apple", "banana", "cherry"]
```

```
fruits.append("orange")
```

```
print(fruits)
```

```
```
```

## Tuples

Ordered, immutable collections.

```
```python
```

```
coordinates = (10.0, 20.0)
```

```
```
```

## Dictionaries

Key-value pairs.

```
```python
```

```
person = {"name": "Alice", "age": 25}
```

```
print(person["name"])
```

```
```
```

## File Handling

Python makes it easy to read from and write to files.

```
```python
```

Writing to a file

with open("example.txt", "w") as file:

```
file.write("Hello, World!")
```

Reading from a file

with open("example.txt", "r") as file:

```
content = file.read()
```

```
print(content)
```

```
...
```

Practical Tips for Beginners

- Practice Regularly: Consistency helps reinforce learning.
- Write Comments: Use comments to explain your code.
- Break Down Problems: Divide complex tasks into smaller parts.
- Utilize Resources: Leverage online tutorials, forums, and documentation.
- Build Projects: Create small projects to apply your skills.

Advanced Topics to Explore After Mastering the Basics

Once comfortable with the fundamentals, consider exploring:

- Object-Oriented Programming (OOP)
- Error and Exception Handling
- Working with APIs
- Data Analysis with Pandas and NumPy
- Web Development using Django or Flask

Conclusion

Python programming for beginners learn the basics is a rewarding journey that opens up a world of possibilities. By understanding core concepts like variables, control structures, functions, and data structures, you lay a strong foundation for more advanced topics. Remember, the key to becoming proficient in Python is consistent practice and a willingness to experiment. Start coding today, utilize the wealth of resources available online, and gradually build your skills to become a competent Python developer.

Embark on your Python programming adventure now and turn your ideas into reality!

Python Programming for Beginners: Learn the Basics

Embarking on your coding journey can be both exciting and overwhelming, especially with the multitude of programming languages available. Among them, Python programming for beginners learn the basics stands out as one of the most approachable and versatile options. Designed with simplicity and readability in mind, Python has become a popular choice for newcomers eager to understand the fundamentals of coding, as well as for seasoned developers working on complex projects. In this guide, we'll walk through the essential concepts to help you start your Python programming adventure confidently.

Why Choose Python for Beginners?

Before diving into the core concepts, it's helpful to understand why Python is so often recommended for those just starting out:

- **Readable Syntax:** Python's code resembles plain English, making it easier for beginners to understand and write.
- **Large Community & Resources:** Extensive tutorials, forums, and documentation are available to support learners.
- **Versatility:** Python is used in web development, data science, artificial intelligence, automation, and more.
- **Ease of Learning Curve:** The language simplifies many programming concepts, enabling quicker grasping of fundamentals.

Setting Up Your Python Environment

Before writing your first lines of code, you need to set up a development environment:

Installing Python

- Visit the official Python website at [python.org](https://www.python.org).
- Download the latest stable release compatible with your operating system (Windows, macOS, Linux).
- Follow installation prompts, ensuring you check the option to add Python to your system PATH.

Choosing a Code Editor

While you can write Python code in any text editor, specialized IDEs streamline the learning process:

- IDLE: Comes bundled with Python, perfect for beginners.
- VS Code: Popular, lightweight, with many extensions.
- PyCharm: Feature-rich IDE, ideal for larger projects.

Running Your First Python Program

Open your chosen editor, create a new file named `hello.py`, and type:

```
```python

print("Hello, World!")

```
```

Save and run the script:

- In IDLE, press F5.
- In terminal or command prompt, navigate to the file directory and type:

```
```bash

python hello.py

```
```

Congratulations! You've just executed your first Python program.

Core Concepts in Python Programming for Beginners

Now that your environment is set up, let's explore the foundational concepts that form the basis of Python programming.

- Variables and Data Types

Variables are containers for storing data. Python is dynamically typed, so you don't need to declare

types explicitly.

Basic Data Types:

- Integers: Whole numbers (`5`, `-3`)
- Floats: Decimal numbers (`3.14`, `-0.001`)
- Strings: Text (`"Hello"`, `'Python'`)
- Booleans: True or False (`True`, `False`)
- Lists: Ordered collections (`[1, 2, 3]`)
- Dictionaries: Key-value pairs (`{'name': 'Alice', 'age': 25}`)

Example:

```
```python
name = "Alice"

age = 25

is_student = True
```
```

- Basic Input and Output

Interacting with users is fundamental:

Output:

