

Python Programming (1323203) - Summer 2023 Solution

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Question 1(a) [3 marks]

Define algorithm. What are the advantages of Algorithm?

Solution

An algorithm is a step-by-step procedure or a set of rules to solve a specific problem in a finite sequence of steps.

Advantages of Algorithm:

- **Clarity:** Provides clear, unambiguous instructions
- **Efficiency:** Helps in optimizing time and resources
- **Reusability:** Can be used repeatedly for similar problems
- **Verification:** Easy to test and debug before implementation
- **Communication:** Acts as a blueprint to communicate the solution

Mnemonic

"CERVC" (Clarity, Efficiency, Reusability, Verification, Communication)

Question 1(b) [4 marks]

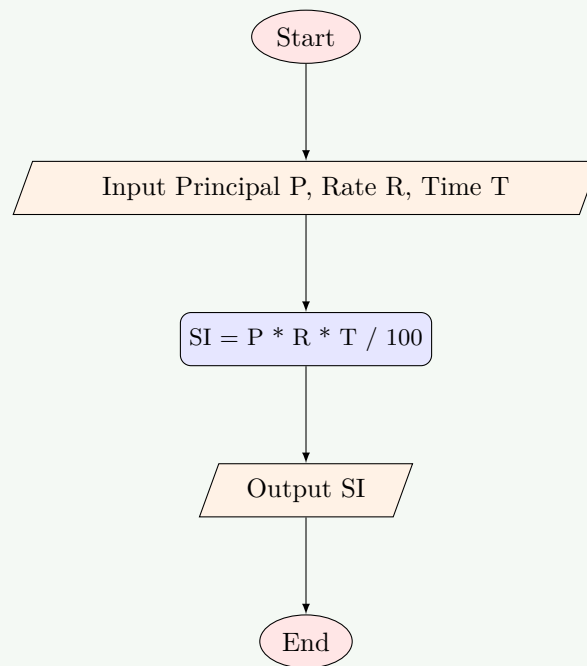
What are the rules for problem solving using flowchart? Design a flowchart to find simple interest.

Solution

Rules for problem solving using flowchart:

- **Proper symbols:** Use standard symbols for different operations
- **Direction flow:** Always maintain clear top-to-bottom, left-to-right flow
- **Single entry/exit:** Have a clear start and end point
- **Clarity:** Keep steps clear and concise
- **Consistency:** Maintain consistent level of detail

Figure 1. Flowchart for Simple Interest Calculation

**Mnemonic**

"PDRSC" (Proper symbols, Direction flow, Required entry/exit, Simplicity, Consistency)

Question 1(c) [7 marks]

List out assignment operator in python and build a python code to demonstrate an operation of any three assignment operators.

Solution

Python assignment operators:

Table 1. Assignment Operators

Operator	Example	Equivalent To
=	x = 5	x = 5
+=	x += 5	x = x + 5
-=	x -= 5	x = x - 5
*=	x *= 5	x = x * 5
/=	x /= 5	x = x / 5
%=	x %= 5	x = x % 5
//=	x //= 5	x = x // 5
**=	x **= 5	x = x ** 5
&=	x &= 5	x = x & 5
=	x = 5	x = x 5
^=	x ^= 5	x = x ^ 5
»=	x »= 5	x = x » 5
«=	x «= 5	x = x « 5

Code demonstrating assignment operators:

```

1 # Demonstrating Assignment Operators
2 num = 10
3 print("Initial value:", num)
4
5 # Using += operator
6 num += 5
7 print("After += 5:", num) # Output: 15
8
9 # Using -= operator
10 num -= 3
11 print("After -= 3:", num) # Output: 12
12
13 # Using *= operator
14 num *= 2
15 print("After *= 2:", num) # Output: 24

```

Mnemonic

"VALUE" (Variable Assignment is Like Updating Existing values)

OR

Question 1(c) [7 marks]

List out data types in python and Develop a Program to identify any three data types in python.

Solution

Python data types:

Table 2. Python Data Types

Data Type	Description	Example
int	Integer (whole numbers)	42
float	Floating point (decimal)	3.14
str	String (text)	"Hello"
bool	Boolean (True/False)	True
list	Ordered, mutable collection	[1, 2, 3]
tuple	Ordered, immutable collection	(1, 2, 3)
set	Unordered collection of unique items	{1, 2, 3}
dict	Key-value pairs	{"name": "John"}
complex	Complex numbers	2+3j
NoneType	Represents None	None

Code to identify three data types:

```

1 # Program to identify data types
2 def identify_data_type(value):
3     data_type = type(value).__name__
4     print(f"Value: {value}")
5     print(f>Data Type: {data_type}")
6     print("-" * 20)
7
8 # Testing with 3 different data types

```

```

9  identify_data_type(42)           # Integer
10 identify_data_type(3.14)        # Float
11 identify_data_type("Hello World") # String
12
13 # Output:
14 # Value: 42
15 # Data Type: int
16 # -----
17 # Value: 3.14
18 # Data Type: float
19 # -----
20 # Value: Hello World
21 # Data Type: str
22 # -----

```

Mnemonic

"TYPE-ID" (Tell Your Python Elements - Identify Data)

Question 2(a) [3 marks]

Define pseudocode. Write pseudocode to find smallest of two number.

Solution

Pseudocode is a high-level description of an algorithm that uses structural conventions of a programming language but is designed for human reading rather than machine reading.

Pseudocode to find smallest of two numbers:

```

1  BEGIN
2      INPUT first_number, second_number
3      IF first_number < second_number THEN
4          smallest = first_number
5      ELSE
6          smallest = second_number
7      END IF
8      OUTPUT smallest
9  END

```

Mnemonic

"RISE" (Read Input, Select smallest, Echo result)

Question 2(b) [4 marks]

Develop a python code to read three numbers from the user and find the average of the numbers.

