J.N.N COLLEGE OF ENGINEERING, SHIVAMOGGA

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

INTRODUCTION TO PYTHON PROGRAMMING LAB BPLCL205B

CODE EXPLANATION OF EACH PROGRAM

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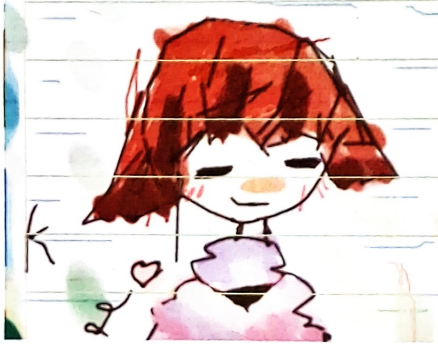

For : 2nd sem

INTRODUCTION TO PYTHON PROGRAMMING LAB

BPLCK/205B → Lab Manual [2022-23]

1a] Program Code explanation :-

This program is to read student details [Name, USN, & marks for 3 subjects] and calculates the total marks & percentage.

Step 1 :- Input details of students
- ↳ Name
- ↳ USN

} Give the details such as name, usn

Step 2 :- Input marks for 3 subjects
- ↳ marks 1
- ↳ marks 2
- ↳ marks 3

} Here you read the marks of sub 1, 2 & 3

Step 3 :- Calculate total marks and percentage
- ↳ tot_marks = marks 1 + marks 2 + marks 3
- ↳ per = tot_marks / 3 → average.

Step 4 :- Display the results.
- ↳ Student details
- ↳ Name
- ↳ USN
- ↳ Total marks
- ↳ % → Display % upto 2 decimal places.

Output Example :-

```
Enter the student name : Aaliya
Enter the student USN  : 4JN22SCS01
Enter Marks 1          : 85
Enter Marks 2          : 90
Enter Marks 3          : 95
```

```
Student Details :
Name : Aaliya
USN  : 4JN22SCS01
Total Marks : 270
%    : 90.00 %
```

1.b] Program Code Explanation :-

This program determine whether a person is a senior citizen [aged 60 / older] based on their year of birth.

Step 1 :- Input the Person's Name & Year of birth.

name → stores the user's name as a string

year → stores the user's year of birth as integer

Step 2 :- Get the current year

datetime.date.today() : ↳ current date is fetched using this

cyear = current year

Step 3 :- Calculate the age.

The person's age is calculated as `age = cyear - year`

Step 4 :- Check if the person is a senior citizen or not

↳ If age > 60 ∴ Et Senior Citizen

↳ If age < 60 ∴ Not a Senior Citizen.

Output Example :-

1. Input

Name : Aaliya

Year of birth : 1960

Current year : 2025

2. Calculation :

Age = 2025 - 1960 = 65

3. Output

Aaliya is a senior citizen.

2a] Program Code Explanation :-

Fibonacci Sequence :- is a series of no's where each no [after the first two) is the sum of the two preceding ones.

Eg:- 1, 1, 2, 3, 5, 8, 13, 21, ...

2 3

1+1 = 2
1+2 = 3
2+3 = 5
3+5 = 8 ....

The goal of the program is to generate the Fibonacci sequence of length 'N', where 'N' is provided by the user.

Step 1 :- Input the value of N.

Step 2 : Initialize the first two terms.

↳ fib1 = 1
↳ fib2 = 1
} bcz 1st two terms of fibonacci sequence are always 1.

Step 3 : Print the first two terms.

↳ print(fib1)
↳ print(fib2)
} The first two terms of sequence are directly printed.

Step 4 : Generate the Remaining terms.

↳ fib3 = fib1 + fib2. } fib3 stores the sum of fib1 & fib2.

↳ later, the value of fib3 is printed

↳ fib1 = fib2
fib2 = fib3
} these are updated to move to the next terms in the sequence.

Output Eg :-

Enter the value of N 5

⇒ 1 1 2 3 5

1+1 = 2
1+2 = 3
2+3 = 5

2b Program Explanation :-

Factorial of a number 'n' [n!] is the product of all +ve integers from 1 to n.