```
```python
print("Welcome to Python!")
```
```

Input:

```
```python
```

```
name = input("Enter your name: ")
```

```
print("Hello, " + name + "!")
```

```
...
```

## - Operators and Expressions

Operators help perform calculations and comparisons:

- Arithmetic Operators: `+`, `-`, `*`, `/`, `//` (floor division), `%` (modulus), `**` (exponentiation)
- Comparison Operators: `==`, `!=`, `>`, `<`, `>=`, `<=`
- Logical Operators: `and`, `or`, `not`

Example:

```
```python
```

```
a = 10
```

```
b = 5
```

```
sum = a + b
```

```
is_greater = a > b
```

```
...
```

- Control Flow: Conditions and Loops

Control structures guide the flow of your program.

Conditional Statements

```
```python
```

```
age = int(input("Enter your age: "))
```

```
if age >= 18:

 print("You're an adult.")

else:

 print("You're a minor.")

'''
```

## Loops

### - While Loop:

```
```python

count = 0

while count < 5:
    print(count)
    count += 1

'''
```

- For Loop:

```
```python

for i in range(5):
 print(i)

'''
```

### - Functions: Reusable Blocks of Code

Functions enhance code modularity.

```
```python
```

```
def greet(name):
```

```
    return "Hello, " + name + "!"
```

```
print(greet("Alice"))
```

```
```
```

Key points:

- Define with `def`.
- Use parameters to pass data.
- Return values with `return`.

- Data Structures

Mastering data structures is crucial:

- Lists: Mutable sequences

```
```python
```

```
fruits = ["apple", "banana", "cherry"]
```

```
fruits.append("orange")
```

```
```
```

- Tuples: Immutable sequences

```
```python
```

```
coordinates = (10.0, 20.0)
```

```
```
```

- Dictionaries: Key-value mappings

```
```python
```

```
person = {"name": "Bob", "age": 30}
```

```
```
```

- Sets: Unordered collections of unique elements

```
```python
```

```
unique_numbers = {1, 2, 3, 2}
```

```
```
```

## Practical Tips for Learning Python

- Practice Regularly: Coding is a skill best developed through consistent practice.
- Start Small: Build simple programs before moving to complex projects.
- Utilize Resources: Use online tutorials, forums, and documentation.
- Experiment: Don't be afraid to modify code snippets to see different outcomes.
- Debug Thoughtfully: Learn to read error messages and troubleshoot.

## Next Steps in Your Python Learning Journey

Once you've grasped the basics, consider exploring:

- File Handling: Reading from and writing to files.
- Object-Oriented Programming: Classes and objects.
- Libraries and Modules: Extend functionality with packages like NumPy, Pandas, or Flask.
- Projects: Build small applications like calculators, to-do lists, or web scrapers.

## Conclusion

Python programming for beginners learn the basics by laying a solid foundation in syntax, control flow, data structures, and core programming principles. Its simplicity and readability make it the ideal first language, enabling you to quickly develop confidence and competence. Remember, the key to

mastering Python?or any programming language?is consistent practice, curiosity, and a willingness to learn from challenges. Happy coding!

**Question** Answer What is Python and why is it recommended for beginners? Python is a high-level, interpreted programming language known for its simplicity and readability. It's recommended for beginners because its syntax is easy to learn, and it has a large community and extensive libraries that make learning and developing projects more accessible. What are the basic data types in Python? Python's basic data types include integers (int), floating-point numbers (float), strings (str), booleans (bool), lists, tuples, sets, and dictionaries. These form the foundation for storing and manipulating data in Python programs. How do I write and run my first Python program? You can write your first Python program by creating a file with a .py extension, such as 'hello.py', and adding code like 'print("Hello, World!")'. To run it, open your terminal or command prompt, navigate to the file's directory, and type 'python hello.py'. What are variables in Python and how do I use them? Variables in Python are used to store data. You assign values to variables using the '=' operator, for example, 'x = 10'. You can then use these variables in your code to perform operations or display data. What are control structures in Python? Control structures allow you to control the flow of your program. Common control structures include 'if' statements for conditional execution, 'for' and 'while' loops for repeated actions, enabling your program to make decisions and iterate over data. How do functions work in Python? Functions are blocks of reusable code that perform a specific task. In Python, you define a function using the 'def' keyword, e.g., 'def greet():', and call it by its name. Functions help organize code and reduce repetition. What is error handling in Python? Error handling in Python involves using 'try' and 'except' blocks to catch and manage exceptions that may occur during program execution. This ensures your program can handle unexpected errors gracefully without crashing. How can I learn Python effectively as a beginner? Start with basic tutorials and practice writing simple programs. Use online courses, coding exercises, and projects to apply what you learn. Consistent practice and exploring real-world problems help solidify your understanding. What are some common libraries I should learn for Python beginners? For beginners, popular libraries include 'NumPy' for numerical computations, 'Pandas' for data manipulation, 'Matplotlib' for plotting, and 'Requests' for making HTTP requests. These libraries extend Python's capabilities and are widely used in various domains.