Solution

```

1  # Program to calculate average of three numbers
2  # Input three numbers from user
3  num1 = float(input("Enter first number: "))

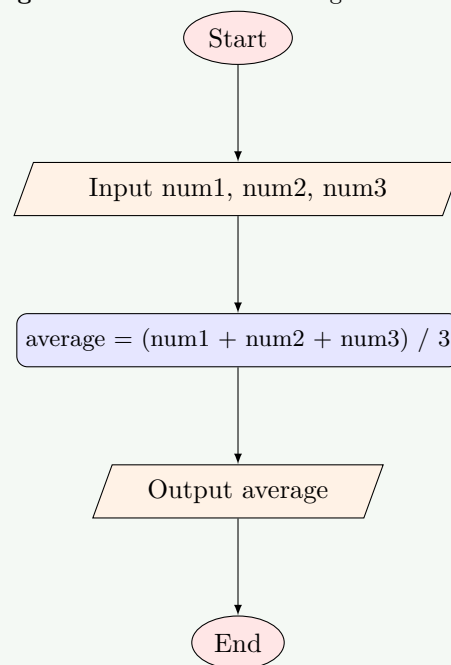
```

```

4 num2 = float(input("Enter second number: "))
5 num3 = float(input("Enter third number: "))
6
7 # Calculate the average
8 average = (num1 + num2 + num3) / 3
9
10 # Display the result
11 print(f"The average of {num1}, {num2}, and {num3} is: {average}")

```

Figure 2. Flowchart for Average Calculation

**Mnemonic**

"I-ADD-D" (Input three, ADD them up, Divide by 3)

Question 2(c) [7 marks]

Write a python code to show whether the entered number is prime or not.

Solution

```

1 # Program to check if a number is prime
2 # Input number from user
3 num = int(input("Enter a number: "))
4
5 # Check if number is less than 2
6 if num < 2:
7     print(f"{num} is not a prime number")
8 else:
9     # Initialize is_prime as True
10    is_prime = True
11
12    # Check from 2 to sqrt(num)
13    for i in range(2, int(num**0.5) + 1):

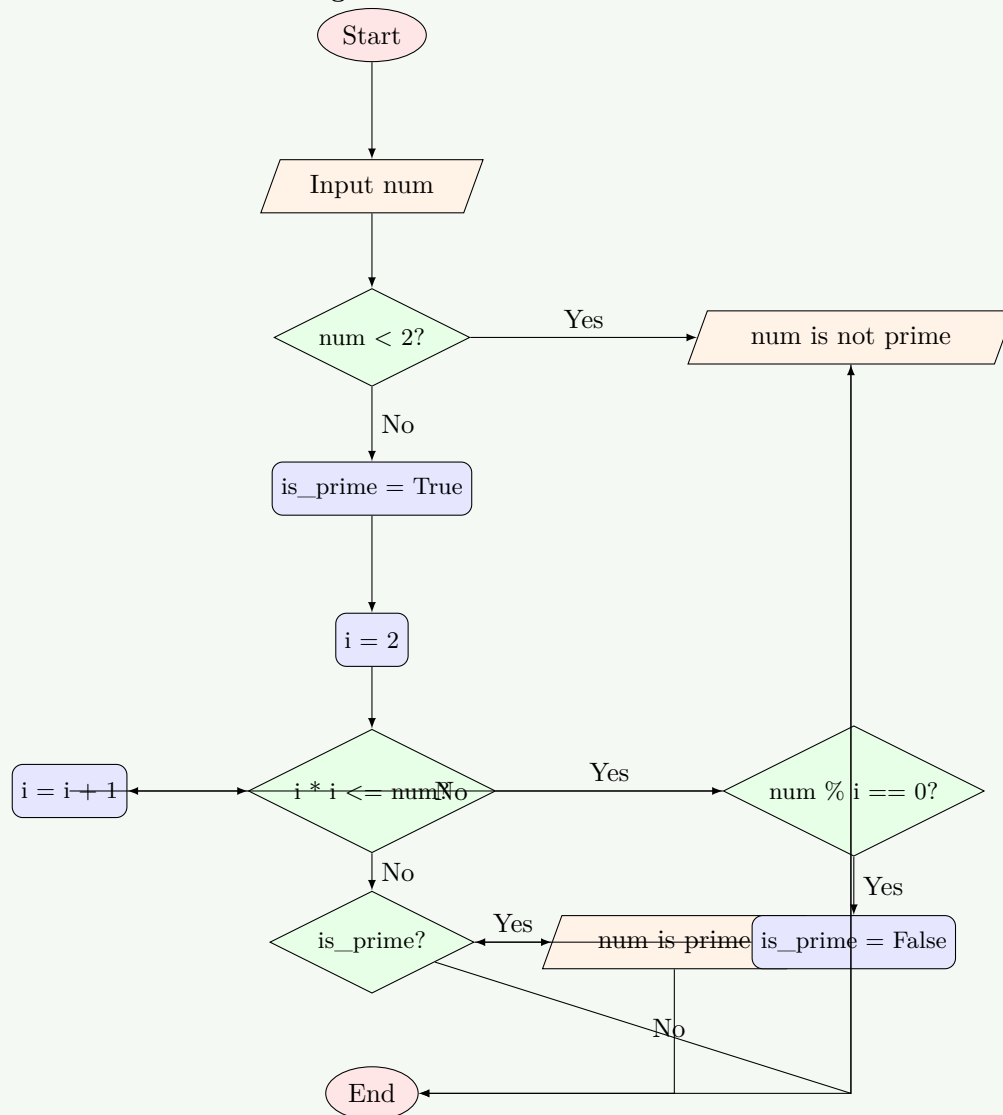
```

```

14     if num % i == 0:
15         is_prime = False
16         break
17
18     # Display result
19     if is_prime:
20         print(f"{num} is a prime number")
21     else:
22         print(f"{num} is not a prime number")

```

Figure 3. Flowchart for Prime Check



Mnemonic

"PRIME" (Positive number, Range check from 2 to \sqrt{n} , If divisible it's Multiple, Else it's prime)

OR

Question 2(a) [3 marks]

Write down a difference between Flow chart and Algorithm.

