Nirma University
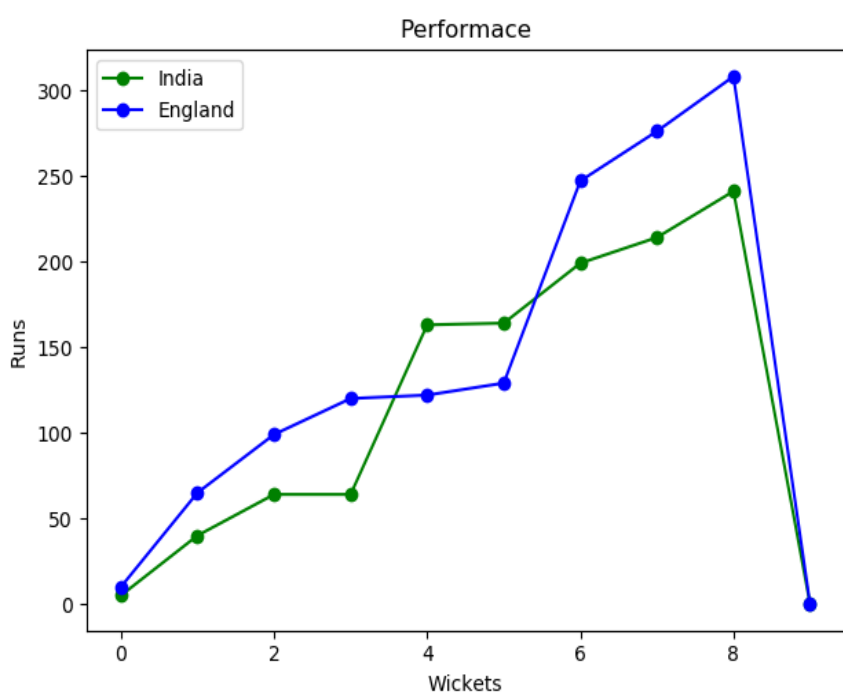## Institute of Technology
Computer Science and Engineering Department
2CS404: Programming for Scientific Computing

Sr. No.	Week No.#	List of Experiments	Schedule*	Mapped CLO
1	1,2,3	Basic python programming: a. Install Anaconda in your system. b. Develop a python program to make a simple calculator using a conditional loop. c. Ask user to input different type of data (int, float, string) and convert them in other formats. d. Write a function areaTriangle that takes the lengths of three sides of the triangle as input parameters and returns the area of the triangle as an output. Also, assert that the sum of the length of any two sides is higher than the third side. Write a main function that accepts as command-line arguments and computes the area of a triangle using the function areaTriangle. e. Write a function that takes two numbers as input parameters and returns True or False depending on whether they are co-primes. Two numbers are said to be co-prime if they do not have any common divisor other than one. f. Write a function that takes a string as a parameter and returns a string with every successive repetitive character replaced with a star(*). For Example, 'balloon' is returned as 'bal*o*n'. g. Write a function that takes a number as n input parameter and returns the corresponding text in words; for example, on input 452, the function should return 'Four Five Two'. Use a dictionary for mapping to digits to their string representation. h. Write a recursive function that takes x value as an input parameter and print x-digit strictly in increasing number. [i.e. x = 6 than output 67891011]		1,2
2	4	User inputs: a. The bell shaped Gaussian function, $$f(x) = \frac{1}{s * \sqrt{2\pi}} \exp[\frac{-1}{2} (\frac{x - m}{s})^2]$$ is one of the most widely used functions in science and technology. The parameters m and s > 0 are prescribed real numbers. Make a program for evaluating this function for different values of s, x and m. Ask the user to input the values b. A car driver, driving at velocity v_0, suddenly puts on the brake. What is braking distance d needed to stop the car? One can derive, using Newton's second law of motion or a corresponding energy equation, that $$d = \frac{1}{2} \frac{v_0^2}{\mu g}$$		1,2

