Data Structures and Algorithms (DSA)

Lab Report 1

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Semester: 3rd

Department: CPED

Submitted To:

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Lab Report 1
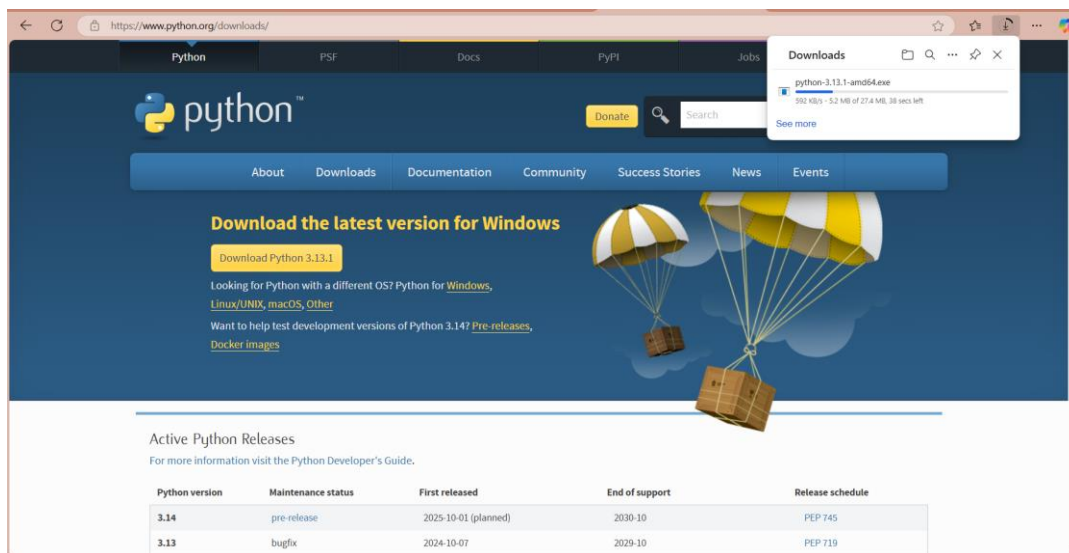
Marks Obtained: 8

Total Marks: 8

Marks Distribution:

Total Lab Report Marks: 04

Total Lab Activity Marks: 04

Completing Requirements:
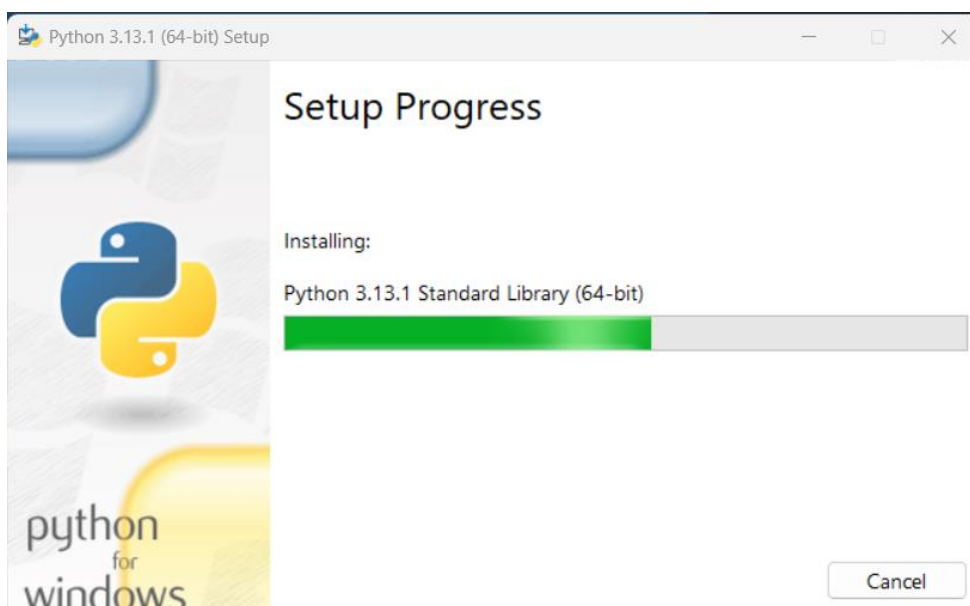
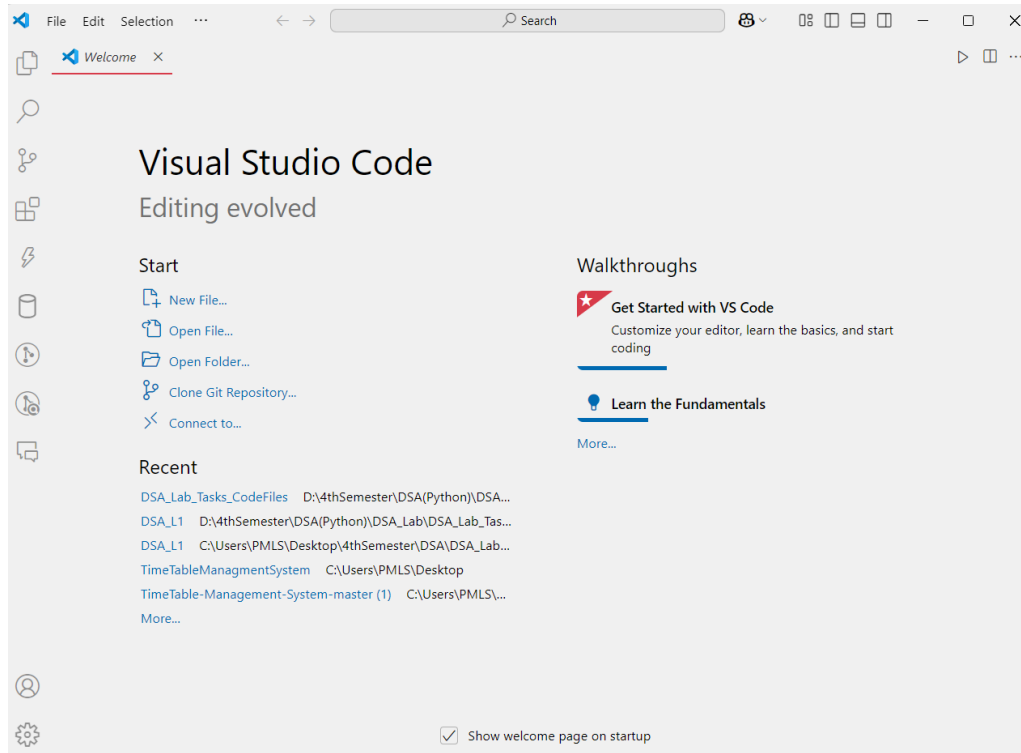- Installed Python 3.13.1 using the link below:

https://www.python.org/downloads/

Run the downloaded .exe file

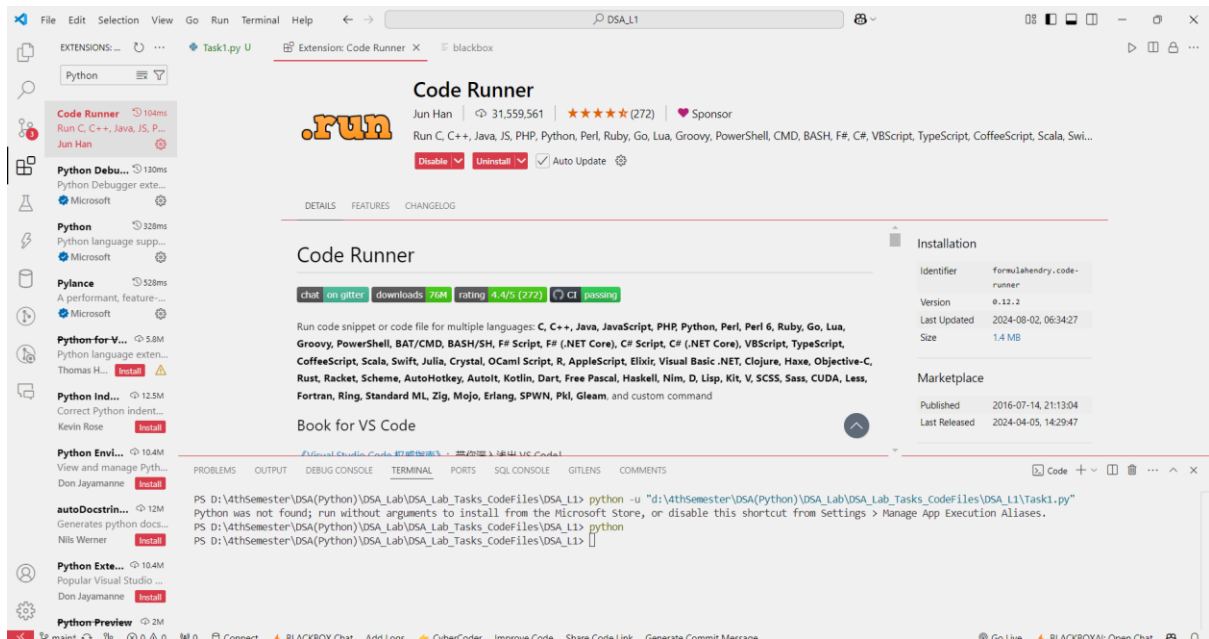- Installed VS code in my PC from **https://code.visualstudio.com/**

- Verified Python installation through command prompt
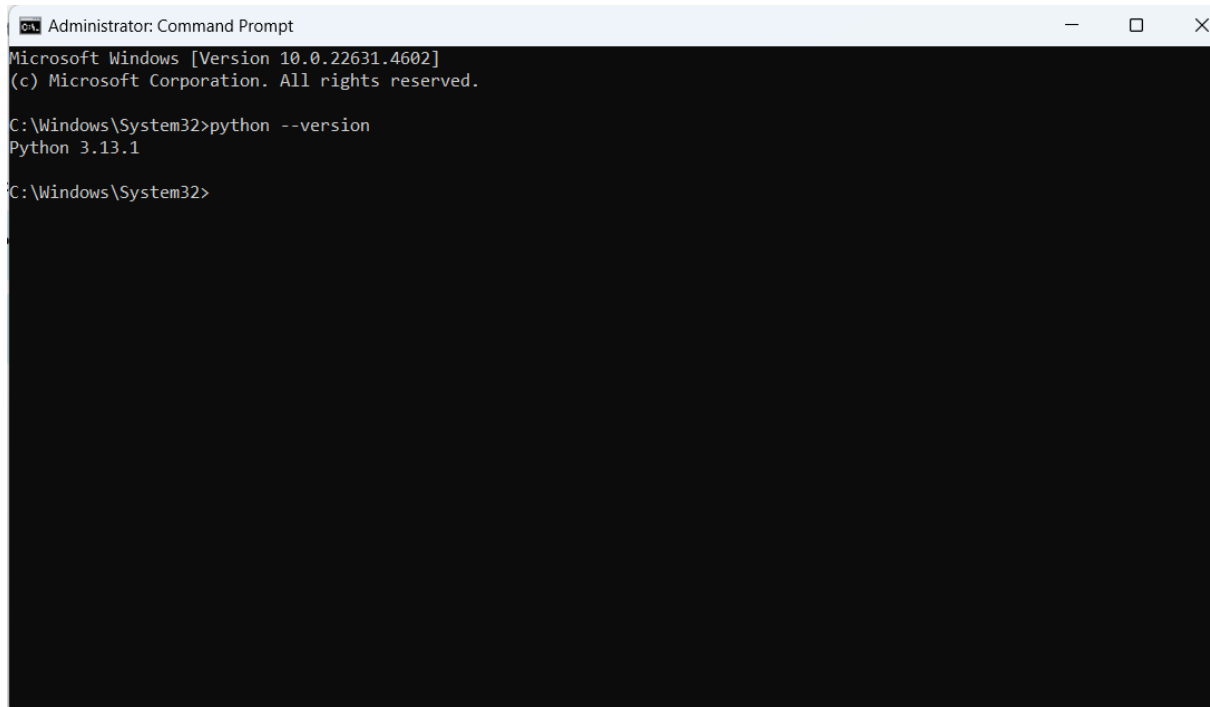
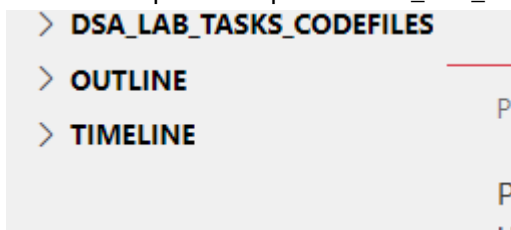- Installed Python & Code Runner extensions.