Solution

Table 3. Difference between Flowchart and Algorithm

Flow Chart	Algorithm
Visual representation using standard symbols and shapes	Textual description using structured language
Easier to understand due to graphical nature	Requires knowledge of syntax and terminology
Shows logical flow and relationships clearly	Provides detailed steps in sequential order
Time-consuming to create but easier to follow	Quicker to draft but may be harder to interpret
More difficult to modify or update	Easier to modify or update

Mnemonic

"VITAL" (Visual vs Textual, Interpretation ease, Time to create, Alteration flexibility, Logical representation)

OR

Question 2(b) [4 marks]

What is the output of the following code:

Solution

```

1 x=10
2 y=2
3 print (x*y)
4 print (x ** y)
5 print (x//y)
6 print (x % y)

```

Answer:

Table 4. Output Explanation

Operation	Explanation	Output
$x*y$	Multiplication: 10×2	20
$x**y$	Exponentiation: 10^2	100
$x//y$	Integer division: $10 \div 2$	5
$x\%y$	Modulus (remainder): $10 \div 2$	0

Mnemonic

"MEMO" (Multiply, Exponent, Modulo, Operations)

OR

Question 2(c) [7 marks]

Write a python code to display the following patterns:

Solution

```

1 A)          B)
2 1            * * * *
3 1 2          * * *
4 1 2 3        * *
5 1 2 3 4      *

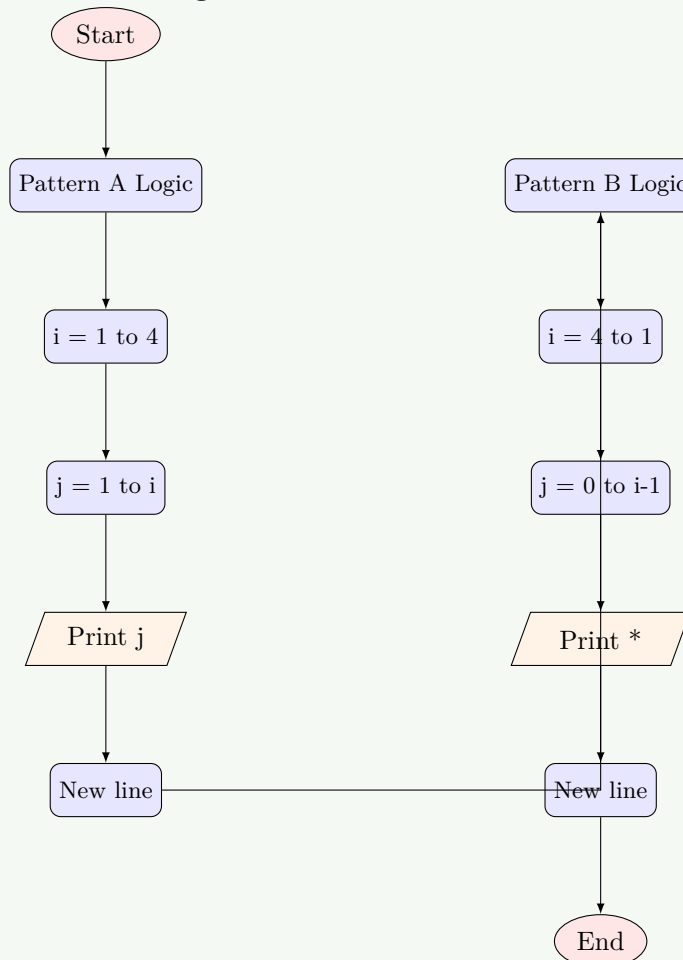
```

```

1 # Pattern A: Number pattern
2 print("Pattern A:")
3 for i in range(1, 5):
4     for j in range(1, i + 1):
5         print(j, end=" ")
6     print()
7
8 # Pattern B: Star pattern
9 print("\nPattern B:")
10 for i in range(4, 0, -1):
11     for j in range(i):
12         print("*", end=" ")
13     print()

```

Figure 4. Flowchart for Patterns



Mnemonic

"LOOP-NED" (Loop Outer, Order Pattern, Nested loops, End with newline, Display)

Question 3(a) [3 marks]

With the necessary examples describe the use of break statement.

Solution

Break statement is used to exit or terminate a loop prematurely when a specific condition is met.

Example:

```
1 # Finding the first odd number in a list
2 numbers = [2, 4, 6, 7, 8, 10]
3 for num in numbers:
4     if num % 2 != 0:
5         print(f"Found odd number: {num}")
6         break
7     print(f"Checking {num}")
```

Output:

```
1 Checking 2
2 Checking 4
3 Checking 6
4 Found odd number: 7
```

Mnemonic

"EXIT" (EXecute until condition, Immediately Terminate)

Question 3(b) [4 marks]

Explain if...else statement with suitable example.

Solution

The if...else statement is a conditional statement that executes different blocks of code based on whether a specified condition evaluates to True or False.

Syntax:

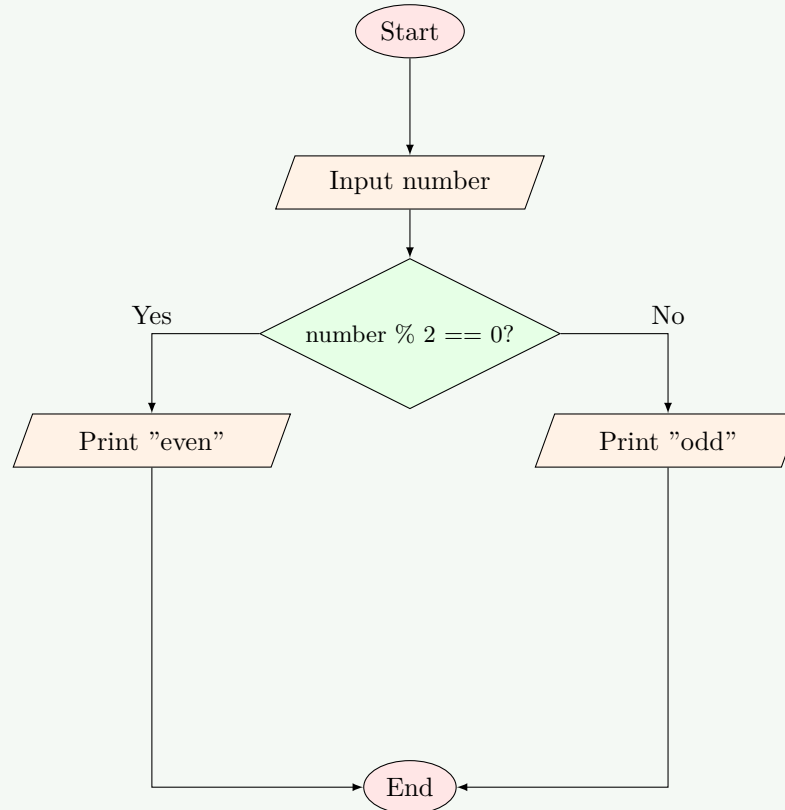
```
1 if condition:
2     # Code to be executed if condition is True
3 else:
4     # Code to be executed if condition is False
```

Example:

```
1 # Check if a number is even or odd
2 number = int(input("Enter a number: "))
3
4 if number % 2 == 0:
5     print(f"{number} is an even number")
6 else:
```

```
7 print(f"{number} is an odd number")
```

Figure 5. Flowchart for If-Else



Mnemonic

"CITE" (Check condition, If True Execute this, Else execute that)

Question 3(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.

Solution

```

1  # Function to print Fibonacci series
2  def print_fibonacci(n):
3      # Initialize first two terms
4      a, b = 0, 1
5
6      # Check if n is valid
7      if n < 0:
8          print("Please enter a positive number")
9          return
10
11     # Print Fibonacci series
12     print("Fibonacci series up to", n, ":")
13

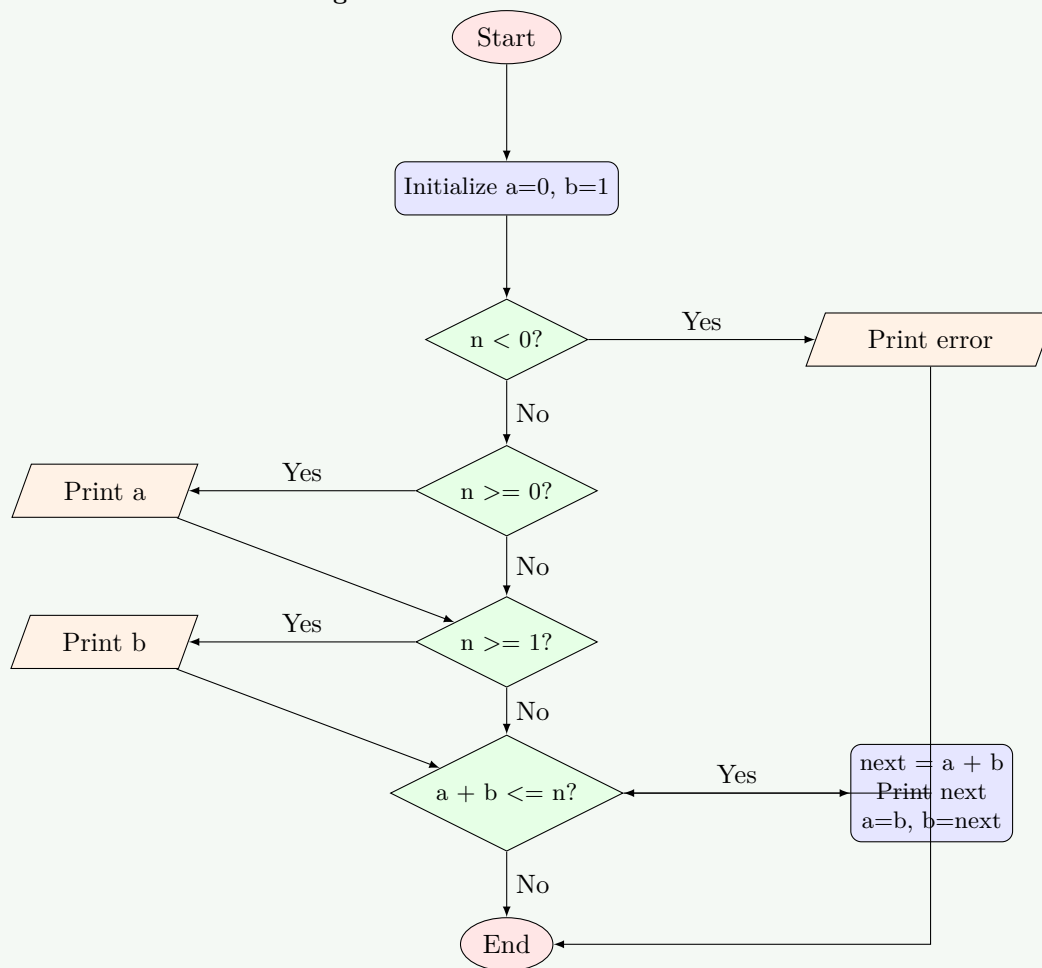
```

```

14  if n >= 0:
15      print(a, end=" ") # Print first term
16
17  if n >= 1:
18      print(b, end=" ") # Print second term
19
20  # Generate and print the rest of the series
21  while a + b <= n:
22      next_term = a + b
23      print(next_term, end=" ")
24      a, b = b, next_term
25
26  # Test the function
27  print_fibonacci(55)

```

Figure 6. Flowchart for Fibonacci Series

**Mnemonic**

"FIBER" (First terms set, Initialize variables, Build next term, Echo results, Repeat until limit)

OR

Question 3(a) [3 marks]

With the necessary examples describe the use of continue statement.

