

My Python Course Notes

Structured Revision for Every Lesson

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Contents

1 Lesson 1: Print Function – Full Usage Guide

```
1 # PRINT FUNCTION – FULL USAGE GUIDE
2
3 # Basic Syntax:
4 # print(*objects, sep=' ', end='\n', file=sys.stdout, flush=False)
5
6 # Parameters:
7 # *objects → One or more objects to be printed (comma-separated).
8 # sep      → String inserted between objects. Default is ' ' (space).
9 # end      → String appended after the last object. Default is '\n' (new line).
10 # file     → A file-like object (stream); default is sys.stdout.
11 # flush    → If True, forcibly flush the stream. Default is False.
12
13 # -----
14
15 # 1. Basic print
16 print("Hello, World!") # Hello, World!
17
18 # 2. Printing multiple objects
19 print("Hello", "Python", 3) # Hello Python 3
20
21 # 3. Using 'sep' to change separator
22 print("2025", "05", "27", sep="-") # 2025-05-27
23
24 # 4. Using 'end' to avoid new line
25 print("Loading", end="...") # Loading...
26
27 # 5. Using custom separator and end together
28 print("Name", "Age", sep=": ", end=" years\n") # Name: Age years
29
30 # 6. Printing to a file
31 with open("output.txt", "w") as f:
32     print("Saving this line to a file.", file=f)
33
34 # 7. Forcing flush (useful in loops/real-time output)
35 import time
36 for i in range(3):
37     print(i, end=" ", flush=True)
38     time.sleep(0.5) # Output appears immediately
39
40 # 8. Printing escape characters
41 print("Line1\nLine2") # New line
42 print("Tabbed\tSpace") # Tab space
43 print("He said \"hello\"") # Quotes inside string
44
45 # 9. Printing with formatted strings (f-strings)
46 name = "Siddhart"
47 age = 21
48 print(f"Hello, my name is {name} and I am {age} years old.")
49
50 # 10. Using print with unpacking
51 nums = [1, 2, 3, 4]
52 print(*nums) # 1 2 3 4
53 print(*nums, sep=", ") # 1, 2, 3, 4
54
55 # 11. Printing Unicode/emojis (note: removed for LaTeX safety)
56 print("Python is fun")
```

Additional Functions Used in This Lesson

Referenced Functions – Syntax and Output Type

Function	Syntax	Return / Output Type
with open()	with open("file.txt", "w") as f:	File object
print(..., file=f)	print("text", file=f)	Writes to file, returns None
range()	range(3) or range(start, stop, step)	Range object (iterable)
time.sleep()	time.sleep(seconds)	None (pauses execution)

2 Lesson 2: Input Function – Full Usage Guide

```

1 # INPUT FUNCTION – FULL USAGE GUIDE
2
3 # Basic Syntax:
4 # input(prompt='')
5
6 # Parameters:
7 # prompt → A string, written to standard output without a trailing newline,
8 #         to ask the user for input. Default is an empty string ''.
9 # Returns → A string entered by the user (always str type).
10 # Notes → Always returns a string. You need to convert it using int(), float(), etc. if needed.
11
12 # -----
13
14 # 1. Basic usage with no prompt
15 user_input = input()
16 print("You entered:", user_input)
17
18 # 2. Input with a prompt
19 name = input("Enter your name: ")
20 print("Hello,", name)
21
22 # 3. Converting input to integer
23 age = int(input("Enter your age: "))
24 print("You will be", age + 1, "next year.")
25
26 # 4. Converting input to float
27 height = float(input("Enter your height in meters: "))
28 print("Your height in cm is", height * 100)
29
30 # 5. Reading multiple values (as strings)
31 x, y = input("Enter two words separated by space: ").split()
32 print("Word 1:", x)
33 print("Word 2:", y)
34
35 # 6. Reading and converting multiple values to int
36 a, b = map(int, input("Enter two integers: ").split())
37 print("Sum =", a + b)
38
39 # 7. Reading many values into a list of ints
40 numbers = list(map(int, input("Enter multiple numbers: ").split()))
41 print("You entered:", numbers)

```

```

42
43 # 8. Handling invalid input using try/except
44 try:
45     salary = float(input("Enter your monthly salary: "))
46     print("Yearly salary:", salary * 12)
47 except ValueError:
48     print("Invalid input! Please enter a number.")
49
50

