Assignment Set 2 (Logic programming using PROLOG)

- **Assignment will be evaluated by the TAs.**
- **You should submit complete source codes.**
- **All codes must be properly documented and good code writing practice should be followed (carry marks).**
- **Copying is strictly prohibited. Any case of copying will automatically result in F for the whole course, irrespective of your performance in the other parts of the lab.**
- **Submission deadline: 28th October, 2018**
- **Total weight = 20%**
- **All problems are compulsory**
- **Marks distribution: 15,15,20,20,30**

Problem 1: Finding Substring and Sub-Sequence (15 Marks)

Write PROLOG programs for the following:

a) Find whether a given String is a subset of another String.
    IsSub(String1,String2)
    E.g. ?- IsSub('hati','IIT Guwahati')
       True.
b) Find Longest Increasing Sub-Sequence from given List.
   Eg: ?-Sub_Seq([4,1,3,8,9,5,6,7]).
        [1,3,5,6,7]

Problem 2: LoveMesh: Relationship Puzzle (15 Marks)

Here's a summary of the current situation on a fictitious television series "Love Mesh":

   Jatin and Payal are married, but Payal is in love with Pawan. Pawan doesn't love her because he is still married to Sheetal, but Amit is romantically inclined toward Payal. He's in competition with Lucky, who also loves Payal despite being married to Priya, whom Jatin is feeling romantic about. Suchi is romantic about Pawan although she is married to Amit.

a)   Represent the basic meaning of these statements by facts. Note that if X is married to Y, then Y is also married to X.
b)   A marriage is on the rocks if both its participants are in love with other people and not with each other. Which people are in marriages that are on the rocks? Show the necessary PROLOG query and its result.

c)   A person is jealous when a person they love is loved by a third person, or a person is jealous when married to someone loved by a third person. Which people are jealous? Show the necessary PROLOG query and its result.

Problem 3: Data Encoding Problem (20 Marks)

Consider a system with limited memory. The data stored in the files need to be encoded in such a way that it consumes less space. For the solution, write a PROLOG program to convert data containing consecutive duplicate elements to an encoded form. The encoding will be done as follows:

a)   The consecutive characters will be replaced by number of times it appears and the character separated by comma, and this pair will be placed in square bracket.

b)   Single occurrence character will be stored in the output file as it is, separated by comma.

c)   Nonconsecutive repeated character will be placed in different pair of brackets.

Note: The input will be read form a file "sample_input.txt" . The output will be stored in a file "encoded_output.txt"

Sample Test Case 1:	Sample Test Case 2:
Sample Input:	*Sample Input:*
5555555777777719999111111	hhhhhhhhhhpppppppkooooooooooooo
Encoded Output:	*Encoded Output:*
[7,5],[8,7],1,[5,9],[1,6]	[10,h],[7,p],k,[12,o]

Problem 4: Integer Number Sequence Generation (20 Marks)

Consider the following integer number sequences:
a)   Lucas numbers L(n)
       {2, 1, 3, 4, 7, 11, 18, 29, 47, 76, …}
       $L(n) = L(n-1) + L(n-2)$ for $n \geq 2$, with $L(0) = 2$ and $L(1) = 1$.
b)   Fibonacci numbers F(n)
       {0, 1, 1, 2, 3, 5, 8, 13, 21, 34, …}
       $F(n) = F(n-1) + F(n-2)$ for $n \geq 2$, with $F(0) = 0$ and $F(1) = 1$.
c)   Tribonacci numbers T(n)
       {0, 1, 1, 2, 4, 7, 13, 24, 44, 81, …}
       $T(n) = T(n-1) + T(n-2) + T(n-3)$ for $n \geq 3$, with $T(0) = 0$ and $T(1) = T(2) = 1$.

Write a PROLOG program to generate the three integer number sequences. Your program should be able to answer queries of the following forms:

       intNumSequence(Sequence Name, n).
       NTerm(Sequence Name, n, nth term).

Sample Queries and Results
?- NTerm(Lucas, 6, X).
X = 18.
?- intNumSequence(Lucas, 5).
 [2,1,3,4,7,11]
?- NTerm (Fibonacci, 4, X).
X = 3.
?- NTerm (Tribonacci, 10, X)..
X = 149.
?- NTerm (Tribonacci, X, 81)..
X = 9.

Problem 5: Bus Travel Planner (30 Marks)

Consider the Bus Service in any locality (you are free to choose any place). Maintain a knowledge base of buses along with their routes hop by hop.

   The Bus details are stored in the following format:

     Bus (Number, Origin, Destination Place, Departure Time, Arrival Time, Distance, Cost)

where,

Number→ Bus number
Origin→ Starting stoppage of the hop
Destination→ Ending stoppage of the hop
Departure time→ Starting time at the Origin
Arrival time→ Time of reaching the Destination
(Store the time in 24 hour format e.g 7AM is stored as 7 , 4PM is stored as 16, 1.30PM is stored as 13.5)
Distance→ Distance between Origin and Destination in kilometers
Cost→ Bus Fare between Origin and Destination in Rs. (The overall fare is the sum of fares between   each hop)

Write a PROLOG program which would provide the optimized route between two places based on:

    a) Distance
    b) Time
    c) Cost

[The program must return 3 results based on the above mentioned factors viz. a), b) and c)]

Sample Bus details:

Bus(123,Amingaon,Jalukbari,14.5,15,10,10).
Bus(756,Panbazar, Chandmari, 16,16.5,7,8).

Sample Query and Result

?-Route(Amingaon,Paltanbazar).

Optimum Distance:
Amingaon,123->Jalukbari,123->Maligaon,123->Paltanbazar,153
Distance=19.5 ,Time=2 ,Cost=20
Optimum Time:
Amingaon,123->Jalukbari,123->Lokhra,327->Panbazar,823
Distance=25 ,Time= 1, Cost=30
Optimum Cost:
Amingaon,123->Jalukbari,123->Maligaon,123->Paltanbazar,153
Distance=19.5 ,Time=2 ,Cost=20