Solution

Continue statement is used to skip the current iteration of a loop and continue with the next iteration.

Example:

```
1 # Print only odd numbers from 1 to 10
2 for i in range(1, 11):
3     if i % 2 == 0:
4         continue # Skip even numbers
5     print(i)
```

Output:

```
1 1
2 3
3 5
4 7
5 9
```

Mnemonic

"SKIP" (Skip current iteration, Keep looping, Ignore remaining statements, Proceed to next iteration)

OR

Question 3(b) [4 marks]

Explain For loop statement with example.

Solution

For loop is used to iterate over a sequence (like list, tuple, string) or other iterable objects and execute a block of code for each item in the sequence.

Syntax:

```
1 for variable in sequence:
2     # Code to be executed for each item
```

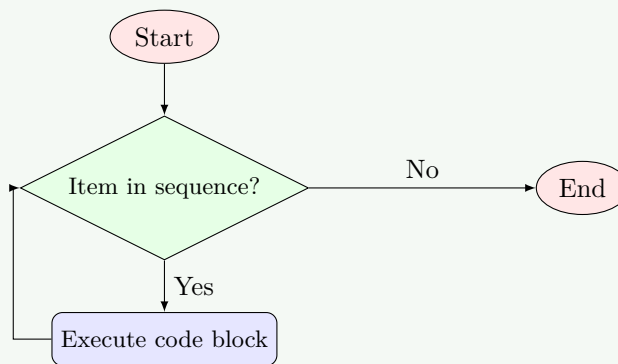
Example:

```
1 # Print squares of numbers from 1 to 5
2 for num in range(1, 6):
3     square = num ** 2
4     print(f"The square of {num} is {square}")
```

Output:

```
1 The square of 1 is 1
2 The square of 2 is 4
3 The square of 3 is 9
4 The square of 4 is 16
5 The square of 5 is 25
```

Figure 7. Flowchart for For Loop

**Mnemonic**

"FIRE" (For each Item, Run commands, Execute until end)

OR

Question 3(c) [7 marks]

Write a python code that determines whether a given number is an 'Armstrong number' or a palindrome using a user-defined function.

Solution

```

1  # Function to check if a number is Armstrong number
2  def is_armstrong(num):
3      # Convert to string to count digits
4      num_str = str(num)
5      n = len(num_str)
6
7      # Calculate sum of each digit raised to power of total digits
8      sum_of_powers = sum(int(digit) ** n for digit in num_str)
9
10     # Check if sum equals the original number
11     return sum_of_powers == num
12
13 # Function to check if a number is a palindrome
14 def is_palindrome(num):
15     # Convert to string
16     num_str = str(num)
17
18     # Check if string equals its reverse
19     return num_str == num_str[::-1]
20
21 # Main function to check both conditions
22 def check_number(num):
23     if is_armstrong(num):
24         print(f"{num} is an Armstrong number")
25     else:
26         print(f"{num} is not an Armstrong number")
27
28     if is_palindrome(num):
29         print(f"{num} is a palindrome")
30     else:
31         print(f"{num} is not a palindrome")
32

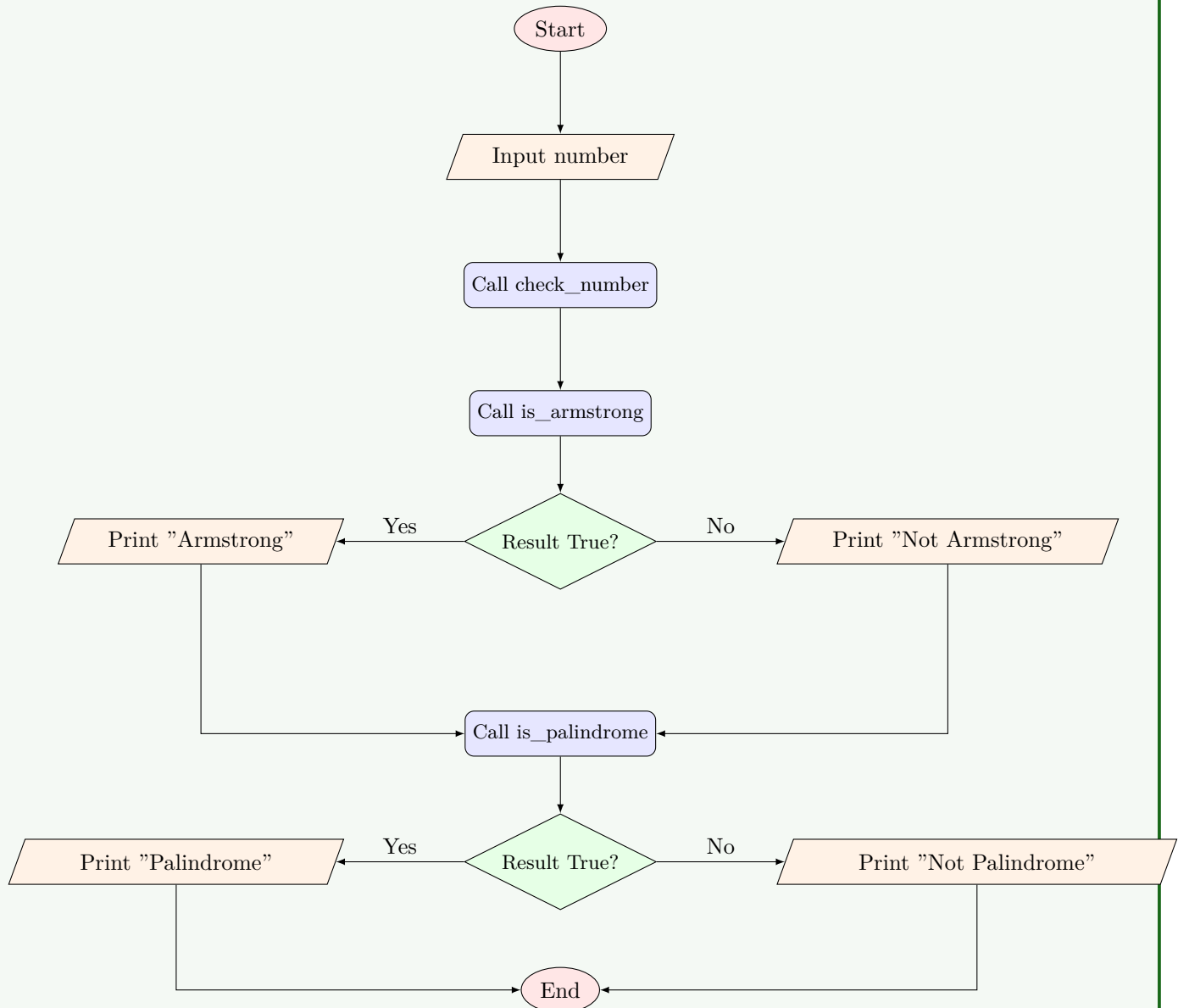
```

```

33 # Test the function
34 number = int(input("Enter a number: "))
35 check_number(number)

