Question 1(a) [3 marks]

Explain the steps involved in problem-solving.

Answer:

Table:

Step	Description
Problem Understanding	Read and understand the problem clearly
Analysis	Break down the problem into smaller parts
Algorithm Design	Create step-by-step solution approach
Implementation	Code the solution using programming language
Testing	Verify solution with different test cases
Documentation	Document the solution for future reference

Key Points:

- **Problem Definition**: Clearly identify what needs to be solved
- **Input/Output**: Determine required inputs and expected outputs
- **Logic Building**: Create logical flow of solution

Mnemonic: "People Always Design Implementation Tests Daily"

Question 1(b) [4 marks]

Write features of Python.

Answer:

Table:

Feature	Description
Simple Syntax	Easy to read and write code
Interpreted	No compilation needed, runs directly
Platform Independent	Runs on Windows, Mac, Linux
Object-Oriented	Supports classes and objects
Large Library	Extensive built-in modules
Dynamic Typing	No need to declare variable types

Key Features:

- **Free and Open Source**: Available for everyone to use
- **High-level Language**: Close to human language
- **Extensive Support**: Large community and documentation

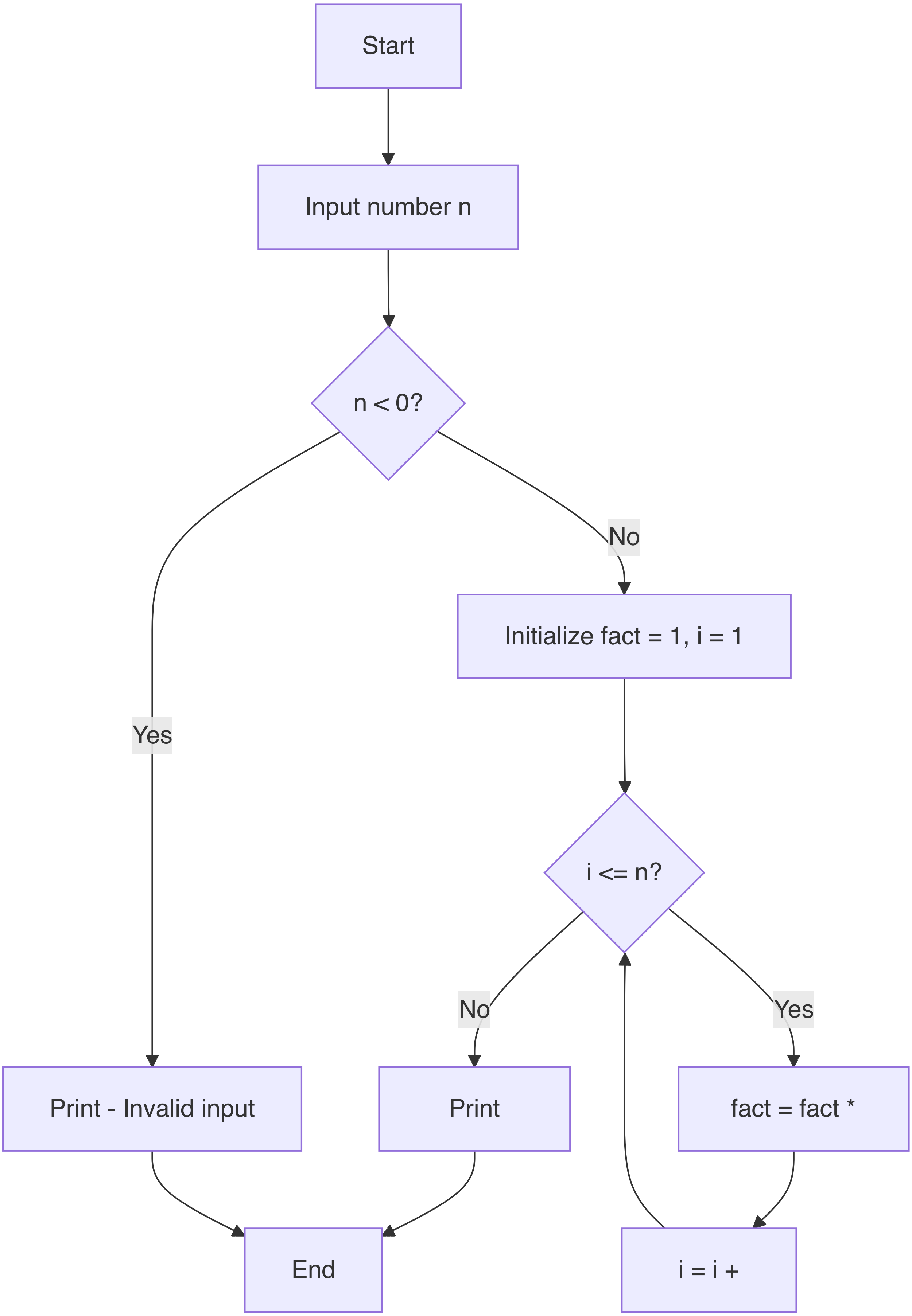
Mnemonic: "Simple Interpreted Platform-independent Object-oriented Libraries Dynamic"