```

Referenced Functions – Syntax and Output Type

Function / State-ment	Syntax	Return / Output Type
.split()	string.split() string.split("delimiter")	or List of strings
map()	map(function, iterable)	Map object (can be converted to list)
list()	list(iterable)	List object
try / except	try: code except ErrorType: fallback	Flow control – no return value; handles runtime errors

3 Lesson 3: Math Operators – Full Usage Guide

```

1 # MATH OPERATORS – FULL USAGE GUIDE
2
3 # Basic Syntax:
4 # <operand1> <operator> <operand2>
5
6 # Operators:
7 # + Addition      → a + b
8 # - Subtraction   → a - b
9 # * Multiplication → a * b
10 # / Division      → a / b
11 # // Floor Division → a // b
12 # % Modulus (Remainder) → a % b
13 # ** Exponentiation → a ** b
14
15 # -----
16
17 # 1. Addition
18 print("1 + 1 =", 1 + 1)
19
20 # 2. Subtraction
21 print("2 - 3 =", 2 - 3)
22
23 # 3. Multiplication
24 print("4 * 5 =", 4 * 5)
25
26 # 4. Division (always returns float)

```

```
27 print("6 / 3 =", 6 / 3)
28
29 # 5. Floor Division (truncates decimals)
30 print("7 // 2 =", 7 // 2)
31
32 # 6. Rounded division result using round()
33 number1 = 1.85
34 number2 = 1.35
35 number3 = 1.5
36 print(f"{number1} rounded is:", round(number1)) # 2
37 print(f"{number2} rounded is:", round(number2)) # 1
38 print(f"{number3} rounded is:", round(number3)) # 2
39
40 # 7. Exponentiation
41 print("3 ** 3 =", 3 ** 3) # 27
42
43 # 8. Modulus (Remainder)
44 print("20 / 6 =", 20 / 6) # Division
45 print("20 % 6 =", 20 % 6) # Remainder (2)
46
47 # 9. Operator Precedence in Python:
48 # 1. ()
49 # 2. **
50 # 3. * and /
51 # 4. + and -
52 # Evaluated left to right within same level
```

4 Lesson 4: Strings – Full Usage Guide

```
1 # STRINGS – FULL USAGE GUIDE
2
3 # Basic Explanation:
4 # A string is a sequence of characters enclosed in single ( ' ') or double ( " ") quotes.
5 # Strings are immutable in Python.
6
7 # -----
8 # 1. Creating Strings
9 name = 'math' # single-quoted string
10 subject = "math" # double-quoted string
11
12 # 2. String Addition and Printing
13 print("math" + "works") # mathworks
14 print("math", "works") # math works
15
16 # 3. String Multiplication
17 string1 = "hello"
18 string2 = "world"
19 number = 5
20
21 print(string1, string2) # hello world
22 print(string1 + string2) # helloworld
23 print(string1 * number) # hellohellohellohellohello
24
25 # 4. Invalid Concatenation Example
26 # print(string1 + number) # TypeError: can only concatenate str (not "int")
27
28 # STRING METHODS – TOP 10 DEFINITIONS
29
```

```
30 text = "hello WORLD"
31
32 # 5. capitalize()
33 # Returns string with first character uppercased, rest lowercased.
34 print(text.capitalize()) # Hello world
35
36 # 6. lower()
37 # Converts all characters to lowercase.
38 print(text.lower())      # hello world
39
40 # 7. title()
41 # Capitalizes first letter of each word.
42 print(text.title())      # Hello World
43
44 # 8. casefold()
45 # Aggressive lowercase, suitable for comparisons.
46 text2 = "Straße"
47 print(text2.casefold())  # strasse
48
49 # 9. upper()
50 # Converts all characters to uppercase.
51 print(text.upper())      # HELLO WORLD
52
53 # 10. count()
54 # Counts how many times a substring appears.
55 print(text.count("l"))   # 3
56 print(text.count("l", 3, 6)) # 1
57
58 # 11. find()
59 # Finds index of substring, or -1 if not found.
60 print(text.find("WORLD")) # 6
61 print(text.find("not_here")) # -1
62
63 # 12. replace()
64 # Replaces substring with another.
65 print(text.replace("WORLD", "Python")) # hello Python
66 print(text.replace("l", "x", 2))      # heXXo WORLD
67
68 # 13. swapcase()
69 # Swaps uppercase to lowercase and vice versa.
70 print("Hello World".swapcase()) # hELLO wORLD
71
72 # 14. join()
73 # Joins elements of iterable with separator.
74 words = ["hello", "world"]
75 print("-".join(words))          # hello-world
```

