

St Stephen College
University of Delhi

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**Paper Name :- Object Oriented Programming
Using Python**

Unique Paper Code :- 2343570001

Practical File

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Practical 1 :- Write a program to find the roots of a quadratic equation.

```
main.py
1 import math
2
3 a = float(input("Enter value of a: "))
4 b = float(input("Enter value of b: "))
5 c = float(input("Enter value of c: "))
6
7 # Calculate discriminant
8 d = b*b - 4*a*c
9
10 if d > 0:
11     root1 = (-b + math.sqrt(d)) / (2*a)
12     root2 = (-b - math.sqrt(d)) / (2*a)
13     print("Roots are real and different:")
14     print("Root 1 =", root1)
15     print("Root 2 =", root2)
16
17 elif d == 0:
18     root = -b / (2*a)
19     print("Roots are real and equal:")
20     print("Root =", root)
21
22 else:
23     real = -b / (2*a)
24     imag = math.sqrt(-d) / (2*a)
25     print("Roots are complex:")
26     print(f"Root 1 = {real} + {imag}i")
27     print(f"Root 2 = {real} - {imag}i")
28
```

Enter value of a: 1
Enter value of b: 6
Enter value of c: 2
Roots are real and different:
Root 1 = -0.3542486889354093
Root 2 = -5.645751311064591
...Program finished with exit code 0
Press ENTER to exit console.

Practical 2 :- Write a program to accept a number 'n' and a. Check if 'n' is prime b. Generate all prime numbers till 'n' c. Generate first 'n' prime numbers This program may be done using functions.

```
main.py
1 import math
2
3 # Part (a): Function to check if n is prime
4 def isPrime(n):
5     if n <= 1:
6         return False
7     for i in range(2, int(math.sqrt(n)) + 1):
8         if n % i == 0:
9             return False
10    return True
11
12 # Part (b): Function to generate all prime numbers till n
13 def primesTillN(n):
14     print(f"Prime numbers till {n}:")
15     for i in range(2, n + 1):
16         if isPrime(i):
17             print(i, end=" ")
18     print()
19
20 # Part (c): Function to generate first n prime numbers
21 def firstNPrimes(n):
22     print(f"First {n} prime numbers:")
23     count = 0
24     num = 2
25     while count < n:
26         if isPrime(num):
27             print(num, end=" ")
28             count += 1
29         num += 1
30     print()
31
32 # Main program
33 n = int(input("Enter a number: "))
34
```

Enter a number: 23
23 is a prime number.
Prime numbers till 23:
2 3 5 7 11 13 17 19 23
First 23 prime numbers:
2 3 5 7 11 13 17 19 23 29 31 37 41 43 47 53 59 61 67 71 73 79 83
...Program finished with exit code 0
Press ENTER to exit console.

```

34
35
36 # Main program
37 n = int(input("Enter a number: "))
38
39 # Part (a)
40 if isPrime(n):
41     print(n, "is a prime number.")
42 else:
43     print(n, "is not a prime number.")
44
45 # Part (b)
46 primesTillN(n)
47
48 # Part (c)
49 firstNPrimes(n)

```

Practical 3 :- Write a program to create a pyramid of the character '*' and a reverse pyramid.

```

main.py
1 # Function to print pyramid of '*'
2 def pyramid(n):
3     for i in range(1, n + 1):
4         print(" " * (n - i) + "*" * (2 * i - 1))
5
6 # Function to print reverse pyramid of '*'
7 def reverse_pyramid(n):
8     for i in range(n, 0, -1):
9         print(" " * (n - i) + "*" * (2 * i - 1))
10
11 # Main program
12 rows = int(input("Enter number of rows: "))
13
14 print("Pyramid:")
15 pyramid(rows)
16
17 print("Reverse Pyramid:")
18 reverse_pyramid(rows)
19

```

Enter number of rows: 5

Pyramid:

```

*
***
*****
*****
*****

```

Reverse Pyramid:

```

*****
*****
***
*

```

...Program finished with exit code 0
Press ENTER to exit console.

Practical 4 :- Write a program that accepts a character and performs the following: a. print whether the character is a letter or numeric digit or a special character. b. if the character is a letter, print whether the letter is uppercase or lowercase c. if the character is a numeric digit, prints its name in text (e.g., if input is 9, output is NINE)

```

main.py
1 # Program to categorize a character
2
3 ch = input("Enter a character: ")
4
5 # Part (a): Check type of character
6 if ch.isalpha():
7     print("It is a letter.")
8
9 # Part (b): Check uppercase/Lowercase
10 if ch.isupper():
11     print("The letter is uppercase.")
12 else:
13     print("The letter is lowercase.")
14
15 elif ch.isdigit():
16     print("It is a numeric digit.")
17
18 # Part (c): Print digit as word
19 names = ["ZERO", "ONE", "TWO", "THREE", "FOUR",
20         "FIVE", "SIX", "SEVEN", "EIGHT", "NINE"]
21 print("In words:", names[int(ch)])
22
23 else:
24     print("It is a special character.")
25
26

```

Enter a character: t

It is a letter.
The letter is lowercase.

