Question 1(a) [3 marks]

Define problem solving and list out the steps of problem solving.

Answer:
Problem solving is a systematic approach to identify, analyze, and resolve challenges or issues using logical thinking and structured methods.

Steps of Problem Solving:

Step	Description
1. **Problem Identification**	Clearly understand and define the problem
2. **Problem Analysis**	Break down the problem into smaller parts
3. **Solution Design**	Develop possible solutions or algorithms
4. **Implementation**	Execute the chosen solution
5. **Testing & Validation**	Verify the solution works correctly
6. **Documentation**	Record the solution for future reference

Mnemonic: "I Always Design Implementation Tests Daily"

Question 1(b) [4 marks]

Define variable and mention rule for choosing names of variable.

Answer:
A variable is a named storage location in memory that holds data values which can be changed during program execution.

Variable Naming Rules:

Rule	Description
Start Character	Must begin with letter (a-z, A-Z) or underscore (_)
Allowed Characters	Can contain letters, digits (0-9), and underscores
Case Sensitive	myVar and MyVar are different variables
No Keywords	Cannot use Python reserved words (if, for, while)
No Spaces	Use underscore instead of spaces
Descriptive Names	Choose meaningful names (age, not x)

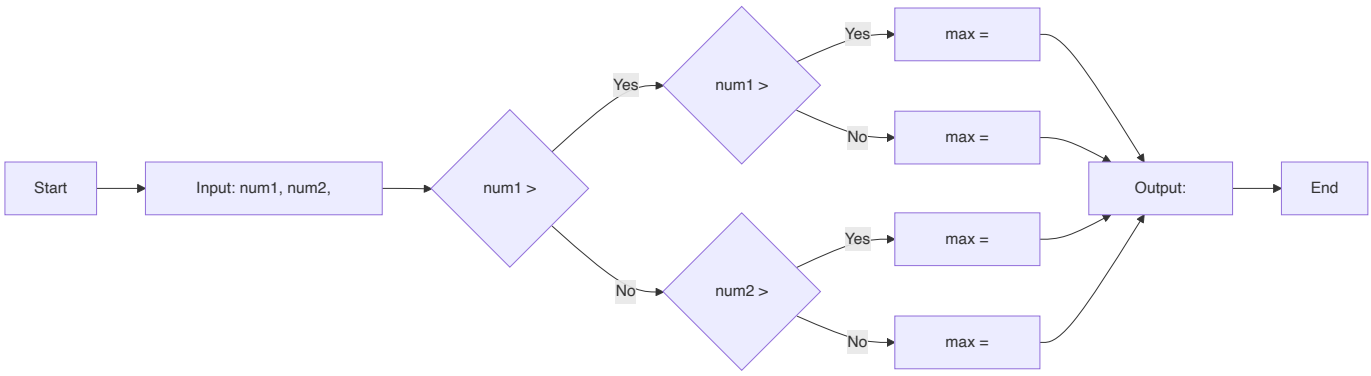
Mnemonic: "Start Alphabetically, Continue Carefully, Never Keywords"

Question 1(c) [7 marks]

Design a flowchart to find maximum number out of three given numbers.

Answer:
A flowchart shows the logical flow to find the maximum of three numbers using comparison operations.

Flowchart:



Key Points:

- **Input**: Three numbers (num1, num2, num3)
- **Process**: Compare numbers using nested conditions
- **Output**: Maximum value among the three

Mnemonic: "Compare First Two, Then With Third"

Question 1(c OR) [7 marks]