Referenced Methods – Syntax and Output Type

Method / Function	Syntax	Return / Output Type
<code>.capitalize()</code>	<code>str.capitalize()</code>	str
<code>.lower()</code>	<code>str.lower()</code>	str
<code>.title()</code>	<code>str.title()</code>	str
<code>.casefold()</code>	<code>str.casefold()</code>	str
<code>.upper()</code>	<code>str.upper()</code>	str
<code>.count()</code>	<code>str.count(substring, start, end)</code>	int
<code>.find()</code>	<code>str.find(substring, start, end)</code>	int
<code>.replace()</code>	<code>str.replace(old, new, count)</code>	str
<code>.swapcase()</code>	<code>str.swapcase()</code>	str
<code>.join()</code>	<code>"separator".join(iterable)</code>	str

5 Lesson 5: If, Else, and Conditional Operators

```

1  # IF / ELSE / ELIF - FULL USAGE GUIDE
2
3  # Basic Syntax:
4  # if condition:
5  #     block of code
6  # elif another_condition:
7  #     another block
8  # else:
9  #     fallback block
10
11 # Conditional Operators:
12 # ==   → Equal to           → (x == y)
13 # !=   → Not equal to      → (x != y)
14 # <     → Less than         → (x < y)
15 # <=    → Less than or equal to → (x <= y)
16 # >     → Greater than      → (x > y)
17 # >=    → Greater than or equal to → (x >= y)
18
19 # Logical Operators:
20 # and   → True if both are True → (x > 5 and x < 10)
21 # or    → True if at least one is True → (x > 5 or x < 3)
22 # not   → Inverts the truth value → not (x > 5)
23
24 # -----
25
26 # 1. Simple if statement
27 x = 10
28 if x > 5:
29     print("x is greater than 5")
30
31 # 2. if-else statement
32 if x % 2 == 0:
33     print("x is even")
34 else:
35     print("x is odd")
36
37 # 3. if-elif-else ladder
38 grade = 85
39 if grade >= 90:
40     print("Grade: A")

```



```
41 elif grade >= 80:
42     print("Grade: B")
43 elif grade >= 70:
44     print("Grade: C")
45 else:
46     print("Grade: F")
47
48 # 4. Nested if statements
49 number = 42
50 if number > 0:
51     if number % 2 == 0:
52         print("Positive even number")
53     else:
54         print("Positive odd number")
55 else:
56     print("Negative number or zero")
57
58 # 5. Using logical 'and'
59 age = 25
60 if age > 18 and age < 65:
61     print("Adult and working age")
62
63 # 6. Using logical 'or'
64 language = "Python"
65 if language == "Python" or language == "Java":
66     print("Popular programming language")
67
68 # 7. Using logical 'not'
69 is_logged_in = False
70 if not is_logged_in:
71     print("User not logged in")
72
73 # 8. Short form if-else (Ternary Expression)
74 # → Python provides a one-line shorthand for simple if-else statements.
75 # → Syntax: value_if_true if condition else value_if_false
76 # → Returns: One of two values based on the boolean result of the condition.
77
78 value = 8
79
80 # Traditional if-else version:
81 if value % 2 == 0:
82     result = "Even"
83 else:
84     result = "Odd"
85
86 print("Traditional form:", result) # Even
87
88 # Shortened using ternary expression:
89 result = "Even" if value % 2 == 0 else "Odd"
90 print("Ternary form:", result)    # Even
91
```

Referenced Operators – Syntax and Output Type

Operator	Syntax	Return / Output Type
== (Equal)	<code>x == y</code>	bool
!= (Not Equal)	<code>x != y</code>	bool
< (Less Than)	<code>x < y</code>	bool
<= (Less Than or Equal)	<code>x <= y</code>	bool
> (Greater Than)	<code>x > y</code>	bool
>= (Greater Than or Equal)	<code>x >= y</code>	bool
and (Logical AND)	<code>x > 5 and x < 10</code>	bool
or (Logical OR)	<code>x < 5 or x > 10</code>	bool
not (Logical NOT)	<code>not (x > 5)</code>	bool
Ternary Expression	<code>value1 if condition else value2</code>	Result of value1 or value2