...Program finished with exit code 0
Press ENTER to exit console.

Practical 5 :- Write a program to perform the following operations on a string: a. Find the frequency of a character in a string. b. Replace a character by another character in a string.

c. Remove the first occurrence of a character from a string. d. Remove all occurrences of a character from a string.

```
main.py | Python 3 | input
1 # Part (a): Find frequency of a character
2 def frequency(s, ch):
3     return s.count(ch)
4
5 # Part (b): Replace a character by another
6 def replace_char(s, old, new):
7     return s.replace(old, new)
8
9 # Part (c): Remove first occurrence of a character
10 def remove_first(s, ch):
11     return s.replace(ch, "", 1)
12
13 # Part (d): Remove all occurrences of a character
14 def remove_all(s, ch):
15     return s.replace(ch, "")
16
17
18 # Main program
19 s = input("Enter a string: ")
20
21 # Part (a)
22 ch = input("Enter character to find frequency: ")
23 print("Frequency:", frequency(s, ch))
24
25 # Part (b)
26 old = input("Character to replace: ")
27 new = input("Replace with: ")
28 print("Updated string:", replace_char(s, old, new))
29
30 # Part (c)
31 ch = input("Enter character to remove first occurrence: ")
32 print("String after removing first occurrence:", remove_first(s, ch))
33
34 # Part (d)
35 ch = input("Enter character to remove all occurrences: ")
36 print("String after removing all occurrences:", remove_all(s, ch))
37
Enter a string: jhjhdsjhashjbqhwegd
Enter character to find frequency: h
Frequency: 5
Character to replace: j
Replace with: p
Updated string: phhsdpdhashpbqhwegd
Enter character to remove first occurrence: s
String after removing first occurrence: jhjhdsjhashjbqhwegd
Enter character to remove all occurrences: j
String after removing all occurrences: hhsdhashbqhwegd
...Program finished with exit code 0
Press ENTER to exit console.
```

Practical 6:- Write a program to swap the first n characters of two strings.

```
main.py | Python 3 | input
1 # Program to swap first n characters of two strings
2
3 s1 = input("Enter first string: ")
4 s2 = input("Enter second string: ")
5 n = int(input("Enter value of n: "))
6
7 # Take first n characters of both strings
8 part1 = s1[:n]
9 part2 = s2[:n]
10
11 # Build new swapped strings
12 new_s1 = part2 + s1[n:]
13 new_s2 = part1 + s2[n:]
14
15 print("After swapping:")
16 print("String 1:", new_s1)
17 print("String 2:", new_s2)
18
Enter first string: Vishal
Enter second string: Viraj
Enter value of n: 4
After swapping:
String 1: Viraal
String 2: Vishj
...Program finished with exit code 0
Press ENTER to exit console.
```

Practical 7 :- Write a function that accepts two strings and returns the indices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string then it should return -1.

The screenshot shows a Python IDE with a file named 'main.py'. The code defines a function `find_occurrences(s, sub)` that finds all occurrences of a substring `sub` in a string `s`. It uses a `while` loop to find the first occurrence, appends its index to a list, and then moves the start position forward to find subsequent occurrences. The function returns the list of indices or `-1` if no occurrences are found. An example usage is provided at the bottom, where the user enters 'VishalJha' as the main string and 'shal' as the substring, resulting in an output of `[2]`. The console on the right shows the program's execution, including the input prompts and the final output.

```
1 def find_occurrences(s, sub):
2     indices = []
3     start = 0
4
5     while True:
6         pos = s.find(sub, start) # find substring from 'start'
7         if pos == -1:
8             break
9         indices.append(pos)
10        start = pos + 1 # move forward to find next occurrence
11
12    if len(indices) == 0:
13        return -1
14    return indices
15
16 # Example usage
17 s = input("Enter main string: ")
18 sub = input("Enter substring: ")
19
20 result = find_occurrences(s, sub)
21 print("Output:", result)
22
23
```

Enter main string: VishalJha
Enter substring: shal
Output: [2]
...Program finished with exit code 0
Press ENTER to exit console.

