Python Programming (1323203) - Summer 2024 Solution

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Question 1(a) [3 marks]

Lists the Importance of flowchart and algorithm

Solution

Table 1. Importance of Flowchart and Algorithm

Importance of Flowchart	**Importance of Algorithm**
Visual representation of program logic	Step-by-step procedure to solve a problem
Easier to debug and identify errors	Language-independent solution approach
Helps in understanding complex processes	Serves as a foundation for programming
Improves communication among team members	Defines logic before coding begins

Mnemonic

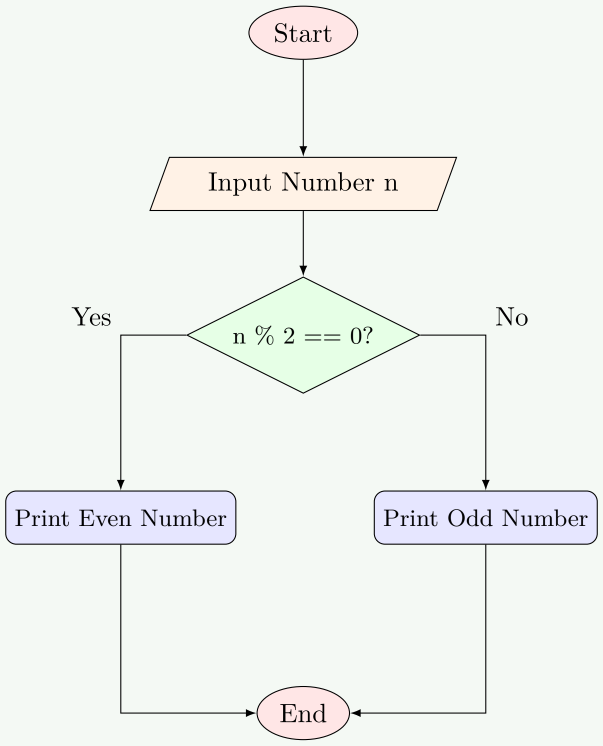
"VASE Decisions" - Visualize, Analyze, Sequence, Execute

Question 1(b) [4 marks]

Draw a flowchart to find the entered number is even or odd.

Solution

Figure 1. Flowchart to check Even or Odd number



Key Steps:

- **Input collection**: Get number from user
- **Modulo operation**: Divide by 2 and check remainder
- **Conditional output**: Display result based on remainder

Mnemonic

"MODE" - Modulo Operation Determines Evenness

Question 1(c) [7 marks]

List out all Logical operators and explain each by giving python code example.

Solution

Table 2. Logical Operators

Operator	Description	Example	Output
`and`	Returns True if both statements are true	`x = 5; print(x > 3 and x < 10)`	`True`
`or`	Returns True if one of the statements is true	`x = 5; print(x > 10 or x == 5)`	`True`
`not`	Reverse the result, returns False if result is true	`x = 5; print(not(x > 3))`	`False`

Code Example:

```python
# Logical AND example
age = 25
income = 50000
print("Loan eligibility:", age > 18 and income > 30000)  # True

# Logical OR example
```

```python
has_credit_card = False
has_cash = True
print("Can purchase:", has_credit_card or has_cash)  # True

# Logical NOT example
is_holiday = False
print("Should work today:", not is_holiday)  # True
```

Mnemonic

"AON Clarity" - And, Or, Not for logical clarity

OR

Question 1(c) [7 marks]

Develop a Program that can calculate simple interest and compound interest on given data.

Solution

```python
# Program to calculate Simple and Compound Interest

# Input values
principal = float(input("Enter principal amount: "))
rate = float(input("Enter rate of interest (in %): "))
time = float(input("Enter time period (in years): "))

# Calculate Simple Interest
simple_interest = (principal * rate * time) / 100

# Calculate Compound Interest
compound_interest = principal * ((1 + rate/100) ** time - 1)

# Display results
print("Simple Interest:", round(simple_interest, 2))
print("Compound Interest:", round(compound_interest, 2))
```

Key Formula

- **Simple Interest (SI)**: Principal × Rate × Time / 100
- **Compound Interest (CI)**: Principal × $((1 + \text{Rate}/100)^{\text{Time}} - 1)$

Mnemonic

"PRT Money Grows" - Principal, Rate, Time make money grow

Question 2(a) [3 marks]

Create a Program to find a minimum number among the given three numbers.