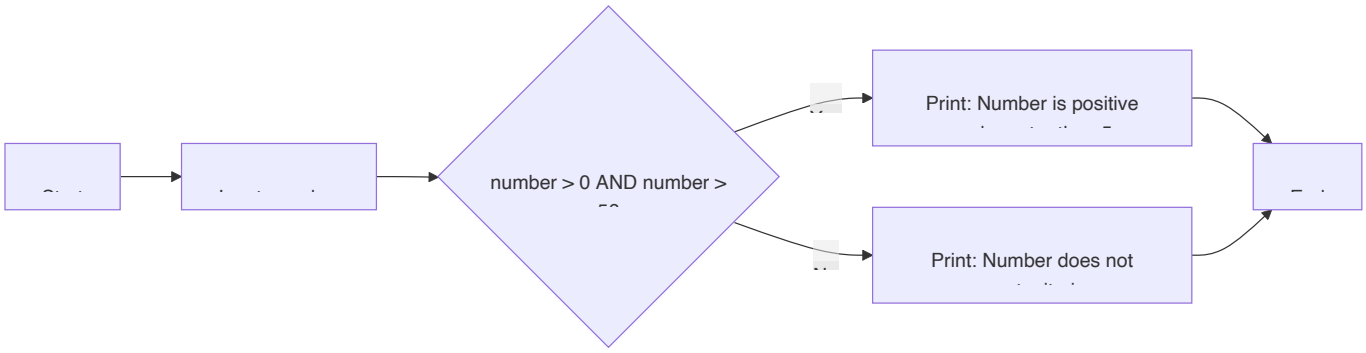
Construct an algorithm which checks entered number is positive and greater than 5 or not.

Answer:
An algorithm to verify if a number is both positive and greater than 5.

Algorithm:

```
Algorithm: CheckPositiveGreaterThan5
Step 1: START
Step 2: INPUT number
Step 3: IF number > 0 AND number > 5 THEN
           PRINT "Number is positive and greater than 5"
        ELSE
           PRINT "Number does not meet criteria"
        END IF
Step 4: END
```

Flowchart:



Key Conditions:

- **Positive**: number > 0
- **Greater than 5**: number > 5
- **Combined**: Both conditions must be true

Mnemonic: "Positive Plus Five"

Question 2(a) [3 marks]

Write a short note on arithmetic operators.

Answer:
Arithmetic operators perform mathematical calculations on numeric values in Python programming.

Arithmetic Operators Table:

Operator	Name	Example	Result
+	Addition	5 + 3	8
-	Subtraction	5 - 3	2
*	Multiplication	5 * 3	15
/	Division	5 / 3	1.67
//	Floor Division	5 // 3	1
%	Modulus	5 % 3	2
**	Exponentiation	5 ** 3	125

Mnemonic: "Add Subtract Multiply Divide Floor Mod Power"

Question 2(b) [4 marks]

Explain the need for continue and break statements.

Answer:
Continue and break statements control loop execution flow for efficient programming.

Statement Comparison:

Statement	Purpose	Action
break	Exit loop completely	Terminates entire loop
continue	Skip current iteration	Jumps to next iteration

Usage Examples:

- **break**: Exit when condition met (finding specific value)
- **continue**: Skip invalid data (negative numbers in positive list)

Benefits:

- **Efficiency**: Avoid unnecessary iterations
- **Control**: Better program flow management
- **Clarity**: Cleaner code logic

Mnemonic: "Break Exits, Continue Skips"

Question 2(c) [7 marks]

Create a program to check whether entered number is even or odd.

Answer:
A Python program using modulus operator to determine if a number is even or odd.

Python Code:

```
# Program to check even or odd
number = int(input("Enter a number: "))

if number % 2 == 0:
    print(f"{number} is Even")
else:
    print(f"{number} is Odd")
```

Logic Explanation:

Condition	Result	Explanation
number % 2 == 0	Even	Divisible by 2, no remainder
number % 2 == 1	Odd	Not divisible by 2, remainder 1

Sample Output:

- Input: 8 → Output: "8 is Even"
- Input: 7 → Output: "7 is Odd"

Mnemonic: "Modulus Zero Even, One Odd"

Question 2(a OR) [3 marks]

Summarize the comparison operators of python.

Answer:
Comparison operators compare values and return boolean results (True/False).

Comparison Operators Table:

Operator	Name	Example	Result
==	Equal to	5 == 5	True
!=	Not equal to	5 != 3	True
>	Greater than	5 > 3	True
<	Less than	5 < 3	False
>=	Greater than or equal	5 >= 5	True
<=	Less than or equal	5 <= 3	False

Return Type: All operators return boolean values (True/False)

Mnemonic: "Equal Not Greater Less Greater-Equal Less-Equal"

Question 2(b OR) [4 marks]

Write short note on while loop.