Question 1(c) [7 marks]

Draw a flowchart and write algorithm to calculate the factorial of a given number.

Answer:

Flowchart:



Algorithm:

1. Start

2. Input number n
3. If n < 0, print "Invalid input" and go to step 8
4. Initialize fact = 1, i = 1
5. While i <= n, do:
    - fact = fact * i
    - i = i + 1
6. Print fact
7. End

Key Points:

- **Base Case**: 0! = 1 and 1! = 1
- **Validation**: Check for negative numbers
- **Loop Logic**: Multiply all numbers from 1 to n

Mnemonic: "Input Validate Initialize Loop Print"

Question 1(c OR) [7 marks]

Explain relational and assignment operators with example.

Answer:

Relational Operators Table:

Operator	Description	Example
==	Equal to	5 == 5 (True)
!=	Not equal to	5 != 3 (True)
>	Greater than	7 > 3 (True)
<	Less than	2 < 8 (True)
>=	Greater than or equal	5 >= 5 (True)
<=	Less than or equal	4 <= 6 (True)

Assignment Operators Table:

Operator	Description	Example
=	Simple assignment	x = 5
+=	Add and assign	x += 3 (x = x + 3)
-=	Subtract and assign	x -= 2 (x = x - 2)
***=**	Multiply and assign	x *= 4 (x = x * 4)
/=	Divide and assign	x /= 2 (x = x / 2)

Code Example:

```
# Relational operators
a, b = 10, 5
print(a > b)    # True
print(a == b)   # False

# Assignment operators
x = 10
x += 5   # x becomes 15
x *= 2   # x becomes 30
```

Mnemonic: "Compare Relations, Assign Values"

Question 2(a) [3 marks]

Draw various symbols used for flowchart and write purpose of each symbol.

Answer:

Flowchart Symbols Table:

Symbol	Name	Purpose
Oval	Terminal	Start/End of program
Rectangle	Process	Processing operations
Diamond	Decision	Conditional statements
Parallelogram	Input/Output	Data input/output
Circle	Connector	Connect different parts
Arrow	Flow line	Direction of flow

ASCII Diagram:

```
   ( Start/End )     [ Process ]     < Decision >

   / Input/Output \     O Connector     ---> Flow
```

Key Points:

- **Standard Symbols**: Universally recognized shapes
- **Clear Flow**: Arrows show program direction
- **Logical Structure**: Helps visualize program logic

Mnemonic: "Terminals Process Decisions Input Connectors Flow"

Question 2(b) [4 marks]

List out characteristics of good algorithm.

Answer:

Table:

Characteristic	Description
Finite	Must terminate after finite steps
Definite	Each step clearly defined
Input	Zero or more inputs specified
Output	At least one output produced
Effective	Steps must be simple and feasible
Unambiguous	Each step has only one meaning

Key Characteristics:

- **Correctness**: Produces correct results for all valid inputs
- **Efficiency**: Uses minimum time and space resources
- **Clarity**: Easy to understand and implement

Mnemonic: "Finite Definite Input Output Effective Unambiguous"

Question 2(c) [7 marks]

Use proper data type to represent the following data values.