Solution

```python
# Program to find minimum of three numbers

# Input three numbers
num1 = float(input("Enter first number: "))
num2 = float(input("Enter second number: "))
num3 = float(input("Enter third number: "))

# Find minimum using built-in min() function
minimum = min(num1, num2, num3)

# Display result
print("Minimum number is:", minimum)
```

Mnemonic

"MIN Finds Least" - Minimum Is Numerically Found with Least

Question 2(b) [4 marks]

Define pseudocode. Write pseudocode to find Largest of three numbers x, y and z.

Solution

Table 3. Pseudocode Definition

Definition
A detailed yet readable description of what a computer program must do, expressed in a formally-styled natural language rather than in a programming language.

Pseudocode for finding largest of three numbers:

```
BEGIN
    INPUT x, y, z
    SET largest = x

    IF y > largest THEN
        SET largest = y
    END IF

    IF z > largest THEN
        SET largest = z
    END IF

    OUTPUT "Largest number is: ", largest
END
```

Mnemonic

"PIE Writing" - Program Ideas Expressed in simple writing

Question 2(c) [7 marks]

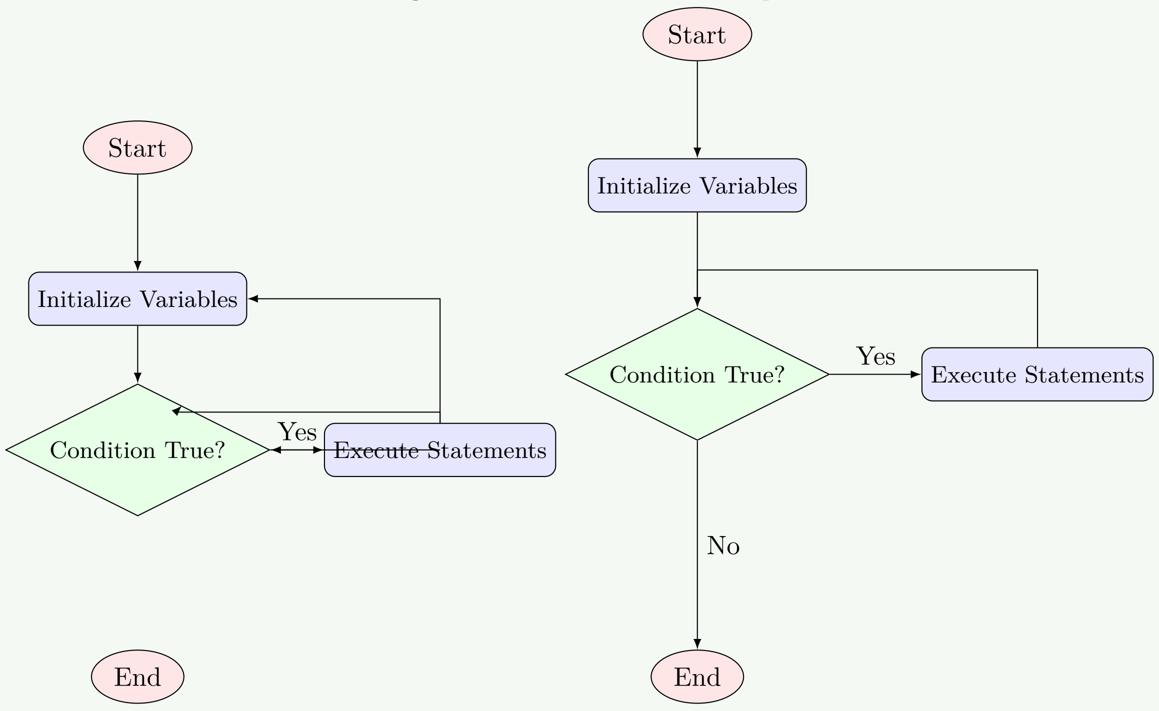
Explain While loop in python with its syntax, flowchart and with python code example.