Eg :- $4! = 4 \times 3 \times 2 \times 1 = 24$

$0! = 1$

Binomial Co-efficient : It denoted as $\binom{n}{k}$, where k items from 'n' items should be chosed w/o considering the order. It is calculated as:

$$\binom{n}{k} = \frac{n!}{(n-k)!\ k!}$$

Eg : $n = 5$, $k = 2$

$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$

$2! = 2 \times 1 = 2$

$(5-2)! = 3! = 3 \times 2 \times 1 = 6$

$$= \frac{5!}{3! \times 2!}$$

$$= \frac{120}{2 \times 6} = 10 //$$

Step 1 :- Factorial function

↳ Base case : If $n = 0/1$, it directly returns 1

↳ Recursive Case : For other values, the function calls itself with $(n-1)$ & multiplies 'n' by the result.

Eg : $n = 3$

↳ $3! = 3 \times 2 \times 1 = 6$

The function which calls itself again & again is recursive where it breaks down into smaller subproblem until it reaches a base case.

Step 2 :- Binomial Co-efficient

Step 3 :- Input / Output

3rd Program Code Explanation :-

This program calculates the mean, variance and standard deviation of a set of numbers.

1. Mean [average] :- The sum of no's divided by the count of no's

Eg: 5, 10, 15

$\Rightarrow 5+10+15 = 30$

$$\text{Mean} = \frac{\text{Sum}}{\text{Total no}} \Rightarrow \frac{30}{3} = 10 //$$

2. Variance :- A measure of how much the no's in the dataset differ from the mean.

Eg:- $\text{Mean} = \frac{5+10+15}{3} = 10$

For 5 : $(5-10)^2 = (-5)^2 = 25 //$

For 10 : $(10-10)^2 = (0)^2 = 0 //$

For 15 : $(15-10)^2 = (5)^2 = 25 //$

→ Sum up the squared d/fces

$25+0+25 = 50$

$$\text{Variance} = \frac{\text{Sum of squared d/fces}}{\text{Count of no's}} = \frac{50}{3} \approx 16.67 //$$

3. Standard Deviation (stdev) :- The square root of the variance, showing how spread out the no's are.

$$\text{Stdev} = \sqrt{\text{variance}} = \sqrt{16.67} \approx 4.08$$

Step 1 :- Input the count of numbers
↳ eg: n = 3

Step 2 :- Create a list
↳ l = list()
} This initializes an empty list to store the no's

Step 3 : Input the numbers

```
↳ for i in range(n):
      num = int(input())
      l.append(num)
```

A loop runs 'n' times, asking the user to input no's one by one, which are then stored in the list l.

Step 4 : Calculate the mean.

```
mean = sum(l) / len(l)
```

↳ sum(l) = adds all the no's in the list.
↳ len(l) = gives the total count of no's.
↳ Their division gives the mean.

Step 5 : Calculate the variance.

```
sm = 0
for i in range(n):
    diff = (l[i] - mean)**2
    sm = sm + diff
variance = sm / len(l)
```

→ calculates the mean then sq (if any -ves are there)
eg $(-2)^2 = 4$ //

Step 6 : Calculate the std deviation. → `stdev = sqrt(variance`

Step 7 : Output the result → `print(mean, variance, stdev)`

4th Program Code Explanation :-

The program explains

↳ Take a multi-digit no (as a string) from the user.

↳ Count how many times each digit (0-9) appears in the no.

↳ Display the fq of each digit.

Step 1 : Input

↳ input('Enter the number')

Step 2 : Initialize Frequency List

↳ digits = list() creates an empty list named digits that will hold the count of each digit (0-9)

Step 3 : Populate the list

The for i in range(10): ,

digits.append(0) , loop adds 10 zeros to the digits. Each position in this list will represent the fq of digits 0 to 9, withe the first position for '0', the second for '1' & so on.

Step 4 : Count digits

↳ The second loop for i in num : goes through each character (or digit) in the no that was i/p.

`digits[int(i)] = digits[int(i)] + 1` → converts the character i to an integer (int(i)) & ncs the count for that gt digit in the digits list.

Output Example :-

If the user 123211 , the output would look like

[0, 3, 2, 1, 0, 0, 0, 0, 0, 0]
0 1 2 3 4 5 6 7 8 9

The digit '1' appears 3 times.
The digit '2' appears 2 times
The digit '3' appears 1 time

Digits 0, 4, 5, 6, 7, 8 & 9 don't appear.