Answer:

Data Type Mapping Table:

Data Value	Data Type	Example
(1) Number of days in a week	**int**	`days = 7`
(2) Resident of Gujarat or not	**bool**	`is_resident = True`
(3) Mobile number	**str**	`mobile = "9876543210"`
(4) Bank account balance	**float**	`balance = 15000.50`
(5) Volume of a sphere	**float**	`volume = 523.33`
(6) Perimeter of a square	**float**	`perimeter = 20.0`
(7) Name of the student	**str**	`name = "Rahul"`

Code Example:

```
# Data type examples
days = 7                    # int
is_resident = True          # bool
mobile = "9876543210"       # str
balance = 15000.50          # float
volume = 523.33            # float
perimeter = 20.0           # float
name = "Rahul"             # str
```

Key Points:

- **int**: Whole numbers without decimals
- **float**: Numbers with decimal points
- **str**: Text data in quotes
- **bool**: True/False values only

Mnemonic: "Integers Float Strings Booleans"

Question 2(a OR) [3 marks]

Find the output of following code.

```
num1 = 2+9*((3*12)-8)/10
print(num1)
```

Answer:

Step-by-step calculation:

```
num1 = 2+9*((3*12)-8)/10
# Step 1: 3*12 = 36
# Step 2: 36-8 = 28
# Step 3: 9*28 = 252
# Step 4: 252/10 = 25.2
# Step 5: 2+25.2 = 27.2
```

Output: `27.2`

Key Points:

- **BODMAS Rule**: Brackets, Orders, Division, Multiplication, Addition, Subtraction
- **Operator Precedence**: Parentheses first, then multiplication/division
- **Result Type**: Float due to division operation

Mnemonic: "Brackets Orders Division Multiplication Addition Subtraction"

Question 2(b OR) [4 marks]

List out the various types of operators used in Python.

Answer:

Python Operators Table:

Type	Operators	Example
Arithmetic	+, -, *, /, %, **, //	`5 + 3 = 8`
Comparison	==, !=, >, <, >=, <=	`5 > 3 = True`
Logical	and, or, not	`True and False = False`
Assignment	=, +=, -=, *=, /=	`x += 5`
Bitwise	&, |, ^, ~, <<, >>	`5 & 3 = 1`
Membership	in, not in	`'a' in 'cat' = True`
Identity	is, is not	`x is y`

Key Points:

- **Arithmetic**: Mathematical operations
- **Comparison**: Compare values and return boolean
- **Logical**: Combine boolean expressions

Mnemonic: "Arithmetic Comparison Logical Assignment Bitwise Membership Identity"

Question 2(c OR) [7 marks]

Write a program to find the sum and average of all the positive numbers entered by the user. As soon as the user enters a negative number, stop taking in any further input from the user and display the sum and average.

Answer:

Code:

```python
# Program to find sum and average of positive numbers
total_sum = 0
count = 0

print("Enter positive numbers (negative to stop):")

while True:
    num = float(input("Enter number: "))

    if num < 0:
        break

    total_sum += num
    count += 1

if count > 0:
    average = total_sum / count
    print(f"Sum: {total_sum}")
    print(f"Average: {average}")
else:
    print("No positive numbers entered")
```

Key Points:

- **Loop Control**: While loop with break statement
- **Input Validation**: Check for negative numbers
- **Division by Zero**: Handle case when no numbers entered

Mnemonic: "Input Loop Check Calculate Display"

Question 3(a) [3 marks]

Explain while loop with example.

Answer:

While Loop Structure:

```python
while condition:
    # statements
    # update condition
```

Example:

```python
# Print numbers 1 to 5
i = 1
while i <= 5:
    print(i)
    i += 1
```

Key Points:

- **Pre-tested Loop**: Condition checked before execution
- **Infinite Loop Risk**: Condition must eventually become False
- **Loop Variable**: Must be updated inside loop

Mnemonic: "While Condition True Execute"

Question 3(b) [4 marks]

Write a program to find the sum of digits of an integer number, input by the user.

Answer:

Code:

```python
# Program to find sum of digits
num = int(input("Enter a number: "))
original_num = num
digit_sum = 0

while num > 0:
    digit = num % 10
    digit_sum += digit
    num = num // 10

print(f"Sum of digits of {original_num} is {digit_sum}")
```

Key Points:

- **Modulo Operation**: Extract last digit using %10
- **Integer Division**: Remove last digit using //10
- **Loop Until Zero**: Continue until no digits remain

Mnemonic: "Extract Add Remove Repeat"

Question 3(c) [7 marks]

Write a program to print Armstrong numbers between 100 to 10000 using a user-defined function.