Solution

Syntax:

```python
while condition:
    # code to be executed
```

Figure 2. Flowchart of While Loop



Code Example:

```python
# Print first 5 natural numbers using while loop
count = 1

while count <= 5:
    print(count)
    count += 1  # Increment counter

# Output:
# 1
# 2
# 3
# 4
# 5
```

Key Characteristics:

- **Entry controlled**: Condition checked before loop execution
- **Initialization**: Variables set before the loop
- **Updation**: Variables updated inside the loop
- **Termination**: Loop exits when condition becomes False

Mnemonic

"IUTE Loop" - Initialize, Update, Test for Exit

OR

Question 2(a) [3 marks]

Describe continue statement in python in brief.

Solution

Table 4. Continue Statement in Python

Description
The continue statement skips the current iteration of a loop and continues with the next iteration
When encountered, the code inside the loop following the continue statement is skipped
Useful for skipping specific conditions while keeping the loop running

Code Example:

```python
# Skip printing even numbers
for i in range(1, 6):
    if i % 2 == 0:
        continue
    print(i)  # Prints only 1, 3, 5
```

Mnemonic

"SKIP Ahead" - Skip Keeping Iteration Process

OR

Question 2(b) [4 marks]

What is the output of the following code:

Solution

Code:

```python
x=8
y=2
print (x*y)
print (x ** y)
print (x % y)
print(x>y)
```

Table 5. Output Analysis

Operation	Result	Explanation
x*y	16	Multiplication: $8 \times 2 = 16$
x**y	64	Exponentiation: $8^2 = 64$
x%y	0	Modulo (remainder): $8 \div 2 = 4$ with remainder 0
x>y	True	Comparison: $8 > 2$ is True

Mnemonic

"MEMO" - Multiply, Exponent, Modulo, Operator comparison

OR

Question 2(c) [7 marks]

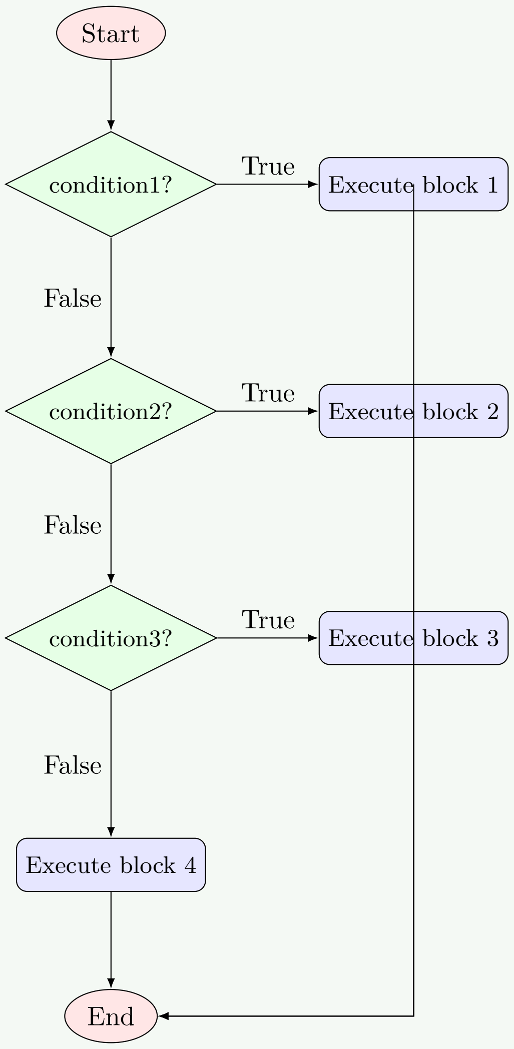
Explain if-elif-else Ladder in python with its syntax, flowchart and with python code example.