Answer:
While loop repeatedly executes code block as long as condition remains true.

While Loop Structure:

Component	Description
Initialization	Set initial value before loop
Condition	Boolean expression to test
Body	Code to execute repeatedly
Update	Modify variable to avoid infinite loop

Syntax:

```
while condition:
    # loop body
    # update statement
```

Characteristics:

- **Pre-tested**: Condition checked before execution
- **Variable iterations**: Unknown number of repetitions
- **Control**: Condition determines continuation

Mnemonic: "While Condition True, Execute Loop"

Question 2(c OR) [7 marks]

Create a program to read three numbers from the user and find the average of the numbers.

Answer:
A Python program to calculate average of three user-input numbers.

Python Code:

```
# Program to find average of three numbers
num1 = float(input("Enter first number: "))
num2 = float(input("Enter second number: "))
num3 = float(input("Enter third number: "))

average = (num1 + num2 + num3) / 3

print(f"Average of {num1}, {num2}, {num3} is: {average:.2f}")
```

Calculation Process:

Step	Operation
Input	Read three numbers
Sum	Add all three numbers
Divide	Sum ÷ 3
Output	Display formatted result

Sample Execution:

- Input: 10, 20, 30
- Sum: 60
- Average: 20.00

Mnemonic: "Sum Three Divide Display"

Question 3(a) [3 marks]

Define control structures, List out control structures available in python.

Answer:
Control structures determine the execution flow and order of statements in a program.

Python Control Structures:

Type	Structures	Purpose
Sequential	Normal flow	Execute statements in order
Selection	if, if-else, elif	Choose between alternatives
Iteration	for, while	Repeat code blocks
Jump	break, continue, pass	Alter normal flow

Categories:

- **Conditional**: Decision making (if statements)
- **Looping**: Repetition (for/while loops)
- **Branching**: Flow control (break/continue)

Mnemonic: "Sequence Select Iterate Jump"

Question 3(b) [4 marks]

Explain how to define and call user defined function by giving example.

Answer:
User-defined functions are custom blocks of reusable code that perform specific tasks.

Function Structure:

Component	Syntax	Purpose
Definition	def function_name():	Create function
Parameters	def func(param1, param2):	Accept inputs
Body	Indented code block	Function logic
Return	return value	Send result back
Call	function_name()	Execute function

Example Code:

```
# Function definition
def greet_user(name):
    message = f"Hello, {name}!"
    return message

# Function call
result = greet_user("Python")
print(result)  # Output: Hello, Python!
```

Mnemonic: "Define Parameters Body Return Call"

Question 3(c) [7 marks]

Create a program to display the following patterns using loop concept

Answer:
A Python program using nested loops to create number patterns.

Python Code:

```
# Pattern printing program
for i in range(1, 6):
    for j in range(1, i + 1):
        print(i, end="")
    print()  # New line after each row
```

Pattern Logic:

Row	Iterations	Output
1	1 time	1
2	2 times	22
3	3 times	333
4	4 times	4444
5	5 times	55555

Loop Structure:

- **Outer loop**: Controls rows (1 to 5)
- **Inner loop**: Prints current row number
- **Pattern**: Row number repeated row times

Mnemonic: "Outer Rows Inner Repeats"

Question 3(a OR) [3 marks]

Explain nested loop using suitable example.

Answer:
Nested loop is a loop inside another loop where inner loop completes all iterations for each outer loop iteration.

Nested Loop Structure:

Component	Description
Outer Loop	Controls main iterations
Inner Loop	Executes completely for each outer iteration
Execution	Inner loop runs n×m times total

Example Code:

```
# Nested loop example - Multiplication table
for i in range(1, 4):      # Outer loop
    for j in range(1, 4):  # Inner loop
        print(f"{i}×{j}={i*j}", end=" ")
    print()  # New line
```

Output Pattern:

```
1×1=1 1×2=2 1×3=3
2×1=2 2×2=4 2×3=6
3×1=3 3×2=6 3×3=9
```

Mnemonic: "Loop Inside Loop"

Question 3(b OR) [4 marks]

Write short note on local and global scope of variables

Answer:
Variable scope determines where variables can be accessed in a program.