Answer:

Code:

```python
def is_armstrong(num):
    """Check if number is Armstrong number"""
    original = num
    num_digits = len(str(num))
    sum_powers = 0

    while num > 0:
        digit = num % 10
        sum_powers += digit ** num_digits
        num //= 10

    return sum_powers == original

def print_armstrong_range(start, end):
    """Print Armstrong numbers in given range"""
    print(f"Armstrong numbers between {start} and {end}:")

    for num in range(start, end + 1):
        if is_armstrong(num):
            print(num, end=" ")
    print()

# Main program
print_armstrong_range(100, 10000)
```

Key Points:

- **Function Definition**: def keyword to create functions
- **Armstrong Logic**: Sum of digits raised to power of number of digits
- **Range Function**: Generate numbers in specified range

Mnemonic: "Define Check Calculate Compare Print"

Question 3(a OR) [3 marks]

Write a Program to print following pattern.

```
5 4 3 2 1
4 3 2 1
3 2 1
2 1
1
```

Answer:

Code:

```python
# Pattern printing program
for i in range(5, 0, -1):
    for j in range(i, 0, -1):
        print(j, end=" ")
    print()
```

Key Points:

- **Nested Loops**: Outer loop for rows, inner for columns
- **Reverse Range**: range(start, stop, -1) for decreasing
- **Print Control**: end=" " for space, print() for newline

Mnemonic: "Outer Inner Reverse Print"

Question 3(b OR) [4 marks]

Explain nested if...else statement.

Answer:

Structure:

```python
if condition1:
    if condition2:
        # statements
    else:
        # statements
else:
    if condition3:
        # statements
    else:
        # statements
```

Example:

```python
marks = 85

if marks >= 50:
    if marks >= 90:
        grade = "A+"
    elif marks >= 80:
        grade = "A"
    else:
        grade = "B"
else:
    grade = "F"

print(f"Grade: {grade}")
```

Key Points:

- **Inner Conditions**: if-else inside another if-else
- **Multiple Levels**: Can nest multiple levels deep
- **Logical Flow**: Inner conditions execute only if outer is true

Mnemonic: "Outer Inner Multiple Levels"

Question 3(c OR) [7 marks]

Write a program to enter n numbers in list and using statistics module find mean, median and mode.

Answer:

Code:

```python
import statistics

# Input number of elements
n = int(input("Enter number of elements: "))
numbers = []

# Input numbers
for i in range(n):
    num = float(input(f"Enter number {i+1}: "))
    numbers.append(num)

# Calculate statistics
mean_val = statistics.mean(numbers)
median_val = statistics.median(numbers)

try:
    mode_val = statistics.mode(numbers)
except statistics.StatisticsError:
    mode_val = "No unique mode"

# Display results
print(f"Numbers: {numbers}")
print(f"Mean: {mean_val}")
print(f"Median: {median_val}")
print(f"Mode: {mode_val}")
```

Key Points:

- **Statistics Module**: Built-in module for statistical functions
- **List Input**: Store numbers in list for processing
- **Exception Handling**: Handle mode calculation errors

Mnemonic: "Import Input Calculate Display"

Question 4(a) [3 marks]

Differentiate between a for loop and a while loop in python.

Answer:

Comparison Table:

Feature	For Loop	While Loop
Purpose	Known iterations	Unknown iterations
Syntax	for var in sequence	while condition
Initialization	Automatic	Manual
Update	Automatic	Manual
Use Case	Iterate over collections	Repeat until condition

Examples:

```python
# For loop
for i in range(5):
    print(i)

# While loop
i = 0
while i < 5:
    print(i)
    i += 1
```

Mnemonic: "For Known While Unknown"

Question 4(b) [4 marks]

Match the following.

Answer:

Correct Matching:

- **A. If statement** → **3.** Used to conditionally execute a block of code based on a certain condition
- **B. While loop** → **1.** Executes a block of code repeatedly as long as a certain condition is met
- **C. Break statement** → **5.** Terminates the current loop and moves on to the next iteration
- **D. Continue statement** → **2.** Skips the current iteration and moves on to the next one

Key Points:

- **If Statement**: Conditional execution
- **While Loop**: Repeated execution with condition
- **Break**: Exit loop completely

- **Continue**: Skip current iteration only

Mnemonic: "If Conditions While Repeats Break Exits Continue Skips"

Question 4(c) [7 marks]

Differentiate between following with the help of an example:
a) Argument and Parameter
b) Global and Local variable