Python Extension

Code Runner Extension

- I created separated space as DS_Lab_Tasks_CodeFiles for my Labs Tasks.

Guided Tasks

Task 1: Python Variables

Code:

```python
# Task1.py > ...
1    #Author: Iqra Fatima
2    #Reg. Number: 23-CP-62
3    #Task 1: Python Variables
4    #Defining Variables
5    name="Alice"
6    age=25
7    is_student=True
8    #Printing Variables
9    print("Name:",name)
10   print("Age:",age)
11   print("Is Student:",is_student)
12
13
```

Output:

```
Name: Alice
Age: 25
Is Student: True
PS D:\4thSemester\DSA(Python)
```

Task 2: Python Data Types

Code:

```python
# Task1.py        # Task2.py U ✕

# Task2.py > ...
1    #Author: Iqra Fatima
2    #Reg. Number: 23-CP-62
3    #Task 2: Python Data Types
4    #Data Types
5    integer_value=10
6    float_value=10.5
7    string_value="Hello Python"
8    boolean_value=True
9    #Printing Data Types
10   print(type(integer_value))
11   print(type(float_value))
12   print(type(string_value))
13   print(type(boolean_value))
```

Output:

```
<class 'int'>
<class 'float'>
<class 'str'>
<class 'bool'>
PS D:\4thSemester\DSA(Python)
```

Task3: Python Numbers and Type Conversions

Code:

```python
Task3.py > ...
1    #Author: Iqra Fatima
2    #Reg. Number: 23-CP-62
3    #Task 3: Python Numbers and Type Conversions
4    num=10
5    decimal=5.7
6    text="123"
7    #Arithmentic Operations
8    print("Sum:",num+decimal)
9    print("Product:",num*decimal)
10   #Type Conversions
11   print("Integer to Float:",float(num))
12   print("String to Integer:",int(text))
```

Output:

```
Sum: 15.7
Product: 57.0
Integer to Float: 10.0
String to Integer: 123
```

Task 4: Python Boolean

Code:

```python
DSA_L1 > Task5.py > ...
1    #Author: Iqra Fatima
2    #Reg. Number: 23-CP-62
3    #Task 5: Python Boolean
4    a=10
5    b=20
6    print("Is a equal to b?",a==b)
7    print("Is a less than b?",a<b)
8    print("Logical AND:" ,a<b and b>15)
9    print("Logical OR:", a>b or b>15)
```

Output:

```
Is a equal to b? False
Is a less than b? True
Logical AND: True
Logical OR: True
PS D:\4thSemester\DSA(Python)\DS
```

Task 6: Python Operators

Code:

```
DSA_L1 > 🐍 Task6.py > ...
  1    #Author: Iqra Fatima
  2    #Reg. Number: 23-CP-62
  3    #Task 6: Python Operators
  4    x=15
  5    y=4
  6    #Arithmetic Operators
  7    print("Addition:",x+y)
  8    print("Division:",x/y)
  9    #Comparison Operators
 10    print("Is x greater than y?",x>y)
 11    #Logical Operators
 12    print("Logical AND:",x>10 and y<5)
```

Output:

```
Addition: 19
Division: 3.75
Is x greater than y? True
Logical AND: True
PS D:\4thSemester\DSA(Python)\DSA_Lab
```

