BACHELOR OF COMPUTER SCIENCE AND ENGINEERING

Third Year First Semester Class Test II

Principles of Programming Language (Set I)

Time- Fifty Minutes **Full Marks-30**

1. a. Write a program in Prolog to compute gcd according to Euclid's algorithm. Compare it with the following method:

```
gcd(U,V,W):-not(V=0), R is U mod V, !
gcd(V,R,W)
```

b. Write the following statements in Horn clause:

- If it is raining or snowing then there is precipitation.
- It is snowing.
- If it is not freezing and there is precipitation, then it is raining.
- If it is freezing and there is precipitation, then it is snowing. 6+4

2. a. Write a program in Prolog that prints sum of first 10 natural numbers. Show the computation tree that is formed.
   b. Write Prolog clauses to (i) reverse a list, (ii) Fibonacci series. 5+5

3. Write the formulation for (i) the Fibonacci series, (ii) product of n natural numbers in Lambda calculus. You can assume the notations for Church numerals, if-then-else and addition. 10

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Principles of Programming Language (Set II)

Time- Fifty Minutes **Full Marks-30**

1. Compare between Omega combinator and Y combinator. 2
2. (a) Write the lambda expression to calculate the sum of n natural numbers. Show the steps for any value of n>2. 6
   (b) Do the same summation in Prolog. Show the DFS tree that gets generated for any input >1. 5
3. Write the Prolog program for insertion sort. Show the steps using unification and/or resolution for the list [3,2,1]. 10
4. How do you represent list in Prolog? How to prepend elements? Explain the concept of pattern directed matching w.r.t your code. 7

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Principles of Programming Language (Set III)

Time- Fifty Minutes **Full Marks-30**

1. a. Given the following Prolog clauses:

```
ancestor(X,Y) :-  parent(X, Z) , ancestor(Z, Y).
ancestor(X, X) :- !.
parent(amy, bob).
```

Show the search tree to be generated for the query ancestor(X, bob). Discuss the role of cut here.

b. How are these clauses modified so that cut prunes all the solutions. 8+2

2.
```
while(i<10) {
      sum+=a[i];
}
Average=sum/10;
```

Represent above construct in lambda calculus. You can assume that *Church numerals*, *predecessor*, *addition*, *less than* predicates are in place. Justify your answer. 10

3. a. Write a program in Prolog that prints the first n fibonacci numbers. Use the concept of cut and fail. Highlight what these notations indicate.

b. Write Prolog clauses to express the relationships: nephew, ancestor and father. Given parent(X,Y) means X is a parent of Y. 5+5

BACHELOR OF COMPUTER SCIENCE AND ENGINEERING

Third Year First Semester Class Test II

Principles of Programming Language (Set IV)

Time- Fifty Minutes **Full Marks-30**

1. a. Given the following Prolog clauses:

```
ancestor(X,Y) :-  ancestor(Z, Y), parent(X, Z).
ancestor(X, X) :- !.
parent(amy, bob).
```

Show the search tree to be generated for the query ancestor(X, bob). Discuss the role of cut here. 8

2.
```
while(i<10) {
      sum+=a[i];
}
Average=sum/10;
```

Represent above construct in lambda calculus. You can assume that *Church numerals*, *predecessor*, *addition*, *less than* predicates are in place. Justify your answer. 10

3. Write a code in Prolog to implement (i) maximum of 3 numbers, (ii) generating a list by replicating a number *n*, *x* times, (iii) appending an element to a list, (iv) prepending an element to a list. (3*3)+1=10

4. Identify the axioms from the following clauses.

```
natural(0).
natural(2).
natural(-1).
natural(X) :- natural(successor(X)).
```

2