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Study Guide – Chapter 29: Programming Languages and Concepts

Learning Objectives

By the end of this chapter, you should be able to:

- Describe the purpose of programming languages.
- Identify and define programming elements: variables, data types, arrays, functions, objects, etc.
- Distinguish between scripting and general-purpose programming.
- Understand control structures such as branching and looping.
- Recognize the difference between compiled and interpreted languages.

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1. Identifiers

- **Identifiers** are the names used to identify **variables**, **functions**, **objects**, and other user-defined elements.
- Must follow naming rules (e.g., no spaces, can't start with a digit, avoid reserved words).
- Example:

```python
CopyEdit
userName = "Alex"  # userName is an identifier
```

2. Variables and Data Types

Variables

- A **variable** is a container that stores data.
- You can assign values to variables using the = operator.

```python
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age = 25
```

Data Types

Data Type	Description	Example
Integer	Whole numbers	5, -100, 0
Float	Decimal or floating-point numbers	3.14, -0.01
String	Textual data	"hello", 'Z9'
Boolean	True/False values	True, False

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3. Text vs. Numeric Data

Text Data (Strings)

- Represented by characters inside quotes (" " or ' ').
- Example:

```python
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first_name = "Thomas"
zip_code = "80920"  # Even though it's numeric, it's text.
```

Note: ZIP codes should be stored as strings, not integers, because they can start with 0 and are not used for calculations.

Numeric Data

- Used for calculations and measurements.
- Can be **integers** (whole numbers) or **floats** (decimals).

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4. Boolean Data

- Only two possible values: `True` or `False`.
- Common in decision-making and control flow.
- Example:

```python
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is_logged_in = True
has_permission = False
```

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5. Containers: Arrays and Lists

Arrays / Lists

- Store **multiple values** in a single variable.
- Items are indexed (starting from 0 in most languages).
- Example (Python list):

```python
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colors = ["red", "green", "blue"]
print(colors[0])   # Outputs: red
```

Arrays are used for managing **collections** of items such as user inputs, scores, or data records.

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6. Functions

- A **function** is a reusable block of code that performs a task.
- You define it once and call it multiple times.

```python
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```

```
def greet(name):
    print("Hello, " + name)

greet("Alex")
```

- Functions may accept **parameters** and may return **values**.

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7. Objects (Introduction)

- **Objects** are instances of **classes**, which define a blueprint for data structures.
- They group **data (attributes)** and **behavior (methods)**.

Example in Python:

```
python
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class Dog:
    def bark(self):
        print("Woof!")

my_dog = Dog()
my_dog.bark()
```

Objects are central to **object-oriented programming (OOP)**.

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8. Control Structures: Branching and Looping

Already introduced in Chapter 28, but briefly:

Branching:

```
python
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if is_valid:
    print("Proceed")
else:
    print("Stop")
```

Looping:

```
python
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```

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

9. Scripting vs. General-Purpose Programming

- **Scripting** is often used to automate simple tasks.
- **Programming** is broader, encompassing application development, logic design, etc.
- Examples of scripting: Python, Bash, PowerShell
- General-purpose languages: Java, C++, C#

Key Terms to Know

- Identifier
- Variable
- Data type
- Array (or list)
- Function
- Object
- Boolean
- String
- Float
- Integer
- Compiler / Interpreter
- Scripting

Practice Questions

1. What's the difference between a string and an integer?
2. Why is a ZIP code stored as text instead of a number?
3. Write a Python function that takes a number and prints its square.
4. What data type is best for storing:
   a) "Colorado"
   b) 3.14159
   c) True
   d) 90210
5. Create a list that contains 3 colors and print the second one.

Answers to Practice Questions

1. A **string** stores text, while an **integer** stores whole numbers used in calculations.
2. ZIP codes are not used for arithmetic and can begin with 0; storing them as strings preserves formatting.
3. python
   CopyEdit
   ```python
   def square(num):
       print(num * num)
   square(4)   # Output: 16
   ```

4. a) String
   b) Float
   c) Boolean
   d) String (not Integer)
5. python
   CopyEdit
   ```python
   colors = ["red", "green", "blue"]
   print(colors[1])   # Output: green
   ```