6 Lesson 6: While Loop – Full Usage Guide

```

1 # WHILE LOOP – FULL USAGE GUIDE
2
3 # Basic Syntax:
4 # while condition:
5 #     block of code
6
7 # The code inside the loop runs repeatedly as long as the condition is True.
8
9 # -----
10
11 # 1. Basic while loop
12 counter = 0
13 while counter < 5:
14     print("Counter is:", counter)
15     counter += 1 # same as: counter = counter + 1
16
17 # 2. Using break to exit loop early
18 i = 0
19 while True:
20     if i == 3:
21         print("Breaking at", i)
22         break
23     print(i)
24     i += 1
25
26 # 3. Using continue to skip to next iteration
27 x = 0
28 while x < 5:
29     x += 1
30     if x == 3:
31         continue # skips printing 3
32     print("x =", x)
33
34 # 4. while loop with else block
35 z = 0
36 while z < 3:

```

```

37     print("z =", z)
38     z += 1
39 else:
40     print("Loop ended normally (no break)")
41
42 # 5. Infinite loop (be careful!)
43 # while True:
44 #     print("This runs forever")
45
46 # 6. Compound condition
47 n = 0
48 while n < 10 and n != 7:
49     print(n)
50     n += 2
51
52 # -----
53 # Counter update operators
54
55 # → counter += 1 → same as counter = counter + 1
56 # → counter -= 1 → same as counter = counter - 1
57 # → counter *= 2 → same as counter = counter * 2
58 # → counter /= 2 → same as counter = counter / 2
59
60 # Note:
61 # Python does NOT support the ++ or -- operators like other languages.
62 # Using x++ or x-- will cause a SyntaxError.

```

Referenced Keywords and Operators – Syntax and Output Type

Keyword / Operator	Syntax	Return / Effect
while	while condition:	Repeats block while condition is True
break	break	Immediately exits the nearest enclosing loop
continue	continue	Skips current iteration and continues with the next
+=	x += y	Updates: x = x + y
-=	x -= y	Updates: x = x - y
*=	x *= y	Updates: x = x * y
/=	x /= y	Updates: x = x / y
++ / --	Not supported in Python	Causes SyntaxError

7 Lesson 7: For Loop – Full Usage Guide

```
1 # FOR LOOP – FULL USAGE GUIDE
2
3 # Basic Syntax:
4 # for variable in iterable:
5 #     block of code
6
7 # -----
8 # 1. Using range()
9 # range(stop) → from 0 to stop-1
10 # range(start, stop) → from start to stop-1
11 # range(start, stop, step)
12
13 for i in range(5):
14     print("i =", i)
15
16 for i in range(2, 6):
17     print("From 2 to 5:", i)
18
19 for i in range(10, 0, -2):
20     print("Countdown by 2:", i)
21
22 # -----
23 # 2. Iterating over a list
24 fruits = ["apple", "banana", "cherry"]
25 for fruit in fruits:
26     print("Fruit:", fruit)
27
28 # 3. Iterating over a string
29 text = "hello"
30 for char in text:
31     print("Char:", char)
32
33 # 4. Iterating over a tuple
34 # A tuple is an ordered, immutable collection.
35 # You can iterate through it just like a list.
36 coordinates = (10, 20, 30)
37 for value in coordinates:
38     print("Value:", value)
39
40
41 # 5. Iterating over a set
42 # A set is an unordered collection of unique elements.
43 # Iteration works, but order is not guaranteed.
44 unique_numbers = {1, 2, 3}
45 for num in unique_numbers:
46     print("Unique:", num)
47
48
49 # 6. Iterating over a dictionary
50 # A dictionary stores key-value pairs.
51 # Iterating over it by default gives you the keys.
52 person = {"name": "Alice", "age": 25}
53 for key in person:
54     print("Key:", key, "| Value:", person[key])
55
56 # 7. Iterating with .items()
57 # .items() returns a list of (key, value) pairs from a dictionary.
58 # Useful when you need both key and value at once.
59 for key, value in person.items():
60     print(f"{key} => {value}")
```

```

61
62 # 8. Using enumerate()
63 # enumerate() gives both the index and the item during iteration.
64 colors = ["red", "green", "blue"]
65 for index, color in enumerate(colors):
66     print(f"{index}: {color}")
67
68
69 # 9. Using break
70 for n in range(5):
71     if n == 3:
72         break
73     print("Breaking loop at:", n)
74
75 # 10. Using continue
76 for n in range(5):
77     if n == 2:
78         continue
79     print("Continuing:", n)
80
81 # 11. Using else with for
82 for n in range(3):
83     print(n)
84 else:
85     print("Loop completed without break.")
86
87 # -----
88 # range() - Recap:
89 # range(stop)
90 # range(start, stop)
91 # range(start, stop, step)
92 # returns a range object which is an iterable of numbers