Solution

Syntax:

```python
if condition1:
    # code block 1
elif condition2:
    # code block 2
elif condition3:
    # code block 3
else:
    # code block 4
```

Figure 3. Flowchart of If-Elif-Else Ladder



Code Example:

```python
# Grade calculation based on marks
marks = 75

if marks >= 90:
    grade = "A+"
elif marks >= 80:
    grade = "A"
elif marks >= 70:
    grade = "B"
elif marks >= 60:
    grade = "C"
else:
    grade = "D"

print("Grade:", grade)  # Output: Grade: B
```

Key Characteristics:

- **Sequential evaluation**: Conditions checked from top to bottom
- **Exclusive execution**: Only one block executes
- **Default action**: Else block executes if no conditions are True

Mnemonic

"SEEP Logic" - Sequential Evaluation with Exclusive Path

Question 3(a) [3 marks]

Write a Python program to print odd numbers between 1 to 20 using loops.

Solution

```python
# Program to print odd numbers between 1 to 20

# Using for loop with range and step
for number in range(1, 21, 2):
    print(number, end=" ")

# Output: 1 3 5 7 9 11 13 15 17 19
```

Alternate approach:

```python
# Using for loop with if condition
for number in range(1, 21):
    if number % 2 != 0:
        print(number, end=" ")
```

Mnemonic

"STEO" - Skip Two, Extract Odds

Question 3(b) [4 marks]

Explain Nested if statement in brief.

Solution

Table 6. Nested if Statement

Description
An if statement inside another if statement
Allows for more complex conditional logic
Inner if only evaluated when outer if is True
Can have multiple levels of nesting

Code Example:

```python
age = 25
income = 50000

if age > 18:
    print("Adult")
    if income > 30000:
        print("Eligible for credit card")
    else:
        print("Not eligible for credit card")
else:
    print("Minor")
```

Mnemonic

"LION" - Layered If-statements Operating Nested

Question 3(c) [7 marks]

Using a user-defined function write a Program to check entered number is an 'Armstrong number' or a palindrome in which number is passed as argument in calling function.

Solution

```python
# Program to check Armstrong number or palindrome

def check_number(num):
    # Check if Armstrong number
    # An Armstrong number is one where sum of each digit raised to power of
    # total digits equals the original number
    temp = num
    digits = len(str(num))
    sum = 0

    while temp > 0:
        digit = temp % 10
        sum += digit ** digits
        temp //= 10

    is_armstrong = (sum == num)

    # Check if palindrome
    # A palindrome reads the same backward as forward
    is_palindrome = (str(num) == str(num)[::-1])

    # Return results
    return is_armstrong, is_palindrome

# Get input from user
number = int(input("Enter a number: "))

# Call function and display results
armstrong, palindrome = check_number(number)

if armstrong:
    print(number, "is an Armstrong number")
else:
    print(number, "is not an Armstrong number")

if palindrome:
    print(number, "is a Palindrome")
else:
    print(number, "is not a Palindrome")
```

Examples:

- **Armstrong**: 153 ($1^3 + 5^3 + 3^3 = 1 + 125 + 27 = 153$)
- **Palindrome**: 121 (Same forward and backward)

Mnemonic

"APTEST" - Armstrong Palindrome Test Equal Sum Test

OR

Question 3(a) [3 marks]

Write a python program to find sum of 1 to 100.

Solution

```python
# Program to find sum of numbers from 1 to 100

# Method 1: Using loop
total = 0
for num in range(1, 101):
    total += num
print("Sum using loop:", total)

# Method 2: Using formula n(n+1)/2
n = 100
sum_formula = n * (n + 1) // 2
print("Sum using formula:", sum_formula)

# Output:
# Sum using loop: 5050
# Sum using formula: 5050
```

Mnemonic

"SUM Formula" - Sum Using Mathematical Formula

OR

Question 3(b) [4 marks]

Write a python program to print the following pattern.

Solution

Pattern:

```
1
2 3
4 5 6
7 8 9 10
```

Code:

```python
# Program to print the number pattern

num = 1
for i in range(1, 5):  # 4 rows
    for j in range(i):  # columns equal to row number
        print(num, end=" ")
        num += 1
    print()  # New line after each row
```

Pattern Logic:

- **Row 1**: 1 number (1)
- **Row 2**: 2 numbers (2, 3)
- **Row 3**: 3 numbers (4, 5, 6)
- **Row 4**: 4 numbers (7, 8, 9, 10)

Mnemonic

"CNIR" - Counter Number Increases with Rows

OR

Question 3(c) [7 marks]

Write a Program using the function that reverses the entered value.