Scope Comparison:

Scope Type	Definition	Access	Lifetime
Local	Inside function	Function only	Function execution
Global	Outside functions	Entire program	Program execution

Example Code:

```python
global_var = "I am global"  # Global scope

def my_function():
    local_var = "I am local"    # Local scope
    global global_var
    print(global_var)   # Accessible
    print(local_var)    # Accessible

print(global_var)   # Accessible
# print(local_var)  # Error - not accessible
```

Key Points:

- **Local**: Function-specific variables
- **Global**: Program-wide variables
- **Access**: Local overrides global in functions

Mnemonic: "Local Limited, Global General"

Question 3(c OR) [7 marks]

Develop a user-defined function to find the factorial of a given number.

Answer:
A recursive function to calculate factorial of a positive integer.

Python Code:

```python
def factorial(n):
    """Calculate factorial of n"""
    if n == 0 or n == 1:
        return 1
    else:
        return n * factorial(n - 1)

# Test the function
number = int(input("Enter a number: "))
if number < 0:
    print("Factorial not defined for negative numbers")
else:
    result = factorial(number)
    print(f"Factorial of {number} is {result}")
```

Factorial Logic:

Input	Calculation	Result
0	Base case	1
1	Base case	1
5	$5 \times 4 \times 3 \times 2 \times 1$	120

Function Features:

- **Recursive**: Function calls itself
- **Base case**: Stops recursion at n=0 or n=1
- **Validation**: Handles negative inputs

Mnemonic: "Multiply All Previous Numbers"

Question 4(a) [3 marks]

Explain math module with various functions

Answer:
Math module provides mathematical functions and constants for numerical computations.

Math Module Functions:

Function	Purpose	Example
math.sqrt()	Square root	math.sqrt(16) = 4.0
math.pow()	Power calculation	math.pow(2, 3) = 8.0
math.ceil()	Round up	math.ceil(4.3) = 5
math.floor()	Round down	math.floor(4.7) = 4
math.factorial()	Factorial	math.factorial(5) = 120

Usage:

```
import math
result = math.sqrt(25)  # Returns 5.0
```

Mnemonic: "Square Power Ceiling Floor Factorial"

Question 4(b) [4 marks]

Discuss the following list functions: i. len() ii. sum() iii. sort() iv. index()

Answer:
Essential list functions for data manipulation and analysis.

List Functions Comparison:

Function	Purpose	Return Type	Example
len()	Count elements	Integer	len([1,2,3]) = 3
sum()	Add all numbers	Number	sum([1,2,3]) = 6
sort()	Arrange in order	None (modifies list)	list.sort()
index()	Find element position	Integer	[1,2,3].index(2) = 1

Usage Notes:

- **len()**: Works with any sequence
- **sum()**: Only numeric lists
- **sort()**: Modifies original list
- **index()**: Returns first occurrence

Mnemonic: "Length Sum Sort Index"

Question 4(c) [7 marks]

Create a user-defined function to print the Fibonacci series of 0 to N numbers. (Where N is an integer number and passed as an argument)

Answer:
A function to generate and display Fibonacci sequence up to N terms.

Python Code:

```
def fibonacci_series(n):
    """Print Fibonacci series of n terms"""
    if n <= 0:
        print("Please enter a positive number")
        return

    # First two terms
    a, b = 0, 1

    if n == 1:
        print(f"Fibonacci series: {a}")
        return

    print(f"Fibonacci series: {a}, {b}", end="")

    # Generate remaining terms
    for i in range(2, n):
        c = a + b
        print(f", {c}", end="")
        a, b = b, c
    print()  # New line

# Test function
num = int(input("Enter number of terms: "))
fibonacci_series(num)
```

Fibonacci Logic:

Term	Value	Calculation
1st	0	Given
2nd	1	Given
3rd	1	0 + 1
4th	2	1 + 1
5th	3	1 + 2

Mnemonic: "Add Previous Two Numbers"

Question 4(a OR) [3 marks]

Explain random module with various functions

Answer:
Random module generates random numbers and makes random selections for various applications.

