Lab Sheet (1)
Advanced Computer Graphics with Python
(Introduction to Python)

1. Write a Python program that converts temperatures from Fahrenheit to Celsius.

2. Write a Python program that converts distances measured in kilometers to miles. One kilometer is approximately 0.62 miles.

3. Write a Python program to perform a unit conversion of your own choosing. Make sure that the program prints an introduction that explains what it does.

4. Write a Python program to calculate the volume and surface area of a sphere from its radius, given as input. Here are some formulas that might be useful :

$$V = \frac{4}{3}\,\pi r^3$$
$$A = 4\,\pi\,r^2$$

5. Write a Python program that computes the molecular weight of a carbohydrate (in grams per mole) based on the number of hydrogen, carbon, and oxygen atoms in the molecule. The program should prompt the user to enter the number of hydrogen atoms, the number of carbon atoms, and the number of oxygen atoms. The program then prints the total combined molecular weight of all the atoms based on these individual atom weights :

Atom	Weight (grams I mole)
H	1.00794
C	12.0107
0	15.9994

For example, the molecular weight of water (H_20) is :

2(1.00794) + 15.9994 = 18.01528.

6. Two points in a plane are specified using the coordinates (x1,y1) and (x2,y2). Write a Python program that calculates the slope of a line through two (non-vertical) points entered by the user.

$$slop = \frac{y2 - y1}{x2 - x1}$$

7. Write a Python program that accepts two points (see previous problem) and determines the distance between them.

$$distance = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

8. A coffee shop sells coffee at $10.50 a pound plus the cost of shipping. Each order ships for $0.86 per pound + $1.50 fixed cost for overhead. Write a Python program that calculates the cost of an order.

9. Write a Python program to calculate the area of a triangle given the length of its three sides-a, b, and c-using these formulas :

$$s = \frac{a + b + c}{2}$$

$$A = \sqrt{s(s - a)(s - b)(s - c)}$$

10. Write a Python program to determine the length of a ladder required to reach a given height when leaned against a house. The height and angle of the ladder are given as inputs. To compute length use :

$$length = \frac{height}{\sin angle}$$

Note: The angle must be in radians. Prompt for an angle in degrees and use this formula to convert :

$$radians = \frac{\pi}{180}\ degree$$

11. Write a Python program to find the sum of the first n natural numbers, where the value of n is provided by the user. 12. Write a program to find the sum of the cubes of the first n natural numbers where the value of n is provided by the user.

12. Write a Python program to sum a series of numbers entered by the user. The program should first prompt the user for how many numbers are to be summed. The program should then prompt the user for each of the numbers in turn and print out a total sum after all the numbers have been entered.

13. Write a Python program that finds the average of a series of numbers entered by the user. As in the previous problem, the program will first ask the user how many numbers there are. Note: The average should always be a float, even if the user inputs are all ints.

14. You have seen that the math library contains a function that computes the square root of numbers. In this exercise, you are to write your own algorithm for computing square roots. One way to solve this problem is to use a guess-and -check approach. You first guess what the square root might be, and then see how close your guess is. You can use this information to make another guess and continue guessing until you have found the square root (or a close approximation to it). One particularly good way of making guesses is to use Newton's method. Suppose x is the number we want the root of, and guess is the current guessed answer. The guess can be improved by using computing the next guess as:

$$\frac{guess + \frac{x}{guess}}{2}$$

Write a Python program that implements Newton's method. The program should prompt the user for the value to find the square root of (x) and the number of times to improve the guess. Starting with a guess value of x/2, your program should loop the specified number of times applying Newton's method and report the final value of guess. You should also subtract your estimate from the value of math. sqrt (x) to show how close it is.

15. A Fibonacci sequence is a sequence of numbers where each successive number is the sum of the previous two. The classic Fibonacci sequence begins: 1, 1, 2, 3, 5, 8, 13, ... Write a Python program that computes the nth Fibonacci number where n is a value input by the user. For example, if n = 6, then the result is 8.