```

Referenced Iteration Helpers – Syntax and Output Type

Function / Method	Syntax	Return / Output Type
tuple	(a, b, c)	Iterable (ordered, immutable)
set	{a, b, c}	Iterable (unordered, unique)
dict.items()	dict.items()	Iterable of (key, value) pairs
enumerate()	enumerate(iterable)	Iterable of (index, item) tuples

8 Lesson 8: Functions – Full Usage Guide

```

1 # FUNCTIONS - FULL USAGE GUIDE
2
3 # Basic Syntax:
4 # def function_name(parameters):

```

```
5 #     block of code
6
7 # -----
8 # 1. Defining a basic function
9 def greet():
10     print("Hello from the function!")
11
12 # Call the function AFTER defining it
13 greet()
14
15 # -----
16 # 2. DOs and DON'Ts
17 # Don't call a function before it's defined:
18 # greet() # This would raise NameError if called before definition
19
20 # Always define before calling:
21 def welcome():
22     print("Welcome to Python!")
23
24 welcome()
25
26 # -----
27 # 3. Function that performs a task (prints something)
28 def print_sum(a, b):
29     print("The sum is:", a + b)
30
31 print_sum(4, 5) # Output: The sum is: 9
32
33 # -----
34 # 4. Function that calculates and returns a value
35 def get_sum(a, b):
36     return a + b
37
38 result = get_sum(10, 20)
39 print("Returned sum:", result)
40
41 # -----
42 # 5. Local vs Global Variables
43
44 # Global variable
45 counter = 100
46
47 def increase_counter():
48     # Local variable (does not affect global counter)
49     counter = 0
50     counter += 1
51     print("Local counter:", counter)
52
53 increase_counter()
54 print("Global counter remains:", counter)
55
56 # -----
57 # 6. Using 'global' keyword to modify global variable
58 count = 0
59
60 def modify_global():
61     global count
62     count += 1
63     print("Modified global count:", count)
64
65 modify_global()
66 print("Global count after function:", count)
```

9 Lesson 9: Lists – Introduction

```

1 # LISTS - INTRODUCTION
2
3 # What is a list?
4 # A list is a built-in data structure in Python that stores an ordered collection of items.
5 # Lists are mutable, meaning you can change their contents after creation.
6 # Defined using square brackets: []
7
8 # -----
9 # 1. Defining a simple list (homogeneous)
10 fruits = ["apple", "banana", "cherry"]
11 print("Fruits:", fruits)
12
13 # 2. List of numbers
14 numbers = [1, 2, 3, 4, 5]
15 print("Numbers:", numbers)
16
17 # 3. List of mixed data types
18 mixed = ["hello", 42, 3.14, True]
19 print("Mixed list:", mixed)
20
21 # 4. Empty list
22 empty = []
23 print("Empty list:", empty)
24
25 # 5. Nested list (list inside a list)
26 matrix = [[1, 2], [3, 4]]
27 print("Nested list:", matrix)
28
29 # 6. List using list() constructor
30 from_string = list("hello")
31 print("List from string:", from_string) # ['h', 'e', 'l', 'l', 'o']
32
33 # 7. List from range()
34 range_list = list(range(5))
35 print("List from range():", range_list) # [0, 1, 2, 3, 4]

```

List Types and Creation Methods

List Type	Syntax / Example	Notes
Homogeneous List	[1, 2, 3, 4]	All elements of the same type
String List	["apple", "banana"]	List of strings
Mixed-Type List	["hi", 42, 3.14, True]	Supports multiple data types
Empty List	[]	No elements yet
Nested List	[[1, 2], [3, 4]]	List inside a list
From String	list("abc")	Converts string into list of characters
From Range	list(range(5))	Converts range object into list