**Related keywords:** Python, programming, beginners, learn, basics, coding, tutorial, Python syntax, beginner guide, programming fundamentals

## Shelly Cashman Programming

**shelly cashman programming** has established itself as a cornerstone in the world of computer science education, especially for beginners and students aiming to build a solid foundation in

programming. As an educator and author, Shelly Cashman has contributed significantly to the development of comprehensive textbooks, online resources, and courses that simplify complex programming concepts. If you're exploring programming or enhancing your skills, understanding the role of Shelly Cashman programming resources can be highly beneficial. This article delves into the key aspects of Shelly Cashman programming, its history, curriculum, and why it remains a preferred choice for learners worldwide.

## Understanding Shelly Cashman Programming

Shelly Cashman programming refers to a series of textbooks, online tutorials, and course materials authored primarily by the Shelly Cashman Series, designed to teach programming fundamentals across various languages and platforms. These resources are widely used in academic institutions and self-paced learning environments due to their clear explanations, practical approach, and step-by-step instructions.

## The Origins and Evolution of Shelly Cashman Series

The Shelly Cashman Series was first introduced in the 1980s, focusing initially on computer literacy and basic programming. Over the decades, it has expanded to cover a broad range of programming languages such as:

- Python
- Java
- C++
- Visual Basic
- HTML/CSS
- JavaScript

This evolution reflects the changing landscape of technology and programming, ensuring learners are equipped with contemporary skills.

## Key Features of Shelly Cashman Programming Resources

- **Structured Learning Path:** The materials are organized sequentially, starting from fundamental concepts to more advanced topics.
- **Practical Exercises:** Each chapter includes exercises, projects, and quizzes to reinforce learning.
- **Real-World Applications:** Concepts are linked to real-world scenarios to demonstrate their relevance.

- Visual Aids: Diagrams, screenshots, and step-by-step instructions facilitate better comprehension.
- Online and Digital Resources: Many textbooks come with companion websites, videos, and interactive content.

## Core Programming Topics Covered

Shelly Cashman programming textbooks typically cover a comprehensive array of topics essential for budding programmers. These include:

### Basic Programming Concepts

- Variables and Data Types
- Operators and Expressions
- Control Structures (if statements, loops)
- Functions and Procedures
- Arrays and Collections

### Object-Oriented Programming

- Classes and Objects
- Inheritance and Polymorphism
- Encapsulation
- Interfaces and Abstract Classes

### Web Development

- HTML and CSS fundamentals
- JavaScript basics
- Responsive design principles

### Database Management

- Introduction to SQL
- Data Modeling
- CRUD Operations

## Software Development Principles

- Debugging and Error Handling
- Version Control
- Software Testing

## Why Choose Shelly Cashman Programming Resources?

Choosing the right learning materials is crucial for success in programming. Shelly Cashman resources stand out for several reasons:

### 1. Pedagogical Approach

The series emphasizes a learner-friendly approach, breaking down complex topics into manageable lessons. The gradual progression ensures that students build confidence as they advance.

### 2. Comprehensive Coverage

Whether you're a beginner or an intermediate programmer, Shelly Cashman textbooks offer material suitable for various skill levels, covering foundational to advanced concepts.

### 3. Practical Focus

By integrating real-world projects and exercises, learners gain hands-on experience, which is vital for understanding and retention.

### 4. Updated Content

The series regularly updates its content to reflect current industry standards, programming languages, and tools, ensuring learners stay relevant.

### 5. Supportive Learning Environment

Many resources include online tutorials, video lectures, and community forums that foster interactive learning.

## Using Shelly Cashman Programming Resources Effectively

To maximize your learning experience with Shelly Cashman programming materials, consider the following tips:

- Follow the structured chapters sequentially to build a solid foundation.
- Complete all exercises and projects to reinforce your understanding.
- Utilize supplementary online resources for additional practice and clarification.
- Join study groups or online forums to discuss concepts and solve problems collaboratively.
- Apply learned skills to real-world projects or personal initiatives to solidify your knowledge.