Random Module Functions:

Function	Purpose	Example
random()	Float 0.0 to 1.0	random.random()
randint()	Integer in range	random.randint(1, 10)
choice()	Random list element	random.choice([1,2,3])
shuffle()	Mix list order	random.shuffle(list)
uniform()	Float in range	random.uniform(1.0, 5.0)

Usage:

```
import random
number = random.randint(1, 100)
```

Applications: Games, simulations, testing, cryptography

Mnemonic: "Random Range Choice Shuffle Uniform"

Question 4(b OR) [4 marks]

Build a python code to check whether given element is member of list or not.

Answer:
A Python program to verify if an element exists in a list using membership operator.

Python Code:

```
# Check element membership in list
def check_membership():
    # Sample list
    numbers = [10, 20, 30, 40, 50]

    # Get element to search
    element = int(input("Enter element to search: "))

    # Check membership
    if element in numbers:
        print(f"{element} is present in the list")
        print(f"Position: {numbers.index(element)}")
```

```
    else:
        print(f"{element} is not present in the list")

# Call function
check_membership()
```

Membership Methods:

Method	Syntax	Returns
in operator	element in list	Boolean
not in operator	element not in list	Boolean
count() method	list.count(element)	Integer

Mnemonic: "In List True False"

Question 4(c OR) [7 marks]

Develop a user defined function that reverses the entered string words

Answer:
A function to reverse each word in a string while maintaining word positions.

Python Code:

```
def reverse_string_words(text):
    """Reverse each word in the string"""
    # Split string into words
    words = text.split()

    # Reverse each word
    reversed_words = []
    for word in words:
        reversed_word = word[::-1]  # Slice notation for reversal
        reversed_words.append(reversed_word)

    # Join words back
    result = " ".join(reversed_words)
    return result

# Test function
input_string = input("Enter a string: ")
output = reverse_string_words(input_string)
print(f"Input: \"{input_string}\"")
print(f"Output: \"{output}\"")

# Example with given input
test_input = "Hello IT"
```

```
test_output = reverse_string_words(test_input)
print(f"Input: \"{test_input}\"")
print(f"Output: \"{test_output}\"")  # Output: "olleH TI"
```

Process Steps:

Step	Operation	Example
1	Split into words	["Hello", "IT"]
2	Reverse each word	["olleH", "TI"]
3	Join with spaces	"olleH TI"

Mnemonic: "Split Reverse Join"

Question 5(a) [3 marks]

Explain given string methods: i. count() ii. strip() iii. replace()

Answer:
Essential string methods for text processing and manipulation.

String Methods Comparison:

Method	Purpose	Syntax	Example
count()	Count occurrences	str.count(substring)	"hello".count("l") = 2
strip()	Remove whitespace	str.strip()	" text ".strip() = "text"
replace()	Replace substring	str.replace(old, new)	"hi".replace("i", "ello") = "hello"

Return Values:

- **count()**: Integer (number of occurrences)
- **strip()**: New string (whitespace removed)
- **replace()**: New string (replacements made)

Mnemonic: "Count Strip Replace"

Question 5(b) [4 marks]

Explain how to traverse a string by giving example.

Answer:
String traversal means accessing each character in a string sequentially.

Traversal Methods:

Method	Syntax	Use Case
Index-based	for i in range(len(str))	Need position
Direct iteration	for char in string	Just characters
Enumerate	for i, char in enumerate(str)	Both index and character

Example Code:

```
text = "Python"

# Method 1: Direct iteration
for char in text:
    print(char, end=" ")  # P y t h o n

# Method 2: Index-based
for i in range(len(text)):
    print(f"{i}: {text[i]}")

# Method 3: Enumerate
for index, character in enumerate(text):
    print(f"Position {index}: {character}")
```

Mnemonic: "Direct Index Enumerate"

Question 5(c) [7 marks]

Develop programs to perform the following list operations:

Answer:
Two programs for essential list operations and analysis.