Answer:

a) Argument vs Parameter:

```
def greet(name, age):  # name, age are parameters
    print(f"Hello {name}, you are {age} years old")

greet("Raj", 20)  # "Raj", 20 are arguments
```

b) Global vs Local Variable:

```
x = 10  # Global variable

def my_function():
    y = 5  # Local variable
    global x
    x = 15  # Modifying global variable
    print(f"Local y: {y}")
    print(f"Global x: {x}")

my_function()
print(f"Global x outside: {x}")
```

Comparison Table:

Type	Scope	Access	Example
Parameter	Function definition	Receives values	`def func(param):`
Argument	Function call	Passes values	`func(argument)`
Global	Entire program	Everywhere	`x = 10`
Local	Inside function	Function only	`y = 5` in function

Mnemonic: "Parameters Receive Arguments Pass Globals Everywhere Locals Function"

Question 4(a OR) [3 marks]

Find the output of following statements.

Answer:

Code Analysis:

```
import math
(i) print(math.ceil(-9.7))   # Output: -9
(ii) print(math.floor(-9.7)) # Output: -10
(iii) print(math.fabs(-12.3)) # Output: 12.3
```

Explanation:

- **ceil(-9.7)**: Ceiling rounds up to nearest integer = -9
- **floor(-9.7)**: Floor rounds down to nearest integer = -10
- **fabs(-12.3)**: Absolute value removes negative sign = 12.3

Key Points:

- **Math Module**: Import required for mathematical functions
- **Negative Numbers**: Ceiling and floor work differently with negatives
- **Absolute Value**: Always returns positive value

Mnemonic: "Ceiling Up Floor Down Absolute Positive"

Question 4(b OR) [4 marks]

Write advantages of function.

Answer:

Advantages Table:

Advantage	Description
Code Reusability	Write once, use multiple times
Modularity	Break complex problems into smaller parts
Easier Debugging	Locate and fix errors easily
Code Organization	Better structure and readability
Maintainability	Easy to update and modify
Reduced Complexity	Simplify complex operations

Key Benefits:

- **Avoid Repetition**: No need to write same code again
- **Team Collaboration**: Different people can work on different functions
- **Testing**: Each function can be tested independently

Mnemonic: "Reuse Modular Debug Organize Maintain Reduce"

Question 4(c OR) [7 marks]

Write a program to find the smallest and largest number in a given list without using in built functions.

Answer:

Code:

```python
# Program to find smallest and largest without built-in functions
def find_min_max(numbers):
    """Find minimum and maximum without built-in functions"""
    if not numbers:
        return None, None

    smallest = numbers[0]
    largest = numbers[0]

    for num in numbers[1:]:
        if num < smallest:
            smallest = num
        if num > largest:
            largest = num

    return smallest, largest

# Input list
n = int(input("Enter number of elements: "))
numbers = []

for i in range(n):
    num = float(input(f"Enter number {i+1}: "))
    numbers.append(num)

# Find min and max
min_num, max_num = find_min_max(numbers)

print(f"List: {numbers}")
print(f"Smallest number: {min_num}")
print(f"Largest number: {max_num}")
```

Key Points:

- **Manual Comparison**: Use if conditions instead of min()/max()
- **Initialize Variables**: Start with first element
- **Loop Through**: Compare each element with current min/max

Mnemonic: "Initialize Compare Update Return"

Question 5(a) [3 marks]

Differentiate sort() and sorted() methods for list in python.

Answer:

Comparison Table:

Feature	sort()	sorted()
Return Type	None (modifies original)	New sorted list
Original List	Modified in-place	Unchanged
Usage	list.sort()	sorted(list)
Memory	Efficient	Uses extra memory

Examples:

```python
# sort() method
list1 = [3, 1, 4, 2]
list1.sort()
print(list1)  # [1, 2, 3, 4]

# sorted() function
list2 = [3, 1, 4, 2]
new_list = sorted(list2)
print(list2)      # [3, 1, 4, 2] (unchanged)
print(new_list)   # [1, 2, 3, 4]
```

Mnemonic: "Sort Modifies Sorted Creates"

Question 5(b) [4 marks]

Explain different way of traversing a string in python with example.

