

Ex. No: 4

## Functional Programming

Section: C1

### 1. Calculate the following using Lambda calculus:

- a. T AND F
- b.  $3 * 4$

### 2. Lambda functions

- a. Write a lambda function to convert measurements from meters to feet.
- b. Write a lambda function in Python to implement the following lambda expression:

$$(\lambda f. \lambda m. (f + m)a)(\lambda x. x^2)(b)$$

Note: You need to write a nested lambda function for implementing  $f+m$  where  $f$  takes the square function (which takes argument  $x$ ) passed as a parameter. The above expression calculates  $a^2+b$ .

### 3. Passing and returning a function as an argument

Define a function 'square' for squaring a number. Define a function named 'twice' that takes a function  $f$  as an argument and returns  $f(f(x))$ . Using 'twice' and 'square' create a function 'quad' that takes  $n$  as an argument and returns  $n^4$ . 'quad' should not be defined explicitly. It should only be created as a variable which is then assigned a function.

### 4. Closure

A Closure is a function object that remembers values in enclosing scopes even if they are not present in memory. We have a closure in Python when a nested function references a value in its enclosing scope.

- a. Study the following program by executing it:

```
def multiplier_of(n):
    def multiplier(number):
        return number*n
    return multiplier

multiplywith5 = multiplier_of(5)
print(multiplywith5(9))
```

- b. In a lottery system, random number is chosen by retrieving the number from a random index from a list of random numbers. Write a program to choose a random number in this way. You must use nested functions – the inner function chooses a number from a random index and the outer function generates a random list of numbers. The outer function takes  $n$  as a parameter where  $n$  is the maximum number that can be put in the random list. (Your code should be similar to the program in 5a)

#### 6. **Map**

A secret message needs to be sent. Use the map function to encrypt the message using Caesar cipher.

#### 7. **Reduce**

Given runs scored by 2 players in a series of matches, write a Python program using reduce function to find who is the better player of the two in terms of maintaining consistency. (You need to find SD).

#### 8. **Filter**

The marks scored by a class of students in 5 different subjects are stored in a list of lists. Using the filter function, write a program to find the students who failed in one or more subjects.

#### 9. **Map+reduce+filter**

Given two trending topics and a bunch of tweets, write a Python program to count the number of tweets that contain each topic. You need to do this by putting together map(), reduce() and filter() functions.