10 Lesson 10: List Methods – General Usage

```
1 # LIST METHODS – GENERAL PURPOSE
2
3 # Lists are mutable and support many built-in methods for adding, removing, searching, and modifying.
4
5 # 1. append()
6 # → Adds a single element to the end
7 items = ["pen", "book"]
8 items.append("pencil")
9 print("append():", items)
10
11 # 2. insert()
12 # → Inserts an element at a specific index
13 items.insert(1, "eraser")
14 print("insert():", items)
15
16 # 3. remove()
17 # → Removes the first matching value
18 items.remove("book")
19 print("remove():", items)
20
21 # 4. pop()
22 # → Removes and returns element at index (default = last)
23 removed = items.pop()
24 print("pop():", removed)
25 print("After pop:", items)
26
27 # 5. clear()
28 # → Empties the list
29 temp = ["a", "b"]
30 temp.clear()
31 print("clear():", temp)
32
33 # 6. copy()
34 # → Returns a shallow copy
35 original = ["x", "y", "z"]
36 cloned = original.copy()
37 print("copy():", cloned)
38
39 # 7. extend()
40 # → Adds multiple elements from another iterable
41 tools = ["pen", "pencil"]
42 tools.extend(["marker", "sharpener"])
43 print("extend():", tools)
44
45 # 8. index() [Use with care]
46 # → Finds index of first match; raises error if not found
47 names = ["Alice", "Bob", "Charlie"]
48 try:
49     idx = names.index("Bob")
50     print("index():", idx)
51 except ValueError:
52     print("Name not found")
53
54 # Alternative using 'in'
55 print("Eve" in names) # False
56
57 # 9. count()
58 # → Counts number of times an item appears
59 letters = ["a", "b", "a", "c", "a"]
60 print("count():", letters.count("a")) # 3
```



```

61
62 # 10. reverse()
63 # → Reverses the list in-place
64 words = ["start", "middle", "end"]
65 words.reverse()
66 print("reverse():", words)
67
68 # 11. sort() [Only works if items are comparable]
69 # → Sorts the list (only if all items can be compared)
70 languages = ["python", "c", "java"]
71 languages.sort()
72 print("sort():", languages)

```

Common List Methods – Overview Table

Method	Description	Return Value
append(x)	Add element x to the end	None
insert(i,x)	Insert x at index i	None
remove(x)	Remove first occurrence of x	None
pop(i)	Remove and return item at index i (last by default)	Element
clear()	Remove all items from the list	None
copy()	Return a shallow copy of the list	List copy
extend(iter)	Append elements from iterable	None
index(x)	Return first index of x (error if not found)	Integer
count(x)	Count occurrences of x	Integer
reverse()	Reverse items in-place	None
sort()	Sort the list in-place	None

11 Lesson 11: List Methods – Numeric Lists Only

```

1 # LIST METHODS – NUMERIC LISTS ONLY
2
3 # These methods are especially useful and commonly used with lists that contain only numbers.
4
5 # Numeric list for demonstration
6 numbers = [5, 2, 8, 3, 5, 1, 8]
7
8 # 1. sort()
9 # → Sorts the list in ascending order (in-place)
10 numbers.sort()
11 print("sort():", numbers) # [1, 2, 3, 5, 5, 8, 8]
12
13 # 2. reverse()
14 # → Reverses the list order in-place
15 numbers.reverse()
16 print("reverse():", numbers) # [8, 8, 5, 5, 3, 2, 1]
17
18 # 3. count()
19 # → Counts occurrences of a specific number
20 print("count(5):", numbers.count(5)) # 2

```

```

21
22 # 4. max()
23 # → Returns the largest number in the list
24 print("max():", max(numbers)) # 8
25
26 # 5. min()
27 # → Returns the smallest number in the list
28 print("min():", min(numbers)) # 1
29
30 # 6. sum()
31 # → Returns the sum of all elements
32 print("sum():", sum(numbers)) # 32
33
34 # 7. average (manual)
35 # → Average = sum / count
36 average = sum(numbers) / len(numbers)
37 print("Average:", average) # 4.571...
38
39 # 8. sorted()
40 # → Returns a new sorted list without modifying the original
41 original = [10, 3, 7]
42 sorted_list = sorted(original)
43 print("original:", original) # [10, 3, 7]
44 print("sorted():", sorted_list) # [3, 7, 10]

