BACHELOR OF COMPUTER SCIENCE AND ENGINEERING

Third Year, First Semester **Set I** Class Test I PPL

Time- Thirty Minutes **Answer using Java Stream API and Lambda Calculus** **Full Marks-30**

1. Reduce (λx. λz.z) ((λy. yy) (λu. uu)) following call by name and call by value. State the kind of reduction method used in each step. 4
2.
```
if(roll_no%2==0)
        return roll_no;
else
        return "Odd Number";
```
Represent above construct in lambda calculus. Derive any predicates, constructs and data types that you need. 8
3. Reduce the following lambda expressions.
   (i) ((λx.((λy.(x y))x))(λz.w))
   (ii) ((λf.((λg.((f f)g))(λh.(k h))))(λx.(λy.y))) 6
4. Given a text file, group it's words into three categories depending on word length-2-letter words, 3-letter words and more than 3 letter words. 6
5. Assuming Church numerals are in place, how can you compute "subtract five from three". 6

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Third Year, First Semester **Set II** Class Test I PPL

Time- Thirty Minutes **Answer using Java Stream API and Lambda Calculus** **Full Marks-30**

1. Suppose you are given with the lambda expressions for zero(0), one(1), two(2), and three(3). Derive the number 18 using operators like successor, and add. You can use other binary operators as well. Define each operator separately. 4
2. How do you encode Boolean operators True and False in Lambda Calculus? Explain. 3
3. Validate the truth table of NAND using the derivation of Ans. 2. 4
4. Reduce the lambda expression- ((((λf.(λg.(λx.((fx)(g x)))))(λm.(λn.(n m))))(λn.z))p) 3
5. Traders execute transactions. The two class structures are as follows. A collection of transactions is given. 9

Trader

private final String name;
private final String city;
 	
public Trader(String n, String c);
 	
public String getName();
 	
public String getCity();
 	
public String toString();

Transactions

private final Trader trader;
private final int year;
private final int value;
public Transaction(Trader trader, int year, int value);
public Trader getTrader();
public int getYear();
public int getValue();
public String toString();

You're asked by your manager to find answers to the following queries. (i) Group traders from different cities. (ii) Find the transaction with the smallest value for each year.

6. Partition the list of natural numbers into prime and non-prime numbers using Java Streams. 7

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Third Year, First Semester **Set III** Class Test I PPL

Time- Thirty Minutes **Answer using Java Stream API and Lambda Calculus** **Full Marks-30**

1. Derive the Boolean operator OR in lambda calculus and validate its truth table. 5
2.
```
int arr[]={1,2,3};
if(arr[2]%2==0)

      return "left";
else
      return "right";
```
Represent above construct in lambda calculus. Derive any predicates, constructs and data types that you need. No need to define Church numerals and the expressions derived as Ans. 1. 12
3. Show the deduction steps for *is_zero* when the Church encoded numeral *two* is passed as argument. 3
4. Write an implementation of the functions min(), average() and count() using collect and lambda expressions. Can it handle empty list? 6
5. Given a list of Dish objects, partition them into high calorie and low calorie groups. 4

BACHELOR OF COMPUTER SCIENCE AND ENGINEERING

Third Year, First Semester **Set IV** Class Test I PPL

Time- Thirty Minutes **Answer using Java Stream API and Lambda Calculus** **Full Marks-30**

1.
```
if(roll_no==0)

      return roll_no+1;
else
      return roll_no;
```
Represent above construct in lambda calculus. Derive any predicates, constructs and data types that you need. 8
2. Reduce the following lambda expressions.
   (i) $((\lambda f.((\lambda g.((f\ f)g))(\lambda h.(k\ h))))(\lambda x.(\lambda y.y)))$
   (ii) $(\lambda g.((\lambda f.((\lambda x.(f\ (x\ x)))(\lambda x.(f\ (x\ x)))))\ g))$ 5
3. Assuming Church numerals are in place, how can you compute "subtract four from three". 7
4. Given a list of Dish objects, partition them into high calorie and low calorie groups. 4
5. Given a text file, group it's words into three categories depending on word length-2-letter words, 3-letter words and more than 3 letter words. 6