Task 7: Python Boolean

Code:

```
  1    #Author: Iqra Fatima
  2    #Reg. Number: 23-CP-62
  3    #Task 5: Python Boolean
  4    a=10
  5    b=20
  6    print("Is a equal to b?",a==b)
  7    print("Is a less than b?",a<b)
  8    print("Logical AND:" ,a<b and b>15)
  9    print("Logical OR:", a>b or b>15)
```

Output:

```
First fruit: apple
List after adding orange: ['apple', 'banana', 'cherry', 'orange']
Fruit: apple
Fruit: banana
Fruit: cherry
Fruit: orange
```

Task 8: Python Lists

Code:

```python
#Author: Iqra Fatima
#Reg. Number: 23-CP-62
#Task 8: Python Tuples
colors = ("red","green","blue")
print("First color:",colors[0])
#Unpacking tuple
(a,b,c)=colors
print("Unpacked values",a,b,c)
```

Output:

```
First color: red
Unpacked values red green blue
```

Task 9: Python Tuples

Code:

```python
#Author: Iqra Fatima
#Reg. Number: 23-CP-62
#Task 9: Python Sets
numbers={1,2,3,4}
numbers.add(5)
numbers.remove(2)
print("Updated set",numbers)
#Set Operations
even_numbers = {2,4,6}
print("Union:", numbers.union(even_numbers))
print("Intersection:",numbers.intersection(even_numbers))
```

Output:

```
Updated set {1, 3, 4, 5}
Union: {1, 2, 3, 4, 5, 6}
Intersection: {4}
```

Task 10: Python Sets

Code:

```python
student ={"name":"Alice","age":21,"grade":"A"}
student["age"]=22
print("Updated dictionary:",student)
#Loop Through Dictionary
for key, value in student.items():
    print(key,":",value)
```

Output:

```
Updated dictionary: {'name': 'Alice', 'age': 22, 'grade': 'A'}
name : Alice
age : 22
grade : A
```

Task 11: Python If-Else

Code:

```python
6   number = int(input("Enter a number: "))
7   if number > 0:
8       print("The number is positive.")
9   elif number < 0:
10      print("The number is negative.")
11  else:
12      print("The number is zero.")
```

Output:

```
Enter a number: 5
The number is positive.
```

Task 12: Python While Loop

Code:

```python
#Task 12: Python While Loop
# Print numbers from 1 to 5 using a while loop
i = 1
while i <= 5:
    print("Number:", i)
    i += 1
```

Output:

```
Number: 1
Number: 2
Number: 3
Number: 4
Number: 5
```

Task 13: Python For Loop

Code:

```
1   #Author: Iqra Fatima
2   #Reg. Number: 23-CP-62
3   #Task 13: Python For Loop
4   #Program 1
5   # Print each character of a string
6   for char in "Python":
7       print("Character:", char)
8   #Program 2
9   for num in range(1, 6):
10      print("Square of", num, "is", num **2)
```

Output:

```
Character: P
Character: y
Character: t
Character: h
Character: o
Character: n
Square of 1 is 1
Square of 2 is 4
Square of 3 is 9
Square of 4 is 16
Square of 5 is 25
```

Task 14: Python Functions

Code:

```python
#Author: Iqra Fatima
#Reg. Number: 23-CP-62
#Task 14: Python Functions
#Program 1
# Define a function to greet the user
def greet(name):
    print(f"Hello, {name}! Welcome to Python programming.")
# Call the function
greet("Alice")
greet("Bob")
#Program 2
#Define a function to calculate the factorial of a number
def factorial(n):
    if n == 0 or n == 1:
        return 1
    else:
        return n * factorial(n - 1)
# Input from user
num = int(input("Enter a number: "))
print("Factorial of", num, "is", factorial(num))
```

Output:

```
Hello, Alice! Welcome to Python programming.
Hello, Bob! Welcome to Python programming.
Enter a number: 5
Factorial of 5 is 120
```

Task 15: Python Lambda Functions

Code:

```python
#Author: Iqra Fatima
#Reg. Number: 23-CP-62
#Task 15: Python Lambda Functions
# Lambda to find square of a number
square = lambda x: x ** 2
print("Square of 5:", square(5))
# Filter even numbers from a list
numbers = [1, 2, 3, 4, 5, 6, 7, 8]
even_numbers = list(filter(lambda x: x % 2 == 0, numbers))
print("Even numbers:", even_numbers)
```

Output:

```
Square of 5: 25
Even numbers: [2, 4, 6, 8]
```

Exercise Questions

Question 1: Check Positive or Negative

Write a program that takes a number as input and checks whether it is positive, negative, or zero.