```

Figure 8. Flowchart for Armstrong and Palindrome Check



Mnemonic

"APC" (Armstrong check: Power sum of digits, Palindrome check: Compare with reverse)

Question 4(a) [3 marks]

Develop a python code to identify whether the scanned number is even or odd and print an appropriate message.

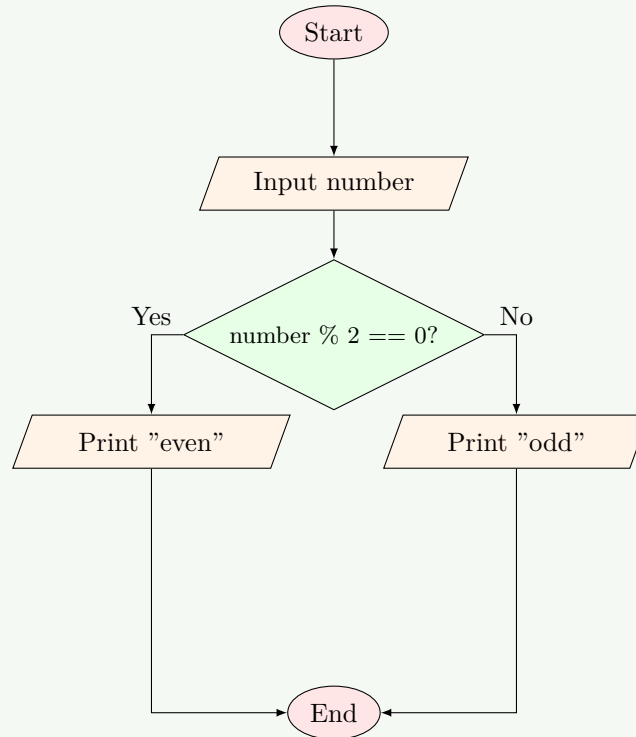
Solution

```

1 # Program to check if a number is even or odd
2 number = int(input("Enter a number: "))
3
4 if number % 2 == 0:
5     print(f"{number} is an even number")
6 else:
7     print(f"{number} is an odd number")

```

Figure 9. Flowchart for Even/Odd



Mnemonic

"MODE" (Modulo Operation Determines Even-odd)

Question 4(b) [4 marks]

Define function. Explain user define function using suitable example.

Solution

A function is a block of organized, reusable code that performs a specific task. User-defined functions are functions created by the programmer to perform custom operations.

Components of a User-defined Function:

- **def keyword:** Marks the start of function definition
- **Function name:** Identifier for the function
- **Parameters:** Input values (optional)
- **Docstring:** Description of the function (optional)
- **Function body:** Code to be executed
- **Return statement:** Output value (optional)

Example:

```

1  # User-defined function to calculate area of rectangle
2  def calculate_area(length, width):
3      """
4      Calculate area of rectangle
5      """
6      area = length * width
7      return area
8
9  # Call the function
10 result = calculate_area(5, 3)
11 print(f"Area of rectangle: {result}")

```

Mnemonic

"DRAPE" (Define function, Receive parameters, Acquire result, Process data, End with return)

Question 4(c) [7 marks]

List out various String operations and explain any three using example.

Solution

String operations in Python:

Table 5. String Operations

Operation	Description
Concatenation	Joining strings together using +
Repetition	Repeating a string using *
Indexing	Accessing characters by position
Slicing	Extracting a portion of a string
Methods	Built-in functions (len, upper, lower, etc.)
Membership Testing	Check if a substring exists in a string
Formatting	Create formatted strings
Escape Sequences	Special characters preceded by \

Three String Operations with Examples:**1. String Concatenation:**

```

1  first_name = "John"
2  last_name = "Doe"
3  full_name = first_name + " " + last_name
4  print(full_name) # Output: John Doe

```

2. String Slicing:

```

1  message = "Python Programming"
2  print(message[0:6]) # Output: Python
3  print(message[7:]) # Output: Programming
4  print(message[-11:]) # Output: Programming

```

3. String Methods:

```

1  text = "python programming"

```



```

2 print(text.upper())    # Output: PYTHON PROGRAMMING
3 print(text.capitalize()) # Output: Python programming
4 print(text.replace("python", "Java")) # Output: Java programming

```

Mnemonic

"CSM" (Concatenate strings, Slice portions, Manipulate with methods)

OR

Question 4(a) [3 marks]

Create a python code to check positive or negative number.