Make a program for computing d above equation, when the initial car velocity v_0 and the friction coefficient μ are given on the command line. Run the program for two cases: $v_0 = 120$ and $v_0 = 50$ km/h, both with μ = 0.3 (μ is dimensionless).
(Note: convert the velocity in m/s)

Practise Questions:

a. Team management wants to pick the top 7 batsmen for the next game. Team management has data of all of their available 11 batsman details. Help the team management to select the best 6 batsmen (need to make a strategy for selecting the top 6 players). The format of all the data is shown below. The first column is showing the playerID, Remaining 10 columns are having data of run scored by a player in 10 innings. If a player is not selected in playing 11, then NA is mentioned. PlayerID must be described format. Generate all the data randomly.
<u>Constrains:</u>
1. All the data is generated randomly.
2. Make sure while generating the random data that all 11 players have played at least 2 games.
3. PlayerID must have 7 characters. The first character is P and the remaining 6 characters are randomly generated integer number.
4. Generate 10 random number as innings score.

<u>Statistical data:</u>
1. Calculate a total score made by the player during the last 10 innings and calculate the average.
2. Count the no of time players score the run <50, >=50 and <100, >=100 and <150 and >=150

<u>Sample Data:</u>

P100012	101	9	8	7	14	NA	NA	NA	NA	43
P000001	NA	NA	NA	NA	10	63	45	00	10	34
P023401	10	12	4	6	NA	NA	NA	NA	NA	NA
P679087	9	31	21	4	62	87	47	94	109	20

b.

3	5	File Handling and exception; a. Write a python program that reads the contents of the file poem.txt and count the number of alphabets blank spaces lowercase letters and uppercase letters the number of words starting from vowel and the number of occurrences of each word in the file. b. An organization wants to compute monthly wages to be paid to an employee in an organization. The input data is provided in two different files. File1 contains permanent employee data about employees (i.e. Empid, name, hourly wages), and File2 contains working hours information of each employee in the current month (i.e., empid and hours). Individual elements of data are separated by commas. Design a python program that reads both the files, computes the monthly wages of each employee and store in another file. Take both file names as		1,2

command line arguments and check the respected exceptions for the same.

<center>File Format:</center>

File1
1001, Vinay kumar, 40
1002, Rohit sen, 35
1003, Vinita sharma, 28

File2
1001, 250
1002, 0   NA in case of there is no data available.
1003, 125

c. Consider the following formula and evaluate the y value for the range of t values found in a file with format

$$y(t) = v_0 t - 0.5gt^2$$

File Format:
v0 3.0
t:
0.15592 0.28075 0.36807889 0.35 0.57681501876 0.21342619
0.0519085 0.042 0.27 0.50620017 0.528 0.2094294 0.1117 0.53012
0.3729850   0.39325246   0.21385894   0.3464815   0.57982969
0.10262264 0.29584013 0.17383923

More precisely, the first two lines are always present, while the next lines contain an arbitrary number of t values on each line, separated by one or more spaces.

  i.   Write a function that reads the input file and returns v0 and a list with the t values.

  ii.   Write a function that creates a file with two nicely formatted columns containing the t values to the left and the corresponding y values to the right. Let the t values appear in increasing order (note that the input file does not necessarily have the t values sorted).

  iii.   Make a test function that generates an input file, calls the function for reading the file, and checks that the returned data objects are correct.

  iv.   Write a function which handle the exception handling for the availability of file or not.

| 4 | 6,7 | | | 1 | |

a. Define a class Bank that keeps track of bank customers. The class should contain the following data member:

Data member name	Details
name	Name of customer
accountNum	Account Number
type	Account Type
amount	Amount deposited in the bank account
interest	Interest earned by the customer

The class should support the following methods:
(a) *__init__* for initializing the data members.
(b) *deposit* for depositing money in the members.
(c) *withdrawal* for withdrawing money from the account
(d) *findInterest* that determines the interest on the basis of amount in the account