## Advantages of Learning Programming with Shelly Cashman

Learning programming through Shelly Cashman resources offers numerous benefits:

- **Clarity and Simplicity:** Clear explanations make complex topics accessible.
- **Structured Learning Path:** Organized content guides learners from basics to advanced topics.
- **Practical Approach:** Emphasis on hands-on exercises enhances real-world readiness.
- **Flexibility:** Suitable for classroom settings, self-study, or online courses.
- **Industry-Relevant Skills:** Focus on current programming languages and tools prepares learners for the job market.

## Conclusion

**shelly cashman programming** remains a trusted resource for students, educators, and self-learners aiming to develop programming skills efficiently and effectively. Its comprehensive curriculum, pedagogical strengths, and practical orientation make it an excellent choice for anyone embarking on a coding journey or seeking to deepen their understanding of computer programming. By leveraging Shelly Cashman's structured approach and extensive resources, learners can gain confidence and competence in various programming languages and concepts, paving the way for academic success and professional growth.

Whether you're just starting or looking to expand your expertise, Shelly Cashman programming resources provide a solid foundation and continuous support to help you achieve your goals in the dynamic world of technology.

### Shelly Cashman Programming

In the realm of computer education, few brands have established as enduring a reputation as Shelly Cashman. Renowned primarily for their comprehensive instructional materials in computer science and programming, the Shelly Cashman Programming series has become a cornerstone for both students and educators seeking a structured, accessible approach to learning programming fundamentals. This article offers an in-depth review of Shelly Cashman Programming, exploring its history, structure, content, pedagogical approach, and the key features that make it a standout resource in the world of programming education.

## Overview and Historical Context

Founded in the late 20th century, the Shelly Cashman Series was originally developed to supplement classroom instruction with textbooks that emphasized clarity, practical application, and step-by-step guidance. Over the years, the series expanded to encompass a wide array of IT and computer science topics, with programming being a significant focus area.

Shelly Cashman Programming materials are typically authored by experienced educators and industry professionals, ensuring that the content remains current and relevant. The series has adapted to technological shifts, from early BASIC and Pascal programming to modern languages such as Python, Java, C++, and C. Its longevity and adaptability underscore its effectiveness as an educational tool.

## Core Components of Shelly Cashman Programming Resources

The Shelly Cashman Programming suite generally comprises textbooks, supplementary workbooks, online resources, and instructor-led materials. Each component is designed to reinforce learning and facilitate mastery of programming concepts.

### Textbooks

The textbooks serve as the backbone of the series, offering comprehensive coverage of programming concepts, syntax, and problem-solving techniques. They are characterized by:

- Clear Language: Concepts are explained using straightforward language, avoiding unnecessary jargon, making complex ideas accessible to beginners.
- Structured Chapters: Each chapter builds upon the previous, gradually increasing in complexity, with logical progression from basic syntax to advanced topics.
- Visual Aids: Diagrams, flowcharts, and screenshots help illustrate programming logic and user interface design.
- Practical Examples: Real-world scenarios and mini-projects reinforce understanding and show practical applications.

### Supplementary Materials

To enhance the learning experience, Shelly Cashman offers:

- Workbooks and Practice Exercises: These provide hands-on opportunities to practice coding skills, often with step-by-step guided exercises.

- Online Resources: Interactive tutorials, coding labs, quizzes, and video lectures are available to supplement the textbooks.
- Instructor Resources: For educators, there are slides, test banks, and solution manuals that facilitate classroom instruction.

## **Pedagogical Approach and Effectiveness**

One of the distinguishing features of the Shelly Cashman Programming series is its pedagogical philosophy, which emphasizes clarity, logical progression, and active learning.

### **Step-by-Step Instruction**

The series excels at breaking down complex programming tasks into manageable steps. Each concept is introduced with a simple explanation, followed by illustrative examples, and then reinforced through practice exercises. This scaffolded approach helps students develop confidence and competence gradually.

### **Hands-On Learning**

Practical exercises are woven throughout the materials, encouraging students to write code, debug, and analyze programs actively. The inclusion of real-world projects helps students see the relevance of their skills.

### **Visual Learning Aids**

Visual aids such as flowcharts and diagrams clarify program flow and logic, catering to visual learners and reinforcing comprehension.

### **Progressive Complexity**

The curriculum is carefully structured so that foundational concepts are mastered before moving to more advanced topics, reducing cognitive overload and building a solid knowledge base.