Practical 8 :- Write a program to create a list of the cubes of only the even integers appearing in the input list (may have elements of other types also) using the following: a. 'for' loop b. list comprehension

The screenshot shows a Python IDE with a file named 'main.py'. The code demonstrates two methods to calculate the cubes of even integers from a list. The first method uses a `for` loop to iterate through the list, checking if each element is an integer and even, and then appending its cube to a result list. The second method uses list comprehension to achieve the same result in a single line. The console on the right shows the program's execution, including the input list `[1, 2, 'hello', 4, 5.5, 6]` and the resulting list of cubes `[8, 64, 216]`.

```
1 # Using For Loop
2 lst = [1, 2, "hello", 4, 5.5, 6]
3 result = []
4
5 for item in lst:
6     if type(item) == int and item % 2 == 0:
7         result.append(item ** 3)
8
9 print(result)
10
11 #Using List comprehension
12 lst = [1, 2, "hello", 4, 5.5, 6]
13
14 result = [item**3 for item in lst if type(item) == int and item % 2 == 0]
15
16 print(result)
17
```

[8, 64, 216]
[8, 64, 216]
...Program finished with exit code 0
Press ENTER to exit console.

Practical 9 :- Write a program to read a file and

- Print the total number of characters, words and lines in the file.**
- Calculate the frequency of each character in the file. Use a variable of dictionary type to maintain the count.**
- Print the words in reverse order.**
- Copy even lines of the file to a file named 'File1' and odd lines to another file named 'File2'.**

```
main.py | sample.txt | File1.txt | File2.txt |
1 filename = "sample.txt"
2
3 # ----- Part (a): Counts -----
4 with open(filename, "r") as f:
5     content = f.read()
6
7 # total characters
8 num_chars = len(content)
9
10 # total words
11 words = content.split()
12 num_words = len(words)
13
14 # total lines
15 with open(filename, "r") as f:
16     lines = f.readlines()
17 num_lines = len(lines)
18
19 print("Total Characters:", num_chars)
20 print("Total Words:", num_words)
21 print("Total Lines:", num_lines)
22
23 # ----- Part (b): Character Frequency -----
24 freq = {}
25
26 for ch in content:
27     if ch in freq:
28         freq[ch] += 1
29     else:
30         freq[ch] = 1
31
32 print("\nCharacter Frequencies:")
33 for ch, count in freq.items():
34     print(repr(ch), ":", count)
35
```

Total Characters: 75
Total Words: 12
Total Lines: 2

Character Frequencies:

'H'	: 1
'e'	: 8
'l'	: 5
'o'	: 3
' '	: 10
'M'	: 1
'y'	: 2
's'	: 4
'f'	: 2
'v'	: 1
'i'	: 5
'h'	: 3
'a'	: 3
'J'	: 1
'\n'	: 1
'I'	: 1
'm'	: 3
'C'	: 1
'p'	: 1
'u'	: 2
't'	: 4
'r'	: 3
'S'	: 1
'c'	: 2
'n'	: 3
'd'	: 1
'D'	: 1
'U'	: 1
'v'	: 1

```
35
36 # ----- Part (c): Print words in reverse order -----
37 print("\nWords in reverse order:")
38 rev_words = words[::-1]
39 print(" ".join(rev_words))
40
41 # ----- Part (d): Copy even and odd lines -----
42 with open("File1.txt", "w") as f_even, open("File2.txt", "w") as f_odd:
43     for i, line in enumerate(lines, start=1):
44         if i % 2 == 0:
45             f_even.write(line)
46         else:
47             f_odd.write(line)
48
49 print("\nEven lines written to File1.txt")
50 print("Odd lines written to File2.txt")
```

'd' : 1
'p' : 1
'u' : 1
'v' : 1

Words in reverse order:
University Delhi from student Science Computer am I Jha Vishal
Myself Hello