Amount	Interest per annum (%)
>= 5,00,000	8
>= 3,00,000 and < 5,00,000	7
>=1,00,000 and <3,00,000	5
<1,00,000	3

b. Define a base class Person, having attributes name, birthdate and city. Define the class Student that derives from Person class which is having attributes like rollno, branch, totalMarks and year as data member. The class should contain the instance method __init__ and the abstract method percentage. Define two classes Grad and PostGrad which inherit from the base class Student. Both the classes should define their __init__ method which asks user t enter totalMarks value and should override the abstract method percentage of the superclass. Note that totalMarks obtained are out of 600 and 400 for Grad and PostGrad classes respectively.

5	8,9	Numpy and Scipy a. As you know, a magic square is a matrix all of whose row sums, column sums and the sums of the two diagonals are the same. (One diagonal of a matrix goes from the top left to the bottom right, the other diagonal goes from top right to bottom left.) Show by direct computation that if the matrix A is given by A=np.array([[17, 24, 1, 8, 15], 　　　　　　[23, 5, 7, 14, 16], 　　　　　　[4, 6, 13, 20, 22], 　　　　　　[10, 12, 19, 21, 3], 　　　　　　[11, 18, 25, 2, 9]]) The matrix A has 5 row sums (one for each row), 5 column sums (one for each column) and two diagonal sums. These 12 sums should all be exactly the same, and you could verify that they are the same by printing them and "seeing" that they are the same. It is easy to miss small differences among so many numbers, though. Instead, verify that A is a magic square by constructing the 5 column sums and computing the maximum and minimum values of the column sums. Do the same for the 5 row sums, and compute the two diagonal sums. Check that these six values are the same. If the maximum and minimum values are the same, the flyswatter principle says that all values are the same. b. Create scientific calculator using numpy API.	2,3

6	10	Matplotlib Plot a line graph that shows in the figure for the given data. The runs scored between two-wicket fall in a one-day international match between India and England is generated using randomly. Example:	2,3

Fall of Wicket	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
India	5	35	24	0	99	1	35	15	27	14
England	10	55	34	21	2	7	118	29	32	10

		Plot:		
7	11	Pandas: a. Develop a python program that reads the data from a given CSV file, which is having phone usage data using a different branded mobile phone. Determine if the usage patterns for users differ between different devices. For example, do users using Samsung devices use more call minutes than those using LG devices?		2,3
8	12,13	Statistical data analysis a. Design a python program which performs the linear regression operation on the given data to predict the house price. Also, visualize the data for different attributes. b. Design a python program which implements the bisection and false positioning method. c. Design a python program that generates the 100 random variables and finds out the mean, median and mode for the same.		3
9	14	Image Processing: a. Develop a python program that reads the image, display matrix representation of an image creates a histogram of the image and apply the smoothing effect on an image. b. Develop a python program which takes the video as an argument and extract all the frames from a video. Select specific frames and recreate the video, which has selected frames only.		3
10	15	Develop a web page using Django, which asks to upload the CSV file and month details from a user, which is having an attendance record of 50 employees of a company. Display the attendance record in HTML tabular		3

form, which is showing details like employeeID, a Total number of days, Present Days and percentage details.

CSV details

E001, p,p,p,p,a,a,p……p

E002, p,a,p,p,p,p,p……p

E003, a,p,p,p,p,p,p……a

In HTML page the display looks like

EmpID	Total Days	Present Days	Percentage
E001	30	26	86.67%
E002	30	25	83.33%
E003	30	20	66.67%

| 11 | **Extras** | Challenging practical list (Option)
 1. Write a python program to perform a binary search tree algorithm.
 2. Develop a python program for checking the typing speed test and show the accuracy along with word per minute.
 3. Create a Sudoku game using python | | 3 |