```

List Methods for Numbers – Reference Table

Method	Description	Return Value
sort()	Sort list in ascending order (in-place)	None
reverse()	Reverse the list (in-place)	None
count(x)	Count how many times x appears	Integer
max(lst)	Return maximum element	Element
min(lst)	Return minimum element	Element
sum(lst)	Sum of all list items	Numeric
sorted(lst)	Return a new sorted list	New list
avg = sum()/len()	Compute average (manual)	Float

12 Lesson 12: 2D Lists and Nested Loops

```

1 # 2D LISTS AND NESTED LOOPS - FULL GUIDE
2
3 # A 2D list is a list of lists (matrix/grid style)
4
5 # Defining a 3x3 grid
6 num_grid = [
7     [1, 2, 3],
8     [4, 5, 6],
9     [7, 8, 9]
10 ]
11
12 # -----
13 # 1. Accessing a specific element (row 0, column 0)

```

```
14 print("Top-left element:", num_grid[0][0]) # Output: 1
15
16 # 2. Accessing other positions
17 print("Middle element:", num_grid[1][1]) # Output: 5
18 print("Bottom-right:", num_grid[2][2]) # Output: 9
19
20 # -----
21 # 3. Iterating through 2D list using nested for-loops
22
23 # Outer loop goes over each row
24 for row in num_grid:
25     # Inner loop goes over each column (element in that row)
26     for column in row:
27         print(column, end=" ")
28     print() # For new line after each row
```

13 Lesson 13: Tuples – Full Usage Guide

```
1 # TUPLES – FULL USAGE GUIDE
2
3 # 1. What is a tuple?
4 # → A tuple is an immutable, ordered collection of items.
5 # → Defined using parentheses: ()
6
7 # 2. Tuple vs List – Key Differences:
8 # → Tuples use () → Lists use []
9 # → Tuples are immutable → Lists are mutable (can be changed)
10 # → Tuples have fewer built-in methods
11 # → Tuples are faster and used for fixed data
12
13 # -----
14 # 3. Defining tuples
15
16 empty_tuple = ()
17 single_item = ("apple",) # Note the comma!
18 fruits = ("apple", "banana", "cherry")
19
20 print("Fruits tuple:", fruits)
21 print("First item:", fruits[0])
22
23 # -----
24 # 4. What can we do with tuples?
25
26 # Tuple concatenation
27 more_fruits = ("mango", "orange")
28 combined = fruits + more_fruits
29 print("Combined tuple:", combined)
30
31 # Tuple unpacking
32 x, y, z = fruits
33 print("Unpacked:", x, y, z)
34
35 # Cannot change a tuple element
36 # fruits[0] = "kiwi" # TypeError
37
38 # Cannot append or remove items
39 # fruits.append("kiwi") # AttributeError
40 # fruits.remove("banana") # AttributeError
```

```

41
42 # You can delete the whole tuple
43 temp = (1, 2, 3)
44 del temp
45 # print(temp) # NameError if uncommented
46
47 # -----
48 # 5. Built-in functions usable with tuples
49
50 values = (10, 20, 5, 30)
51
52 # 1. len()
53 print("Length:", len(values)) # 4
54
55 # 2. max()
56 print("Maximum:", max(values)) # 30
57
58 # 3. min()
59 print("Minimum:", min(values)) # 5
60
61 # 4. tuple() constructor
62 sample_list = ["x", "y", "z"]
63 converted = tuple(sample_list)
64 print("Converted to tuple:", converted)

```

Tuple Functions – Syntax and Return Type

Function	Syntax	Return Type
len()	len(tuple)	int (length of tuple)
max()	max(tuple)	Largest item from tuple
min()	min(tuple)	Smallest item from tuple
tuple()	tuple(iterable)	A new tuple object

14 Lesson 14: Sets – General Usage Guide

```

1 # SETS - GENERAL USAGE GUIDE
2
3 # 1. What is a set?
4 # → A set is an unordered, unindexed collection with no duplicate elements.
5 # → Defined using curly braces {} or the set() constructor.
6
7 # -----
8 # 2. Creating a set
9
10 # From a list with duplicates
11 values = [2, 3, 3, 4, 5]
12 unique_values = set(values)
13 print("Set from list:", unique_values) # {2, 3, 4, 5}
14