5th Program Code Explanation :-

This program is designed to find the 10 most frequently occuring words in the text file.

Step 1 : You need to create a text file "data.txt" & store the text in it

Eg' all the glitters is not gold
all is well
This is a well written story
all are fruited

Step 2 : Creating an Empty Dictionary

```
d= dict()
```

Step 3 : Reading the file Line by Line

```
for line in lines :
```

} The for loop iterates over each line in the file.

Step 4: Processing Each Line.

```
words = line.strip().split(" ")
```

line.strip() → removes any leading / trailing whitespaces / newline characters.

split(" ") → splits the line into individual words using space as a separator.

Step 5: Counting Word Frequencies

```
for word in words:
    d[word] = d.get(word, 0)+1
```

retrieves current count of the word from the dictionary (if the word doesn't exist, it returns 0)

+1, ↑ces the count by 1 for each occurance of the word.

Step 6: Sorting the dictionary by Frequency.

```
srtd = dict(sorted(d.item(), key: operator.items(), key =operato
 .itemgetter(1), reverse = True))
```

d.items() returns a list of tuples (word, fq)

operator.itemgetter(1) sorts based on the fq (the second element in each tuple)

reverse = True. sorts the dictionary in descending order (most frequent first)

Step 7: Displaying the Top 10 Most Frequent Words.

```
print(dict(list(srtd.item())[:10]))
```

srtd.items() → converts the sorted dictionary back into a list of tuples.

[:10] → slices the list to get the first 10 items (top most frequent words)

dict() → convert this list of tuples back into a dictionary

print() → displays the top 10 words & their frequencies.

6th Program Code Explanation :-

This program reads the contents of a text file, sorts the line alphabetically & writes the sorted lines into a new text file.

Step 1 :- Opening the Files :

`fd = open("alp.txt")` → This line open the file alp.txt in read mode. This is where we'll get the data.

`wfd = open("sorted.txt", "w")` → This line opens a new file sorted.txt in write mode. This is where we'll write the sorted lines.

Step 2 :- Reading the Contents :

`lines = fd.readlines()` → This reads all the lines from the alp.txt file & stores them in a list called lines.

Step 3 :- Printing the Original List :

print(lines) → This line prints the list of lines from the file so we can see what the data looks like before sorting.

Step 4 :- Sorting the Lines :

lines.sort() → this method sorts the lines list in alphabetical order. After this step, the lines will be rearranged alphabetically.

Step 5 :- Printing the Sorted List :

print(lines) → This prints the sorted list, so you can see the result of sorting.

Step 6 :- Writing the Sorted Lines to a New File :

for line in lines → This loop goes through each line in the sorted list

wfd.write(line) → For each line in the sorted list, this writes the line into sorted.txt file

Step 7 :- Closing the Files :

fd.close() → this closes the input file (alp.txt) to free up resources.

wfd.close() → This closes the o/p file (sorted.txt) to save the changes.

Summary :-

↳ Open & reads the content of a file alp.txt
↳ sorts the lines alphabetically.
↳ Write the sorted lines into another file sorted.txt

7th Program Code Explanation :-

This Python code snippet demonstrates how to create a zip file containing files & subfolders from a specific directory using the zipfile & os modules.

Step 1 :- Importing Modules :

↳ from zipfile import ZipFile
import os

- ZipFile → helps to create, read or extract zip files
- os → used for interacting with the file system (eg. navigating directories)

Step 2 :- Creating a Zip File :

```
with ZipFile ("backup.zip", "w") as zipob:
```

- Opens a new zip file named backup.zip in write mode ("w")
- Ensures the file is automatically closed after the block ends.

Step 3 :- Walking Through a Directory -

```
for folders, subfolders, files in os.walk ('programs'):
```

- folders → The current folder's path
- subfolders → A list of subfolder names inside the current folder
- files → A list of files names in the current folder
- os.walk ('programs') → Iterates through the programs directory

Step 4 :- Adding Files to the zip:

```
for file in files:
    file_path = os.path.join(folders, file)
    zipob.write(file_path)
```

os.path.join(folders, file) → combines the folder path & file name to get the full path of each file.

zipob.write(file_path) → Adds the file to the zip archieve.

