# AI Assignement 12.3

**NAME**:T.AKANKSHA

**HALL TICKET NO:**2403A510D8

**COURSE:**CSE-AIML

**BATCH NO:**01

**QUESTIONS:**

**Task Description #1 – Linear Search implementation**

Task: Write python code for linear_search() function to search a value in a list and extract it's index.

**Task Description #2 – Sorting Algorithms**

Task: Ask AI to implement Bubble Sort and check sorted output

**Task Description #3 – Optimization**

Task: Write python code to solve below case study using linear optimization

Consider a chocolate manufacturing company that produces only two types of chocolate i.e. A and B. Both the chocolates require Milk and Choco only.
To manufacture each unit of A and B, the following quantities are required:
Each unit of A requires 1 unit of Milk and 3 units of Choco
Each unit of B requires 1 unit of Milk and 2 units of Choco
The company kitchen has a total of 5 units of Milk and 12 units of Choco. On each sale, the company makes a profit of Rs 6 per unit A sold and Rs 5 per unit B sold.
Now, the company wishes to maximize its profit. How many units of A and B should it produce respectively?

| | | |
|---|---|---|
| | **Task Description #4 – Gradient Descent Optimization**<br>Task: Write python code to find value of x at which the function $f(x)=2X^3+4x+5$ will be minimum | |

**TASK-1**

```python
def linear_search(data, value):
  """
  Searches for a value in a list using linear search.

  Args:
    data: The list to search within.
    value: The value to search for.

  Returns:
    The index of the value if found, otherwise -1.
  """
  for index, item in enumerate(data):
    if item == value:
      return index
  return -1

# Example usage:
my_list = [10, 20, 30, 40, 50]
search_value = 30
index = linear_search(my_list, search_value)

if index != -1:
  print(f"Value {search_value} found at index {index}")
else:
  print(f"Value {search_value} not found in the list")

search_value = 60
index = linear_search(my_list, search_value)

if index != -1:
  print(f"Value {search_value} found at index {index}")
else:
  print(f"Value {search_value} not found in the list")
```


```python
if index != -1:
  print(f"Value {search_value} found at index {index}")
else:
  print(f"Value {search_value} not found in the list")
```

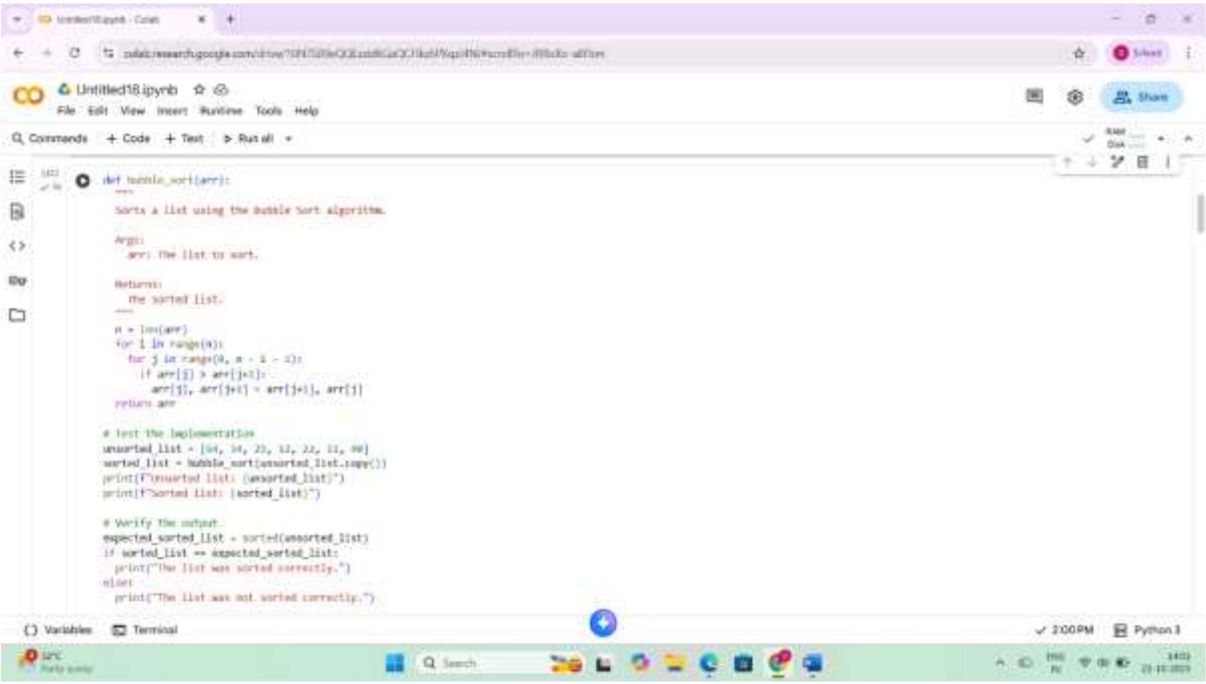

```
Value 30 found at index 2
Value 60 not found in the list
```