Answer:

String Traversal Methods:

1. Using For Loop:

```python
text = "Python"
for char in text:
    print(char, end=" ")  # P y t h o n
```

2. Using Index:

```python
text = "Python"
for i in range(len(text)):
    print(text[i], end=" ")  # P y t h o n
```

3. Using While Loop:

```
text = "Python"
i = 0
while i < len(text):
    print(text[i], end=" ")
    i += 1
```

4. Using Enumerate:

```
text = "Python"
for index, char in enumerate(text):
    print(f"{index}:{char}", end=" ")  # 0:P 1:y 2:t 3:h 4:o 5:n
```

Mnemonic: "For Index While Enumerate"

Question 5(c) [7 marks]

Write output of following scripts.

Answer:

Output Results:

```
(1) s = "Hello, World!"
    print(s[0:5])              # Output: Hello

(2) lst = [1, 2, 3, 4, 5]
    print(lst[2:4])            # Output: [3, 4]

(3) s = "python"
    print(len(s))              # Output: 6

(4) lst = [5, 2, 3, 1, 8]
    lst.sort()                 # lst becomes [1, 2, 3, 5, 8]

(5) s1 = "hello"
    s2 = "world"
    print(s1 + s2)             # Output: helloworld

(6) lst = [1, 2, 3, 4, 5]
    print(sum(lst))            # Output: 15

(7) s = "python"
    print(s[::-1])             # Output: nohtyp
```

Key Points:

- **Slicing**: [start:end] extracts substring/sublist
- **String Length**: len() returns character count

- **List Sorting**: sort() modifies list in-place
- **String Concatenation**: + operator joins strings
- **Sum Function**: Adds all list elements
- **Reverse Slicing**: [::-1] reverses sequence

Mnemonic: "Slice Length Sort Concatenate Sum Reverse"

Question 5(a OR) [3 marks]

Explain type conversion in python.

Answer:

Type Conversion Table:

Type	Function	Example
int()	Convert to integer	`int("5")` → 5
float()	Convert to float	`float("3.14")` → 3.14
str()	Convert to string	`str(25)` → "25"
bool()	Convert to boolean	`bool(1)` → True
list()	Convert to list	`list("abc")` → ['a','b','c']

Examples:

```
# Implicit conversion
x = 5 + 3.2  # int + float = float (8.2)

# Explicit conversion
num_str = "123"
num_int = int(num_str)  # "123" → 123
```

Key Points:

- **Implicit**: Python automatically converts
- **Explicit**: Programmer manually converts using functions
- **Type Safety**: Some conversions may raise errors

Mnemonic: "Implicit Automatic Explicit Manual"

Question 5(b OR) [4 marks]

Explain concatenation and repetition operation on string with example.

Answer:

String Operations:

1. Concatenation (+):

```
str1 = "Hello"
str2 = "World"
result = str1 + " " + str2
print(result)  # Hello World

# Multiple concatenation
name = "Python"
version = "3.9"
info = "Language: " + name + " Version: " + version
print(info)  # Language: Python Version: 3.9
```

2. Repetition (*):

```
text = "Hi! "
repeated = text * 3
print(repeated)  # Hi! Hi! Hi!

# Pattern creation
pattern = "-" * 10
print(pattern)  # ----------
```

Key Points:

- **Concatenation**: Joins strings together using +
- **Repetition**: Repeats string n times using *
- **Immutable**: Original strings remain unchanged

Mnemonic: "Plus Joins Star Repeats"

Question 5(c OR) [7 marks]

Write a program to count and display the number of vowels, consonants, uppercase, lowercase characters in a string.

Answer:

Code:

```
def analyze_string(text):
    """Analyze string for different character types"""
    vowels = "aeiouAEIOU"

    vowel_count = 0
    consonant_count = 0
    uppercase_count = 0
    lowercase_count = 0
```

```python
    for char in text:
        if char.isalpha():  # Check if character is alphabet
            if char in vowels:
                vowel_count += 1
            else:
                consonant_count += 1

            if char.isupper():
                uppercase_count += 1
            elif char.islower():
                lowercase_count += 1

    return vowel_count, consonant_count, uppercase_count, lowercase_count

# Input string
text = input("Enter a string: ")

# Analyze string
vowels, consonants, uppercase, lowercase = analyze_string(text)

# Display results
print(f"String: '{text}'")
print(f"Vowels: {vowels}")
print(f"Consonants: {consonants}")
print(f"Uppercase: {uppercase}")
print(f"Lowercase: {lowercase}")
```

Key Points:

- **Character Classification**: Use isalpha(), isupper(), islower()
- **Vowel Check**: Compare with vowel string
- **Loop Processing**: Check each character individually

Mnemonic: "Check Classify Count Display"