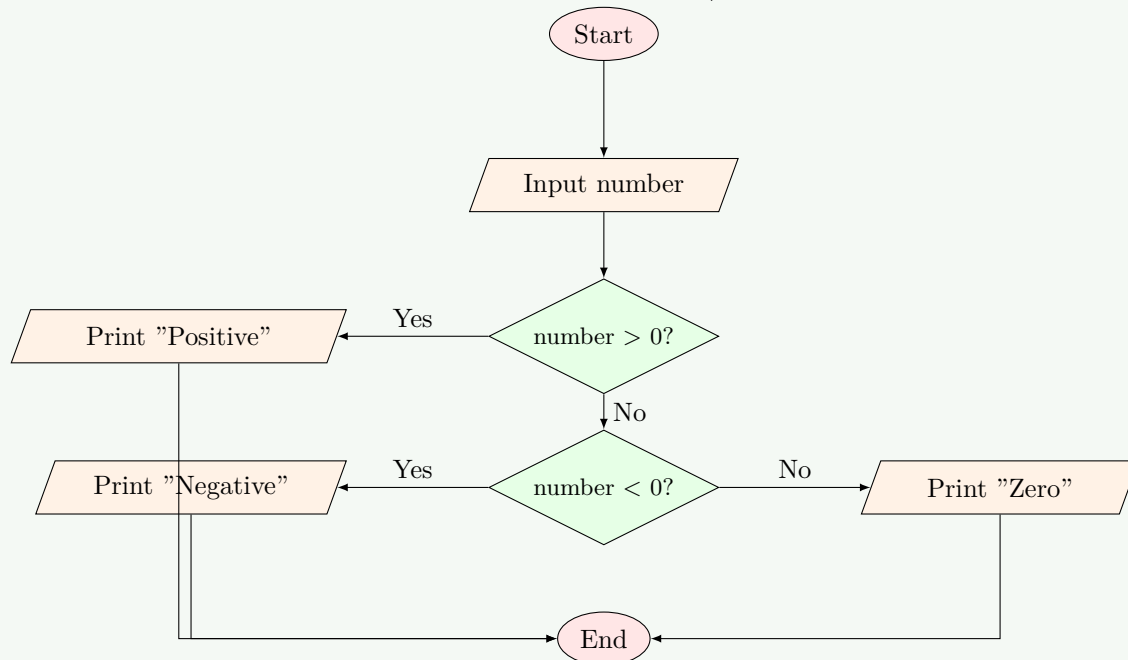
Solution

```

1 # Program to check if a number is positive or negative
2 number = float(input("Enter a number: "))
3
4 if number > 0:
5     print(f"{number} is a positive number")
6 elif number < 0:
7     print(f"{number} is a negative number")
8 else:
9     print("The number is zero")

```

Figure 10. Flowchart for Positive/Negative

**Mnemonic**

"SIGN" (See If Greater than 0, Negative otherwise)

OR

Question 4(b) [4 marks]

Explain local and global variables using suitable examples.

Solution

In Python, variables can have different scopes:

Table 6. Variable Scopes

Variable Type	Description
Local Variable	Defined within a function and accessible only inside that function
Global Variable	Defined outside functions and accessible throughout the program

Example:

```

1  # Global variable
2  count = 0
3
4  def update_count():
5      # Local variable
6      local_var = 5
7
8      # Accessing global variable inside function
9      global count
10     count += 1
11
12     print(f"Local variable: {local_var}")
13     print(f"Global variable (inside function): {count}")
14
15 # Call the function
16 update_count()
17
18 # Accessing variables outside function
19 print(f"Global variable (outside function): {count}")

```

Mnemonic

"SCOPE" (Some variables Confined to function Only, Program-wide Exposure for others)

OR

Question 4(c) [7 marks]

List out various List operations and explain any three using example.

Solution

List operations in Python:

Table 7. List Operations

Operation	Description
Creating Lists	Using square brackets []
Indexing	Accessing elements by position
Slicing	Extracting portions of a list
Append	Adding elements to the end
Insert	Adding elements at specific positions
Remove	Removing specific elements
Pop	Removing and returning elements
Sort	Ordering list elements
Reverse	Reversing list order
Extend	Combining lists

Three List Operations with Examples:

1. List Indexing and Slicing:

```

1 fruits = ["apple", "banana", "cherry", "orange", "kiwi"]
2 print(fruits[1])      # Output: banana
3 print(fruits[-1])     # Output: kiwi
4 print(fruits[1:4])    # Output: ['banana', 'cherry', 'orange']

```

2. List Methods (append, insert, remove):

```

1 numbers = [1, 2, 3]
2 numbers.append(4)      # Add 4 to the end
3 numbers.insert(0, 0)   # Insert 0 at position 0
4 numbers.remove(2)      # Remove element with value 2
5 print(numbers)         # Output: [0, 1, 3, 4]

```

3. List Comprehensions:

```

1 # Create a list of squares
2 squares = [x**2 for x in range(1, 6)]
3 print(squares) # Output: [1, 4, 9, 16, 25]

```

Mnemonic

"AIM" (Access with index, Insert/modify elements, Make using comprehensions)

Question 5(a) [3 marks]

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

Solution

```

1 # Program to swap two elements in a list
2 def swap_elements(my_list, pos1, pos2):
3     # Check if positions are valid
4     if 0 <= pos1 < len(my_list) and 0 <= pos2 < len(my_list):
5         # Swap elements
6         my_list[pos1], my_list[pos2] = my_list[pos2], my_list[pos1]
7         return True
8     else:
9         return False
10

```

```

11 # Example usage
12 numbers = [10, 20, 30, 40, 50]
13 print("Original list:", numbers)
14
15 # Swap elements at positions 1 and 3
16 if swap_elements(numbers, 1, 3):
17     print("After swapping:", numbers)
18 else:
19     print("Invalid positions")

```

Mnemonic

"SWAP" (Select positions, Watch boundaries, Assign simultaneously, Print result)

Question 5(b) [4 marks]

Explain math module and random module in python using example.

Solution

Math and random modules provide functions for mathematical operations and random number generation.