Code:

```
number=int(input("Enter a number: "))

if number>0:

    print("The number is positive")

elif number<0:

    print("The number is negative")

else:

    print("The number is zero")
```

Output:

```
Enter a number: 4
The number is positive
```

Question 2: Calculate the Sum of Two Numbers

Write a program to take two numbers as input and print their sum.

Code:

```
num1 = int(input("Enter first number: "))

num2 = int(input("Enter second number: "))

print("Sum of the numbers is:", num1 + num2)
```

Output:

```
Enter first number: 12
Enter second number: 23
Sum of the numbers is: 35
```

Question 3: Find the Maximum of Three Numbers

Write a program to input three numbers and print the largest one.

Code:

```
a = int(input("Enter first number: "))

b = int(input("Enter second number: "))

c = int(input("Enter third number: "))

#Now, we'll use if-elif-else statement to find the largest number

if a > b and a > c:
```

```
    print("The largest number is", a)

elif b>c:

    print("The largest number is", b)

else:

    print("The largest number is", c)
```

Output:

```
Enter first number: 12
Enter second number: 2
Enter third number: 3
The largest number is 12
```

Question 4: Reverse a String

Write a program to reverse a string input by the user.

Code:

```
str = input("Enter a string:")

print("Original string:", str)

#Reverse the string

reversed_str = str[::-1]

print("Reversed string:", reversed_str)
```

Output:

```
Enter a string:Iqra Fatima
Original string: Iqra Fatima
Reversed string: amitaF arqI
```

Question 5: Check for Even or Odd Number

Write a program to check if a number is even or odd.

Code:

```
n= int(input("Enter a number:"))

if n % 2 == 0:

    print("Even")

else:

    print("Odd")
```

Output:

```
Enter a number:34
Even
```

Question 6: Print Multiplication Table

Write a program to print the multiplication table for a given number (from 1 to 10).

```
n= int(input("Enter a number:"))

for i in range(1,11):

   print(n,"x",i,"=",n*i
```

Output:

```
Enter a number:3
3 x 1 = 3
3 x 2 = 6
3 x 3 = 9
3 x 4 = 12
3 x 5 = 15
3 x 6 = 18
3 x 7 = 21
3 x 8 = 24
3 x 9 = 27
3 x 10 = 30
```

Question 7: Convert Celsius to Fahrenheit

Write a program to convert a temperature from Celsius to Fahrenheit using the formula:

Fahrenheit = (Celsius x 9 / 5) + 32

Code:

```
celsius=float(input("Enter temperature in Celsius:"))

fahrenheit=(celsius*9/5)+32

print("Temperature in Fahrenheit:",fahrenheit)
```

Output:

```
Enter temperature in Celsius:37
Temperature in Fahrenheit: 98.6
```

Question 8: Count the Vowels in a String

Write a program to count the number of vowels in a string the user provides.

Code:

```
str = input("Enter a string: ")

vowels = ['a','e','i','o','u','A','E','I','O','U']

count = 0

for i in str:

   if i in vowels:

      count+=1
```

print("Number of vowels in the string:",count)

Output:

```
Enter a string: Iqra
Number of vowels in the string: 2
```

Question 9: Calculate the Factorial of a Number

Write a program to calculate the factorial of a number using a loop.

Code:

```python
def factorial(n):

    fact = 1

    for i in range(1,n+1):

        fact = fact * i

    return fact

n = int(input("Enter a number: "))

print("Factorial of",n,"is",factorial(n))
```

Output:

```
Enter a number: 5
Factorial of 5 is 120
```

Question 10: Find Prime Numbers in a Range

Write a program to print all prime numbers between 1 and 50.