Solution

```python
# Program to reverse entered value using functions

def reverse_number(num):
    """Function to reverse an integer number"""
    return int(str(num)[::-1])

def reverse_string(text):
    """Function to reverse a string"""
    return text[::-1]

# Main program
def main():
    choice = input("What do you want to reverse? (n for number, s for string): ")

    if choice.lower() == 'n':
        num = int(input("Enter a number: "))
        print("Reversed number:", reverse_number(num))
    elif choice.lower() == 's':
        text = input("Enter a string: ")
        print("Reversed string:", reverse_string(text))
    else:
        print("Invalid choice!")

# Call the main function
main()
```

Alternate Method for Number Reversal:

```python
def reverse_number_algorithm(num):
    reversed_num = 0
    while num > 0:
        digit = num % 10
        reversed_num = reversed_num * 10 + digit
        num //= 10
    return reversed_num
```

Mnemonic

"FLIP Digits" - Function Logic Inverts Position of Digits

Question 4(a) [3 marks]

Describe python math module with proper python code example.

Solution

Table 7. Python Math Module

Features
Provides mathematical functions and constants
Includes trigonometric, logarithmic, and other functions
Contains mathematical constants like pi and e
Requires import before use

Code Example:

```python
import math

# Constants
print("Value of pi:", math.pi)  # 3.141592653589793
print("Value of e:", math.e)    # 2.718281828459045

# Basic math functions
print("Square root of 16:", math.sqrt(16))  # 4.0
print("5 raised to power 3:", math.pow(5, 3))  # 125.0

# Trigonometric functions (radians)
print("Sine of 90°:", math.sin(math.pi/2))  # 1.0
print("Cosine of 0°:", math.cos(0))  # 1.0

# Logarithmic functions
print("Log base 10 of 100:", math.log10(100))  # 2.0
print("Natural log of e:", math.log(math.e))  # 1.0
```

Mnemonic

"CALM Operations" - Constants And Logarithmic Mathematical Operations

Question 4(b) [4 marks]

Write a python program that explains scope of variable.

Solution

```python
# Program to demonstrate variable scope in Python

# Global variable
global_var = "I am global"

def demonstration():
    # Local variable
    local_var = "I am local"

    # Accessing global variable
    print("Inside function - Global variable:", global_var)

    # Accessing local variable
    print("Inside function - Local variable:", local_var)

    # Creating a variable with same name as global
    global_var = "I am local with global name"
    print("Inside function - Shadowed global:", global_var)

# Function call
demonstration()

# Accessing global variable
print("Outside function - Global variable:", global_var)

# Trying to access local variable would cause error
# print("Outside function - Local variable:", local_var)  # Error!
```

Mnemonic

"GLOVES" - Global Local Variable Encapsulation System

Question 4(c) [7 marks]

Explain List Methods and its built-in Functions

Solution

Table 8. List Methods and Functions

Method	Description	Example	Output
`append()`	Adds an element at the end	`l=['a']; l.append('b')`	`['a', 'b']`
`insert()`	Adds element at specified position	`l=[1,3]; l.insert(1,2)`	`[1, 2, 3]`
`remove()`	Removes specified item	`l=['r','b']; l.remove('r')`	`['b']`
`pop()`	Removes item at specified index	`l=['a','b']; l.pop(1)`	`'b'`
`clear()`	Removes all elements	`l=[1,2]; l.clear()`	`[]`
`len()`	Returns number of elements	`len([1, 2, 3])`	`3`
`sorted()`	Returns sorted list	`sorted([3, 1, 2])`	`[1, 2, 3]`
`max()`	Returns max value	`max([5, 10, 3])`	`10`

Code Example:

```python
# Create a list
my_list = [3, 1, 4, 1, 5]
my_list.append(9)          # Add to end
my_list.insert(2, 7)       # Add at index 2
my_list.remove(1)          # Remove first occurrence of 1
popped = my_list.pop()     # Remove last element

print("Length:", len(my_list))
print("Sorted:", sorted(my_list))
print("Sum:", sum(my_list))
print("Count of 1:", my_list.count(1))
```

Mnemonic

"LISP Operations" - List Insert Sort Pop Operations

OR

Question 4(a) [3 marks]

List out Python standard library mathematical functions.

