Week 10 Function Programming

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:

$(\lambda f.\ \lambda m.\ (f + m)a)(\lambda x.\ x2)(b)$

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 a2+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 n4. '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
```

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 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.

10. Given the list of scores secured by the students as a multidimesnion list Extracting Toppers From a Student Record print the index of top scorer in each subject using function tools

11. Given the list scores secured by the batsmans over a certain matches, compute the average score of individual batsman, also the individual highest score of the batsman

12. Calculate the number of grains of wheat on a chessboard given that the number on each square doubles.

There once was a wise servant who saved the life of a prince. The king promised to pay whatever the servant could dream up. Knowing that the king loved chess, the servant told the king he would like to have grains of wheat. One grain on the first square of a chess board, with the number of grains doubling on each successive square.

There are 64 squares on a chessboard (where square 1 has one grain, square 2 has two grains, and so on).

Write code that shows:

how many grains were on a given square, and

the total number of grains on the chessboard