## TASK-2

```python
def bubble_sort(data):
  """
  Sorts a list using the Bubble Sort algorithm.

  Args:
    data: The list to sort.

  Returns:
    The sorted list.
  """
  n = len(data)
  for i in range(n):
    # Last i elements are already in place
    for j in range(0, n - i - 1):
      # traverse the list from 0 to n-i-1
      # Swap if the element found is greater than the next element
      if data[j] > data[j + 1]:
        data[j], data[j + 1] = data[j + 1], data[j]
  return data

# Example usage:
my_list = [64, 34, 25, 12, 22, 11, 90]
sorted_list = bubble_sort(my_list.copy()) # Create a copy to avoid modifying the origin
print("Original list:", my_list)
print("Sorted list:", sorted_list)
```

```
Original list: [64, 34, 25, 12, 22, 11, 90]
Sorted list: [11, 12, 22, 25, 34, 64, 90]
```

## TASK-3



**TASK-4**

```python
from sympy import symbols, diff, solve, I

# Define the variable and the function
x = symbols('x')
f_x = 2*x**3 + 4*x + 5

# Find the derivative of the function
f_prime_x = diff(f_x, x)
print(f"The derivative of f(x) is: {f_prime_x}")

# Solve for x where the derivative is zero
critical_points = solve(f_prime_x, x)
print(f"The critical points are: {critical_points}")

# Analyze the critical points to find the minimum.
# For a cubic function like this, the second derivative test can help.
# If the second derivative is positive at a critical point, it's a local minimum.
f_double_prime_x = diff(f_prime_x, x)
print(f"The second derivative of f(x) is: {f_double_prime_x}")

# Evaluate the second derivative at the critical points, but only for real critica
real_critical_points = [p for p in critical_points if p.is_real]

if not real_critical_points:
    print("There are no real critical points for this function.")
    print("For this specific cubic function with a positive leading coefficient,")
    print("there is no local minimum for real values of x.")
    print("The function decreases towards negative infinity as x approaches negati
else:
    for point in real_critical_points:
        second_deriv_value = f_double_prime_x.subs(x, point)
        print(f"Second derivative at x = {point}: {second_deriv_value}")
        if second_deriv_value > 0:
            print(f"x = {point} is a local minimum.")
        elif second_deriv_value < 0:
            print(f"x = {point} is a local maximum.")
        else:
            print(f"Second derivative test is inconclusive at x = {point}.")
```

```
The derivative of f(x) is: 6*x**2 + 4
The critical points are: [-sqrt(6)*I/3, sqrt(6)*I/3]
The second derivative of f(x) is: 12*x
There are no real critical points for this function.
For this specific cubic function with a positive leading coefficient,
there is no local minimum for real values of x.
The function decreases towards negative infinity as x approaches negative infinity.
```

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