Solution

Table 9. Standard Mathematical Functions

Function	Description	Example
`abs()`	Returns absolute value	`abs(-5)` → 5
`round()`	Rounds to nearest integer	`round(3.7)` → 4
`max()`	Returns largest item	`max(1, 5)` → 5
`min()`	Returns smallest item	`min(1, 5)` → 1
`sum()`	Adds items of iterable	`sum([1, 2])` → 3
`pow()`	Returns x to power y	`pow(2, 3)` → 8

Additional from math module:

- `math.sqrt()`: Square root
- `math.floor()`: Rounds down
- `math.ceil()`: Rounds up
- `math.factorial()`: Factorial of a number
- `math.gcd()`: Greatest common divisor

Mnemonic

"SMART Calculations" - Standard Mathematical Arithmetic Routines and Tools

OR

Question 4(b) [4 marks]

Explain built in function in python.

Solution

Table 10. Built-in Functions

Description
Pre-defined functions available in Python without importing any module
Called directly without any prefix
Designed to perform common operations
Examples include `print()`, `len()`, `type()`, `input()`, `range()`

Categories with Examples:

```python
# Type conversion
print(int("10"))       # 10
print(str(10))         # "10"

# Math functions
print(abs(-7))         # 7
print(max(5, 10, 3))   # 10

# Collection processing
print(len("hello"))    # 5
print(sorted([3,1,2])) # [1, 2, 3]
```

Mnemonic

"EPIC Functions" - Embedded Python Integrated Core Functions

OR

Question 4(c) [7 marks]

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

Solution

```python
# Program to count vowels, consonants, uppercase and lowercase characters

def analyze_string(text):
    # Initialize counters
    vowels = 0
    consonants = 0
    uppercase = 0
    lowercase = 0

    # Define vowels
    vowel_set = {'a', 'e', 'i', 'o', 'u'}

    # Analyze each character
    for char in text:
        # Check if alphabetic
        if char.isalpha():
            # Check case
            if char.isupper():
                uppercase += 1
            else:
                lowercase += 1

            # Check if vowel (case-insensitive)
            if char.lower() in vowel_set:
                vowels += 1
            else:
                consonants += 1

    # Return results
    return vowels, consonants, uppercase, lowercase

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

# Get counts
vowels, consonants, uppercase, lowercase = analyze_string(text)

# Display results
print("Number of vowels:", vowels)
print("Number of consonants:", consonants)
print("Number of uppercase characters:", uppercase)
print("Number of lowercase characters:", lowercase)
```

Mnemonic

"VOCAL Analysis" - Vowels Or Consonants And Letter case

Question 5(a) [3 marks]

Write a python code to swap given two elements in a list.

Solution

```python
# Program to swap two elements in a list

def swap_elements(lst, pos1, pos2):
    """Function to swap two elements in a list"""
    lst[pos1], lst[pos2] = lst[pos2], lst[pos1]
    return lst

# Example usage
my_list = [10, 20, 30, 40, 50]
print("Original list:", my_list)

# Swap elements at positions 1 and 3
```

```python
result = swap_elements(my_list, 1, 3)
print("After swapping elements at positions 1 and 3:", result)

# Output:
# Original list: [10, 20, 30, 40, 50]
# After swapping elements at positions 1 and 3: [10, 40, 30, 20, 50]
```

Mnemonic

"STEP Logic" - Swap Two Elements with Python Logic

Question 5(b) [4 marks]

Write a python Program to check if a substring is present in a given string.