Program 1: Check Element Existence

```
def check_element_exists(lst, element):
    """Check if element exists in list"""
    if element in lst:
        return True, lst.index(element)
    else:
        return False, -1

# Test program 1
numbers = [10, 25, 30, 45, 50]
search_item = int(input("Enter element to search: "))
exists, position = check_element_exists(numbers, search_item)

if exists:
    print(f"{search_item} found at position {position}")
else:
```

```
    print(f"{search_item} not found in list")
```

Program 2: Find Smallest and Largest

```
def find_min_max(lst):
    """Find smallest and largest elements"""
    if not lst:  # Empty list check
        return None, None

    smallest = min(lst)
    largest = max(lst)
    return smallest, largest

# Test program 2
numbers = [15, 8, 23, 4, 16, 42]
min_val, max_val = find_min_max(numbers)
print(f"List: {numbers}")
print(f"Smallest: {min_val}")
print(f"Largest: {max_val}")
```

Key Operations:

- **Membership**: Using 'in' operator
- **Min/Max**: Built-in functions
- **Validation**: Empty list handling

Mnemonic: "Search Find Compare"

Question 5(a OR) [3 marks]

Explain slicing of list with example.

Answer:
List slicing extracts specific portions of a list using index ranges.

Slicing Syntax:

Format	Description	Example
list[start:end]	Elements from start to end-1	[1,2,3,4][1:3] = [2,3]
list[:end]	From beginning to end-1	[1,2,3,4][:2] = [1,2]
list[start:]	From start to end	[1,2,3,4][2:] = [3,4]
list[::step]	Every step element	[1,2,3,4][::2] = [1,3]

Example:

```
numbers = [0, 1, 2, 3, 4, 5]
print(numbers[1:4])   # [1, 2, 3]
print(numbers[:3])    # [0, 1, 2]
print(numbers[3:])    # [3, 4, 5]
print(numbers[::2])   # [0, 2, 4]
```

Mnemonic: "Start End Step"

Question 5(b OR) [4 marks]

Explain how to traverse a list by giving example.

Answer:
List traversal involves accessing each element in a list systematically.

Traversal Techniques:

Method	Syntax	Output Type
Value iteration	for item in list	Elements only
Index iteration	for i in range(len(list))	Index access
Enumerate	for i, item in enumerate(list)	Index and value

Example Code:

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

# Method 1: Direct value access
print("Values only:")
for fruit in fruits:
    print(fruit)

# Method 2: Index-based access
print("\nWith indices:")
for i in range(len(fruits)):
    print(f"Index {i}: {fruits[i]}")

# Method 3: Enumerate
print("\nUsing enumerate:")
for index, fruit in enumerate(fruits):
    print(f"{index} -> {fruit}")
```

Use Cases:

- **Value only**: Simple processing
- **Index access**: Position-dependent operations
- **Enumerate**: Both index and value needed

Mnemonic: "Value Index Both"

Question 5(c OR) [7 marks]

Develop python code to create list of prime and non-prime numbers in range 1 to 50.

Answer:
A Python program to categorize numbers into prime and non-prime lists.

Python Code:

```
def is_prime(n):
    """Check if a number is prime"""
    if n < 2:
        return False
    for i in range(2, int(n**0.5) + 1):
        if n % i == 0:
            return False
    return True

def categorize_numbers(start, end):
    """Create lists of prime and non-prime numbers"""
    prime_numbers = []
    non_prime_numbers = []

    for num in range(start, end + 1):
        if is_prime(num):
            prime_numbers.append(num)
        else:
            non_prime_numbers.append(num)

    return prime_numbers, non_prime_numbers

# Generate lists for 1 to 50
primes, non_primes = categorize_numbers(1, 50)

print("Prime numbers (1-50):")
print(primes)
print(f"\nTotal prime numbers: {len(primes)}")

print("\nNon-prime numbers (1-50):")
print(non_primes)
print(f"\nTotal non-prime numbers: {len(non_primes)}")
```

Prime Logic:

Number Type	Condition	Examples
Prime	Only divisible by 1 and itself	2, 3, 5, 7, 11
Non-Prime	Has other divisors	1, 4, 6, 8, 9

Algorithm Steps:

- **Check divisibility** from 2 to √n
- **Categorize** based on prime test
- **Store** in appropriate lists

Mnemonic: "Check Divide Categorize Store"