## **Coverage of Programming Languages**

The series has evolved to include a variety of programming languages, each tailored to different learning objectives and industry needs:

- Python: Known for simplicity and readability, Python is ideal for beginners and rapid application development.

- Java: Widely used in enterprise applications, Java materials focus on object-oriented programming and platform independence.
- C++: For students interested in systems programming and performance-critical applications, C++ coverage includes memory management and advanced data structures.
- C: Popular in game development and Windows applications, C tutorials emphasize event-driven programming and .NET framework integration.
- JavaScript: As a cornerstone of web development, JavaScript modules cover client-side scripting and interactive web pages.

Each language section typically includes syntax fundamentals, control structures, data types, functions, object-oriented principles, and project-based exercises.

## Strengths and Unique Features

Shelly Cashman Programming distinguishes itself through several key strengths:

### Clarity and Accessibility

The materials are designed to be approachable for newcomers, with jargon minimized and explanations detailed yet concise.

### Structured Learning Path

The logical sequence of topics enables learners to build a robust understanding incrementally, reducing frustration and confusion.

### Integration of Theory and Practice

The series balances theoretical concepts with practical coding exercises, fostering both understanding and skill acquisition.

### Multi-Platform and Language Support

Offering resources across various programming languages and platforms accommodates diverse learning needs and interests.

### Supplemental Digital Resources

Interactive online labs, quizzes, and videos enhance engagement and cater to different learning styles.

## Limitations and Considerations

While Shelly Cashman Programming is highly regarded, potential limitations include:

- Curriculum Scope: As with any textbook series, some topics may be simplified for beginners, requiring supplementary materials for advanced learners.
- Language Focus: Depending on updates, some languages may not be covered in depth or may lag behind industry trends.
- Pedagogical Style: The step-by-step approach, while accessible, might lack the depth necessary for students seeking more rigorous or theoretical understanding.

## Ideal Audience and Usage Context

Shelly Cashman Programming is particularly well-suited for:

- Beginner programmers: Those new to coding or programming concepts.
- High school or introductory college courses: As primary textbooks or supplementary resources.
- Self-learners: Individuals seeking structured guidance and practice.
- Instructors: Looking for comprehensive, ready-made teaching materials.

## Conclusion: A Valuable Educational Tool

In summary, Shelly Cashman Programming stands out as a comprehensive, user-friendly resource that effectively bridges the gap between theoretical understanding and practical application. Its structured approach, clear explanations, and extensive supplementary materials make it a reliable choice for beginners and educators aiming to foster foundational programming skills.

While it may not replace more advanced or specialized texts for experienced programmers, its strengths lie in its accessibility and pedagogical design, making programming less intimidating and more approachable for learners at various stages. As the landscape of programming continues to evolve, the Shelly Cashman series remains a trusted companion, adapting its content to meet the needs of new generations of programmers and continuing its legacy of quality technical education.

**Question** What are the key topics covered in Shelly Cashman Programming textbooks? Shelly Cashman Programming textbooks typically cover programming fundamentals, including syntax, algorithms, data structures, object-oriented programming, and popular languages like C++, Java, and Python, along with practical problem-solving exercises. **Answer** How can I effectively use Shelly Cashman Programming resources for learning coding? To effectively utilize Shelly Cashman Programming resources, follow a structured approach by completing all exercises, reviewing

example code, participating in online forums, and practicing coding regularly to reinforce concepts and improve problem-solving skills. Are Shelly Cashman Programming textbooks suitable for beginners? Yes, Shelly Cashman Programming textbooks are designed to be accessible for beginners, providing clear explanations, step-by-step instructions, and practical examples to help new learners grasp programming fundamentals. What are some popular Shelly Cashman Programming titles for advanced programmers? For more advanced learners, titles such as 'Programming with C++,' 'Java Programming,' and 'Python Programming: A Comprehensive Guide' offer in-depth coverage of complex topics and advanced programming techniques. Where can I find online supplementary materials for Shelly Cashman Programming courses? Online supplementary materials for Shelly Cashman Programming courses are usually available through the publisher's website, educational platforms like MyITLab, or through instructor-provided resources that include practice quizzes, labs, and coding projects.

**Related keywords:** Shelly Cashman, programming tutorials, computer science education, programming textbooks, beginner programming, programming courses, coding lessons, programming exercises, software development, programming fundamentals

**Read the full article online:** [shelly cashman programming](#)