Even lines written to File1.txt
Odd lines written to File2.txt

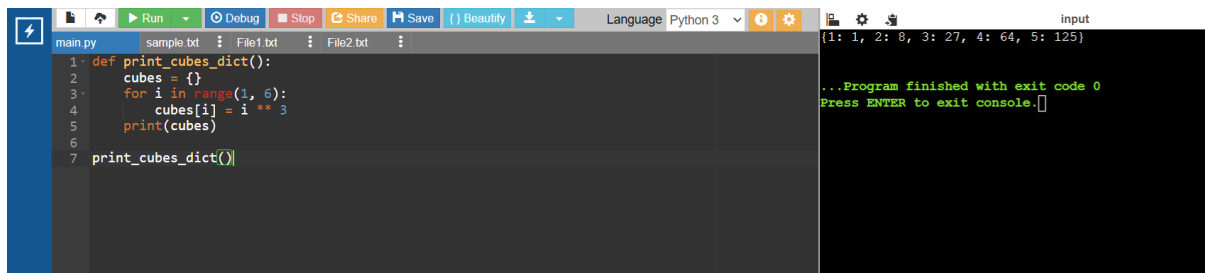
...Program finished with exit code 0
Press ENTER to exit console.

```
main.py | sample.txt | File1.txt | File2.txt |
1 Hello Myself Vishal Jha
2 I am Computer Science student from Delhi University
```

```
main.py | sample.txt | File1.txt | File2.txt |
1 I am Computer Science student from Delhi University
```

```
main.py | sample.txt | File1.txt | File2.txt |
1 Hello Myself Vishal Jha
2
```

Practical 10 :- Write a function that prints a dictionary where the keys are numbers between 1 and 5 and the values are the cubes of the keys.



```
main.py | sample.txt | File1.txt | File2.txt |
1- def print_cubes_dict():
2-     cubes = {}
3-     for i in range(1, 6):
4-         cubes[i] = i ** 3
5-     print(cubes)
6-
7- print_cubes_dict()
```

input
{1: 1, 2: 8, 3: 27, 4: 64, 5: 125}

...Program finished with exit code 0
Press ENTER to exit console.

Practical 11 :- Consider a tuple t1=(1, 2, 5, 7, 9, 2, 4, 6, 8, 10). Write a program to perform following operations: a) Print half the values of the tuple in one line and the other half in the next line. b) Print another tuple whose values are even numbers in the given tuple. c) Concatenate a tuple t2=(11, 13, 15) with t1. d) Return maximum and minimum value from this tuple.



```
main.py | sample.txt | File1.txt | File2.txt |
1 t1 = (1, 2, 5, 7, 9, 2, 4, 6, 8, 10)
2
3 # (a) Print half values in two lines
4 mid = len(t1) // 2
5 print("First half:", t1[:mid])
6 print("Second half:", t1[mid:])
7
8 # (b) Tuple of even numbers
9 even_tuple = tuple(x for x in t1 if x % 2 == 0)
10 print("Even numbers tuple:", even_tuple)
11
12 # (c) Concatenate t2 with t1
13 t2 = (11, 13, 15)
14 t3 = t1 + t2
15 print("Concatenated tuple:", t3)
16
17 # (d) Maximum and minimum values
18 print("Maximum value:", max(t1))
19 print("Minimum value:", min(t1))
20
```

input
First half: (1, 2, 5, 7, 9)
Second half: (2, 4, 6, 8, 10)
Even numbers tuple: (2, 2, 4, 6, 8, 10)
Concatenated tuple: (1, 2, 5, 7, 9, 2, 4, 6, 8, 10, 11, 13, 15)
Maximum value: 10
Minimum value: 1

...Program finished with exit code 0
Press ENTER to exit console.

Practical 12 :- Define a class Employee that stores information about employees in the company. The class should contain the following:

- (i) **data members - count (to keep a record of all the objects being created for this class) and for every employee: \$\\text{employee number}, \$\\text{Name}, \$\\text{Dept}, \$\\text{Basic}, \$\\text{DA} and \$\\text{HRA}.**
- (ii) **function members: a. \$\\text{__init__}\$ method to initialize and/or update the members. Add statements to ensure that the program is terminated if any of \$\\text{Basic}, \$\\text{DA} and \$\\text{HRA} is set to a negative value. b. \$\\text{function salary}\$, that returns salary as the sum of \$\\text{Basic}, \$\\text{DA} and \$\\text{HRA}. c. \$\\text{__del__}\$ function to decrease the number of objects created for the class. d. \$\\text{__str__}\$ function to display the details of an employee along with the salary of an employee in a proper format.**

```

1 class Employee:
2     # class variable to count objects
3     count = 0
4
5     def __init__(self, emp_no, name, dept, basic, da, hra):
6         # terminate program if any value is negative
7         if basic < 0 or da < 0 or hra < 0:
8             print("Error: Basic, DA, and HRA cannot be negative.")
9             exit()
10
11        # initialize instance variables
12        self.emp_no = emp_no
13        self.name = name
14        self.dept = dept
15        self.basic = basic
16        self.da = da
17        self.hra = hra
18
19        # increase count
20        Employee.count += 1
21
22        # (b) salary function
23        def salary(self):
24            return self.basic + self.da + self.hra
25
26        # (c) destructor
27        def __del__(self):
28            Employee.count -= 1
29
30        # (d) string representation
31        def __str__(self):
32            return (f"Employee Number: {self.emp_no}\n"
33                    f"Name: {self.name}\n"
34                    f"Department: {self.dept}\n"
35                    f"Basic: {self.basic}\n"
36                    f"DA: {self.da}\n"
37                    f"HRA: {self.hra}\n"
38                    f"Salary: {self.salary()}\n"
39                    f"Total Employees: {Employee.count}")

```

```

Employee Number: 101
Name: Rahul
Department: IT
Basic: 20000
DA: 5000
HRA: 3000
Salary: 28000
Total Employees: 1

...Program finished with exit code 0
Press ENTER to exit console.