Solution

```python
# Program to check if a substring is present in a string

def check_substring(main_string, sub_string):
    """Function to check if a substring exists in a string"""
    if sub_string in main_string:
        return True
    else:
        return False

# Get input from user
main_string = input("Enter the main string: ")
sub_string = input("Enter the substring to find: ")

# Check and display result
if check_substring(main_string, sub_string):
    print(f"'{sub_string}' is present in '{main_string}'")
else:
    print(f"'{sub_string}' is not present in '{main_string}'")
```

Mnemonic

"FIND Method" - Find IN Directly with Methods

Question 5(c) [7 marks]

Explain tuple Operations, Functions and Methods

Solution

Table 11. Tuple Operations

Op/Func	Description	Example	Result
Creation	Create with parentheses	`t=(1,2)`	`(1, 2)`
Indexing	Access elements	`t[1]`	`2`
Slicing	Get subset	`t[0:1]`	`(1,)`
Concatenation	Join tuples	`(1)+(2)`	`(1, 2)`
Repetition	Repeat elements	`(1)*2`	`(1, 1)`
Membership	Check existence	`1 in t`	`True`
`len()`	Number of items	`len(t)`	`2`
`count()`	Count value	`t.count(1)`	`1`
`index()`	Find position	`t.index(2)`	`1`

Code Example:

```python
my_tuple = (3, 1, 4, 1, 5, 9)
print("First:", my_tuple[0])
print("Slice:", my_tuple[1:4])
print("Count of 1:", my_tuple.count(1))
print("Index of 4:", my_tuple.index(4))
a, b, c, *rest = my_tuple # Unpacking
```

Mnemonic

"ICONS" - Immutable Collection Operations, Numbering, and Searching

OR

Question 5(a) [3 marks]

Write a python program find the sum of elements in a list.

Solution

```python
# Program to find sum of elements in a list

def sum_of_list(numbers):
    """Function to find sum of all elements in a list"""
    total = 0
    for num in numbers:
        total += num
    return total

# Example with user input
num_elements = int(input("Enter the number of elements: "))
my_list = []

# Get elements from user
for i in range(num_elements):
    element = float(input(f"Enter element {i+1}: "))
    my_list.append(element)

# Calculate sum using function
result1 = sum_of_list(my_list)
print("Sum using custom function:", result1)

```

```python
# Calculate sum using built-in sum() function
result2 = sum(my_list)
print("Sum using built-in function:", result2)
```

Mnemonic

"SALT" - Sum All List Together

OR

Question 5(b) [4 marks]

Write a Program to demonstrate the set functions and operations.

Solution

```python
# Program to demonstrate set functions and operations

set1 = {1, 2, 3, 4, 5}
set2 = {4, 5, 6, 7, 8}

# Set operations
print("Union:", set1 | set2)
print("Intersection:", set1 & set2)
print("Difference:", set1 - set2)
print("Symmetric Difference:", set1 ^ set2)

# Set methods
set3 = set1.copy()
set3.add(6)
set3.remove(1)
set3.discard(10) # No error if not found
popped = set3.pop()
set3.clear()
```

Mnemonic

"COSI Methods" - Create, Operate, Search, Investigate with Set Methods

OR

Question 5(c) [7 marks]

Write a Program to demonstrate the dictionaries functions and operations.

Solution

```python
# Program to demonstrate dictionary functions and operations

# Creating a dictionary
student = {
    'name': 'John',
    'roll_no': 101,
    'marks': 85
}

# Accessing elements
print("Name:", student['name'])
print("Roll No:", student.get('roll_no'))

# Modifying and Adding
student['marks'] = 90
student['address'] = 'New York'

# Removing items
removed = student.pop('address')
last_item = student.popitem()

# Dictionary methods
print("Keys:", list(student.keys()))
print("Values:", list(student.values()))
print("Items:", list(student.items()))

# Clearing
student.clear()
```

Key Operations:

- **Access**: Using key or get() method
- **Modify**: Assign new value to existing key
- **Add**: Assign value to new key
- **Remove**: Using pop(), popitem(), or del

Mnemonic

"ACME Dictionary" - Access, Create, Modify, Extract from Dictionary