Step 5 :- Checking if the zip File Was Created.

```
if os.path.exists("backup.zip")
    print("zip file created")
else:
    print("Error in creation")
```

os.path.exists("backup.zip")

↳ Checks if the file backup.zip exists

↳ Prints a success message if the zip file is created otherwise, prints an error message.

Logical Flow →

Import the required modules

↓

Open/ Create a zip file named backup.zip in write mode

↓

Traverse the target directory (programs) & gather files / sub folders

↓

Add each file to the zip archieve

↓

Check if the zip file was succesfully created.

8th Program Code Explanation :-

This program calculates the division of two numbers a & b using a function called DivExp.

↳ The numerator a must be greater than 0. If not, the program will stop & show an error.

↳ The denominator (b) can't be zero becz dividing by zero is mathematically invalid. If b is zero, the program will show an error message.

Division Logic :-

If all checks pass, the division is performed using $c = a / b$ and the result is returned.

Case (I) :- Normal Division

Enter the numerator (a): 10
Enter the denominator (b): 2

10/2 = 5.0

Output: The result of division is : 5.0

Case (II) : Numerator is less than or equal to 0

Enter the numerator (a) : -5
Enter the denominator (b) : 3

Output : Error → the numerator must be > than 0

Case (III) : Denominator is zero :-

Enter the numerator (a) : 8
Enter the denominator (b) : 0

Output : Denominator can't be zero.

9th Program Code Explanation :-

This program defines a complex class for working with complex no's (numbers with real & imaginary parts)

Step 1 : Class Definition & Constructor (__init__ method):

```
class Complex:
    def __init__(self, real, imag):
        self.real = real
        self.imag = imag
```

this method is special method in python used to initialize new objects of this class

Step 2 : String Representation (__str__ method):

```
def __str__(self):
    return str(self.real) + "+i" + str(self.imag)
```

This method defines how a complex object will look when converted to a string (eg, for printing)

Example : If real = 3 & imag = 4, it will return "3+i4"

Step 3 : Addition of Complex Numbers (add function).

```
def add(c1, c2):          → complex objects c1 & c2
    return Complex(c1.real + c2.real, c1.imag
                   +c2.imag)
```

real part

imaginary part

Step 4 : Input and Logic

```
N = int(input("Enter N: "))
l = []  → empty list to store complex objects
          ↳ no of complex no's to i/p
for i in range(N):
    real = int(input('Enter real : '))
    imag = int(input('Enter imag : '))
    l.append(complex(real, imag))
```

Step 5 : Adding all Complex Numbers :

```
result = [0]
for i in range(1,N):
    result = add(result, l[i])
print(result)
```

↳ Finally prints the sum of all complex no's using the _str_ method

OUTPUT :-

```
Enter N : 2
Enter real : 3
Enter imag : 4
Enter real : 1
Enter imag : 2
```

Real part : 3+1 = 4

Imaginary part : 4+2 = 6

Output :- 4 + i6

Process :-

- Two complex no's are created
  - 3+i4
  - 1+i2
- They are added

10th Program Code Explanation :

This code defines a Student class to represent student information & their marks. However, the code has a few syntax. &

Step 1 : Class Definition

The class Student represents a student with

↳ name
↳ USN
↳ Marks

Step 2 : Constructor (_init_ method)

```
def _init_ (self, name, USN):
    self.name = name
    self.USN = USN
    self.marks = list()
```

* The constructor initializes the name, USN & marks as an empty list.
* Correct Syntax : self.name = name

(~~dtse~~-

Step 3 : getmarks Method

↳ This method takes input of 3 subject marks.
↳ Calculates the total marks.
↳ Calculates the %
↳ Adds total & % to the marks list.

Step 4 : display Method

```
def display(self):
    print("Marks List:", self.marks)
```

Displays the marks list, including the 3 subject marks total & %.

Step 5 : Object Creation & Method Calls

```
s1 = Student("Arman", "4JN22A1000")
s1.getmarks()
s1.display()
```

A student object s1 is created with name 'Arman' & USN '4JN22A1000'

collects 3 subject marks, calculates total & % & stores them in s1.marks

prints the marks