```

```

29
30 # (d) string representation
31 def __str__(self):
32     return (f"Employee Number: {self.emp_no}\n"
33             f"Name: {self.name}\n"
34             f"Department: {self.dept}\n"
35             f"Basic: {self.basic}\n"
36             f"DA: {self.da}\n"
37             f"HRA: {self.hra}\n"
38             f"Salary: {self.salary()}\n"
39             f"Total Employees: {Employee.count}")
40
41 # ----- Example Usage -----
42
43 e1 = Employee(101, "Rahul", "IT", 20000, 5000, 3000)
44 print(e1)
45

```

Practical 13 :- Write a program to define a class '2DPoint' with coordinates x and y as attributes. Create relevant methods and print the objects. Also define a method distance to calculate the distance between any two point objects.

```

1 import math
2
3 class TwoDPoint:
4
5     def __init__(self, x, y):
6         self.x = x
7         self.y = y
8
9     # method to print object details
10    def __str__(self):
11        return f"Point({self.x}, {self.y})"
12
13    # method to calculate distance from another point
14    def distance(self, other):
15        return math.sqrt((self.x - other.x)**2 + (self.y - other.y)**2)
16
17
18    # ----- Example Usage -----
19
20    p1 = TwoDPoint(3, 4)
21    p2 = TwoDPoint(7, 1)
22
23    print("Point 1:", p1)
24    print("Point 2:", p2)
25
26    print("Distance between points:", p1.distance(p2))
27
28

```

```

Point 1: Point(3, 4)
Point 2: Point(7, 1)
Distance between points: 5.0

...Program finished with exit code 0
Press ENTER to exit console.

```


Practical 14 :- Inherit the above class (referring to '2DPoint' from Q13) to create a "3Dpoint" with additional attribute z. Override the method defined in "2DPoint" class, to calculate distance between two points of the "3Dpoint" class.

```
main.py
1 import math
2
3 # Base Class (from previous question)
4 class TwoDPoint:
5     def __init__(self, x, y):
6         self.x = x
7         self.y = y
8
9     def __str__(self):
10        return f"Point({self.x}, {self.y})"
11
12    def distance(self, other):
13        return math.sqrt((self.x - other.x)**2 + (self.y - other.y)**2)
14
15 # Derived Class
16 class ThreeDPoint(TwoDPoint):
17
18     def __init__(self, x, y, z):
19         super().__init__(x, y) # Initialize x and y from parent class
20         self.z = z
21
22     def __str__(self):
23        return f"Point({self.x}, {self.y}, {self.z})"
24
25 # Overriding distance method
26 def distance(self, other):
27     return math.sqrt(
28         (self.x - other.x)**2 +
29         (self.y - other.y)**2 +
30         (self.z - other.z)**2
31     )
32
33
34
35 # ----- Example Usage -----
36
37 p1 = ThreeDPoint(1, 2, 3)
38 p2 = ThreeDPoint(4, 6, 8)
39
40 print("Point 1:", p1)
41 print("Point 2:", p2)
42
43 print("Distance between points:", p1.distance(p2))
44
```

```
input
Point 1: Point(1, 2, 3)
Point 2: Point(4, 6, 8)
Distance between points: 7.0710678118654755
...Program finished with exit code 0
Press ENTER to exit console.
```

Practical 15 :- Write a program to accept a name from a user. Raise and handle appropriate exception(s) if the text entered by the user contains digits and/or special characters.

```
main.py
1 class InvalidNameError(Exception):
2     pass
3
4 try:
5     name = input("Enter your name: ")
6
7     # Check for invalid characters
8     for ch in name:
9         if not ch.isalpha() and ch != " ":
10            raise InvalidNameError("Name should not contain digits or special characters.")
11
12    print("Valid name entered:", name)
13
14 except InvalidNameError as e:
15    print("Error:", e)
16
```

```
input
Enter your name: Vishal@123
Error: Name should not contain digits or special characters.
...Program finished with exit code 0
Press ENTER to exit console.
```