```

```

15 # Direct set definition
16 colors = {"red", "green", "blue"}
17 print("Set of colors:", colors)
18
19 # Empty set must be created using set()
20 empty_set = set()
21 print("Empty set:", empty_set)
22
23 # -----
24 # 3. General set methods
25
26 # 1. add()
27 colors.add("yellow")
28 print("After add():", colors)
29
30 # 2. remove()
31 colors.remove("green") # Raises error if not found
32 print("After remove():", colors)
33
34 # 3. discard()
35 colors.discard("blue") # Safe: no error if not found
36 print("After discard():", colors)
37
38 # 4. pop()
39 item = colors.pop() # Removes random item (sets are unordered)
40 print("Popped:", item)
41
42 # 5. clear()
43 numbers = {1, 2, 3}
44 numbers.clear()
45 print("After clear():", numbers)
46
47 # 6. copy()
48 original = {"a", "b"}
49 cloned = original.copy()
50 print("Copy of set:", cloned)
51
52 # 7. update()
53 colors.update({"white", "black"})
54 print("After update():", colors)
55
56 # -----
57 # Sets do NOT support indexing or duplicate elements.

```

General Set Methods – Syntax and Return Type

Method	Description	Return Type
add(x)	Adds element x to the set	None
remove(x)	Removes x; error if not found	None
discard(x)	Removes x; no error if not found	None
pop()	Removes and returns an arbitrary element	Element
clear()	Removes all items from the set	None
copy()	Returns a shallow copy of the set	Set copy
update(iter)	Adds elements from another iterable	None

15 Lesson 15: Sets – Mathematical Operations

```
1 # SETS – MATHEMATICAL OPERATIONS
2
3 # We use sets to perform classic mathematical operations like:
4 # union, intersection, difference, symmetric difference, etc.
5
6 a = {1, 2, 3, 4}
7 b = {3, 4, 5, 6}
8
9 # -----
10 # 1. union() - combines both sets
11 print("Union:", a.union(b))      # {1, 2, 3, 4, 5, 6}
12 print("Using | :", a | b)
13
14 # 2. update() - adds elements from b to a
15 a1 = a.copy()
16 a1.update(b)
17 print("Update:", a1)
18
19 # -----
20 # 3. intersection() - common elements
21 print("Intersection:", a.intersection(b)) # {3, 4}
22 print("Using & :", a & b)
23
24 # 4. intersection_update() - keeps only common elements in a
25 a2 = a.copy()
26 a2.intersection_update(b)
27 print("Intersection Update:", a2)
28
29 # -----
30 # 5. difference() - items in a but not in b
31 print("Difference (a - b):", a.difference(b)) # {1, 2}
32 print("Using - :", a - b)
33
34 # 6. difference_update() - removes items in b from a
35 a3 = a.copy()
36 a3.difference_update(b)
37 print("Difference Update:", a3)
38
39 # -----
40 # 7. symmetric_difference() - elements in a or b but not both
41 print("Symmetric Difference:", a.symmetric_difference(b)) # {1, 2, 5, 6}
42 print("Using ^ :", a ^ b)
43
44 # 8. symmetric_difference_update() - modifies a to symmetric diff
45 a4 = a.copy()
46 a4.symmetric_difference_update(b)
47 print("Symmetric Difference Update:", a4)
48
49 # -----
50 # 9. issubset()
51 print("Is a subset of b:", a.issubset(b)) # False
52
53 # 10. issuperset()
54 print("Is a superset of b:", a.issuperset(b)) # False
55
56 # 11. isdisjoint()
57 x = {10, 20}
58 print("Is disjoint:", a.isdisjoint(x)) # True (no common elements)
```

Set Operations – Syntax and Result

Method / Operator	Description	Return Type
a.union(b) / a b	All unique elements from both sets	New set
a.update(b)	Adds all elements from b to a	None (in-place)
a.intersection(b) / a & b	Elements common to both sets	New set
a.intersection_update(b)	Keeps only common elements in a	None (in-place)
a.difference(b) / a - b	Elements in a but not in b	New set
a.difference_update(b)	Removes items in b from a	None (in-place)
a.symmetric_difference / a ^ b	Elements in a or b, not both	New set
a.symmetric_difference_update(b)	Updates a to symmetric diff	None (in-place)

Set Comparison – Membership and Relationship

Method	Description	Returns
a.issubset(b)	True if all elements of a are in b	Boolean
a.issuperset(b)	True if a contains all elements of b	Boolean
a.isdisjoint(b)	True if a and b have no elements in common	Boolean