Code:

```python
def is_prime(n):

    if n <= 1:

        return False

    for i in range(2, int(n**0.5) + 1):

        if n % i == 0:

            return False

    return True


for num in range(1, 51):

    if is_prime(num):

        print(num)
```

```
2
3
5
7
11
13
17
19
23
29
31
37
41
43
47
```

Real Life Scenarios

Program 1: Electricity Bill Calculation

Write a program to calculate the electricity bill based on the following tariff:

o Up to 100 units: Rs. 30/unit

o 101 to 300 units: Rs. 40/unit

o Above 300 units: Rs. 60/unit

o Meter Rent: 1500

o Additional Tax: 200

Ask the user to input the units consumed and print the total bill.

Code:

```python
meter_rent=1500

additional_tax=200

units_consumed=int(input("Enter the units consumed:"))

if units_consumed<=100:

    bill=units_consumed*30+meter_rent+additional_tax

elif units_consumed<=300:

    bill=units_consumed*40+meter_rent+additional_tax

else:

    bill=units_consumed*60+meter_rent+additional_tax

print("Electricity Bill:",bill)
```

```
Enter the units consumed:200
Electricity Bill: 9700
```

Program 2: GPA Calculation

Write a program to calculate the GPA of a student.

Input the grades for 5 courses (on a scale of 4.0) and calculate the average GPA.

Code:

Input the grades for 5 courses

g1 = float(input("Enter your grade points in subject 1: "))

g2 = float(input("Enter your grade points in subject 2: "))

g3 = float(input("Enter your grade points in subject 3: "))

g4 = float(input("Enter your grade points in subject 4: "))

g5 = float(input("Enter your grade points in subject 5: "))

Calculate the average GPA

average_gpa = (g1 + g2 + g3 + g4 + g5) / 5

Print the average GPA

print("Your average GPA is:", average_gpa)

Output:

```
Enter your grade points in subject 1: 4.6
Enter your grade points in subject 2: 5
Enter your grade points in subject 3: 5
Enter your grade points in subject 4: 4.9
Enter your grade points in subject 5: 5
Your average GPA is: 4.9
```

Program 3: Monthly Budget Planner

Write a program to help a user plan their monthly budget.

Input the monthly income and expenses for categories like rent, food, transportation,

and savings. Calculate the remaining balance or deficit.

Code:

mincome = float(input("Enter your monthly income: "))

rent = float(input("Enter your rent expense: "))

food = float(input("Enter your food expense: "))

```
transportation = float(input("Enter your transportation expense: "))

savings = float(input("Enter your savings: "))

total_expense = rent + food + transportation + savings

remaining_balance = mincome - total_expense

if remaining_balance > 0:

    print("You have a remaining balance of $", remaining_balance)

else:

    print("You have a deficit of $", -remaining_balance)
```

Output:

```
Enter your monthly income: 20000000000
Enter your rent expense: 1000
Enter your food expense: 2000
Enter your transportation expense: 100000
Enter your savings: 1000000000
You have a remaining balance of $ 18999897000.0
```

Program 4:

Loan EMI Calculator

Write a program to calculate the EMI (Equated Monthly Installment) for a loan based on

the following formula:

$$EMI = \frac{P \times R \times (1 + R)^N}{(1 + R)^N - 1}$$

Where:

   • P = Principal loan amount

   • R = Monthly interest rate (Annual interest rate / 12 / 100)

   • N = Number of monthly installments

Code:

```
loan_amount = float(input("Enter the loan amount: "))

annual_interest_rate = float(input("Enter the annual interest rate: "))

monthly_interest_rate = annual_interest_rate / 12 / 100

number_of_installments = int(input("Enter the number of monthly installments: "))

emi = (loan_amount * monthly_interest_rate * (1 + monthly_interest_rate) **
number_of_installments) / ((1 + monthly_interest_rate) ** number_of_installments - 1)

print("The EMI is: ", emi)
```

Output:

```
Enter the loan amount: 10000
Enter the annual interest rate: 2
Enter the number of monthly installments: 10
The EMI is:  1009.1895641503921
```