Math Module:

```

1 import math
2 print(math.pi)           # Output: 3.14159...
3 print(math.sqrt(16))     # Output: 4.0
4 print(math.ceil(4.2))    # Output: 5

```

Random Module:

```

1 import random
2 print(random.random())    # Random float
3 print(random.randint(1, 10)) # Random integer
4 colors = ["red", "green"]
5 print(random.choice(colors)) # Random choice

```

Mnemonic

"MR-CS" (Math for Calculations, Random for Choice and Shuffling)

Question 5(c) [7 marks]

Write a python code to demonstrate tuples functions and operations.

Solution

```

1 # Creating tuples
2 mixed_tuple = (1, "Hello", 3.14, True)
3
4 # Accessing tuple elements
5 print(mixed_tuple[0])    # Output: 1
6
7 # Tuple slicing

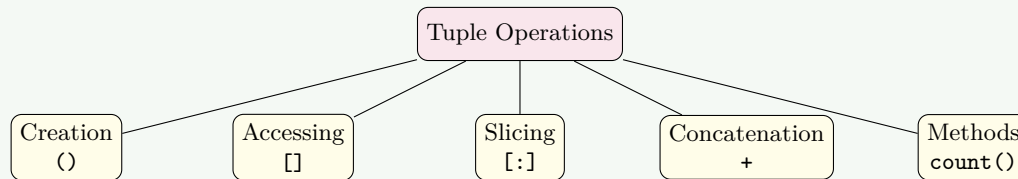
```

```

8 print(mixed_tuple[1:3])    # Output: ("Hello", 3.14)
9
10 # Tuple concatenation
11 tuple1 = (1, 2)
12 tuple2 = (3, 4)
13 print(tuple1 + tuple2)    # Output: (1, 2, 3, 4)
14
15 # Tuple methods
16 numbers = (1, 2, 2)
17 print(numbers.count(2))    # Output: 2
18
19 # Membership testing
20 print(1 in numbers)        # Output: True

```

Figure 11. Tuple Operations Visualized

**Mnemonic**

"CASC-RUMTC" (Create, Access, Slice, Concatenate, Repeat, Use methods, Membership test, Tuple conversion)

OR

Question 5(a) [3 marks]

Write a python code to find the sum of elements in a list.

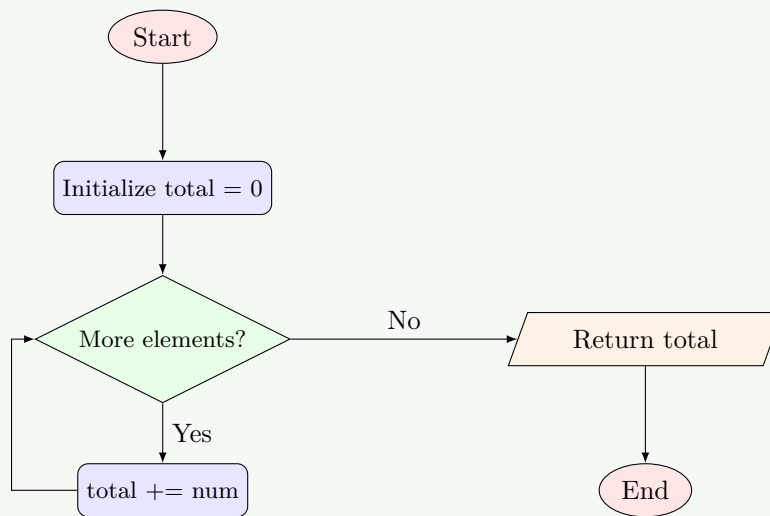
Solution

```

1 # Program to find the sum of elements in a list
2 def sum_of_elements(numbers):
3     total = 0
4     for num in numbers:
5         total += num
6     return total
7
8 # Example usage
9 my_list = [10, 20, 30, 40, 50]
10 print("Sum of elements:", sum_of_elements(my_list))

```

Figure 12. Flowchart for Sum of Elements

**Mnemonic**

"SITE" (Sum Initialized To zero, Elements added one by one)

OR

Question 5(b) [4 marks]

Explain the usage of following built in functions: 1) Print() 2) Min() 3) Sum() 4) Input()

Solution

Table 8. Built-in Functions

Function	Purpose	Example
print()	Displays output to the console	<code>print("Hi")</code>
min()	Returns smallest item	<code>min([5, 1])</code>
sum()	Returns sum of all items	<code>sum([1, 2])</code>
input()	Reads input from the user	<code>input("Name: ")</code>

```

1 print("Hello")
2 print(min([5, 3, 8]))
3 print(sum([1, 2, 3]))
4 name = input("Enter name: ")
  
```

Mnemonic

"PMSI" (Print to display, Min for smallest, Sum for total, Input for reading)

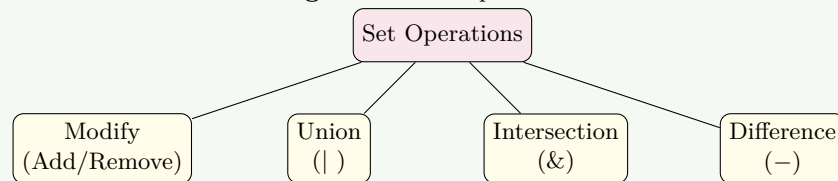
OR

Question 5(c) [7 marks]

Write a python code to demonstrate the set functions and operations.

Solution

```
1 # Creating sets
2 numbers = {1, 2, 3}
3
4 # Adding elements
5 numbers.add(4)
6
7 # Update
8 numbers.update([5, 6])
9
10 # Remove
11 numbers.remove(3)
12
13 # Set operations
14 set1 = {1, 2, 3}
15 set2 = {3, 4, 5}
16
17 # Union
18 print(set1 | set2)      # Output: {1, 2, 3, 4, 5}
19
20 # Intersection
21 print(set1 & set2)      # Output: {3}
22
23 # Difference
24 print(set1 - set2)      # Output: {1, 2}
```

Figure 13. Set Operations**Mnemonic**

"CARDS-UI" (Create, Add, Remove, Discard elements, Set operations - Union, Intersection)