B.E. COMPUTER SCIENCE & ENGINEERING 3rd YEAR 2nd SEMESTER EXAM- 2019

Principles of Programming Languages

Time: 3 hours

Full Marks: 100

Group A (Total Marks: 20) [CO1]
Answer any ONE question

1.	Given a text file, answer (a),(b) and (c) (a) count the number of times each word appears; (b) identify and list the duplicate words; (c) count and print the number of different letters. (d) Write an implementation of the functions min(), average() and count() using only reduce and lambda expressions. Can it handle empty list? (e) Which of these lambda expressions are valid Function<Long,Long> implementations? Explain. (i) x → x; (ii) (x,y)→ x + y + 1; (iii)x→ x>1	4+4+4 +5+3= 20
2.	(a) Print the result of summing up first 20 fibonacci numbers using Streams. (b) Write an implementation of the Stream function map using only reduce and lambda expressions. You can return a List instead of a Stream. (c) Why are default methods introduced in Java? Give an Example. Describe its resolution rules. (d) Write code snippet in Java using Predicate functional interface or its variations to generate numbers divisible by 5 between [30, 90].	3+4+10 +3=20

Group B (Total Marks: 20) [CO2]
Answer any ONE question from this group.

3.	(a) How do you represent list in Prolog? Write the code to reverse the numbers of a list. (b) Write a program in Prolog to sort a list of numbers according to quick sort algorithm. (c) Write Prolog code and Horn clauses to compute GCD of two numbers. (d) Discuss about the occur-check problem and nonmonotonic reasoning w.r.t logic programming.	5+5+5 +5=20
4.	(a) Write a program in Prolog that prints sum of first 20 natural numbers. What is the role of cut here? (b) Write Prolog code to compute factorial of a number using and without using accumulator. Compare the two approaches. (c) Write Prolog code that both finds out and validate the minimum of two numbers. Write two pieces of code using green cut and red cut. Explain the difference. (d) Write Prolog clauses to express the relationships: grandparent and sibling. Given parent(X,Y) means X is a parent of Y.	5+6+7 +2=20

Group C (Total Marks: 20) [CO3]
Answer any ONE question.

5.	(a) State two theorems of Church-Rosser. (b) How do you encode Boolean operators True and False in Lambda Calculus? Explain. (c) How would you extend this definition to encode Boolean AND and OR logic in Lambda calculus? (d) How would you represent Fibonacci series in Lambda calculus? Assume that one, two etc. represent the corresponding Lambda encoding of natural numbers. Explain the role of combinator here.	4+3+3 +10=20
6.	(a) How do you encode natural numbers in Lambda Calculus? (b) How would you compare two natural numbers in Lambda calculus? (c) Encode division of natural numbers in Lambda calculus. (d) Define Lambda Calculus.	2+6+9 +3=20

Group D (Total Marks: 10) [CO4]
Answer any ONE question.

7.	(a) What is the advantage of following value semantics while designing parallel programming? (b) Explain the concept of currying w.r.t Lambda calculus. How is it implemented using functional interfaces such as Function<T,R>?	4+6= 10
8.	(a) Compare between call by name and call by value w.r.t Lambda calculus and their applicability to modern programming languages. (b) Give an example implementation of higher order functions w.r.t Java Streams API. (c) Do higher order functions follow call by value? Give reasons.	6+2+2 =10

Group E (Total Marks: 30) [CO5 and CO6]
Answer any TWO question.

9.	(a) Discuss about different types of control abstractions. (b) Discuss about von Neumann bottleneck and its effect on imperative programming paradigm. Name one paradigm where it can be overcome.	10+5= 15
10.	(a) Define and provide one example each of orthogonality, generality, and uniformity in the programming language of your choice. (b) Compare between static typing and dynamic typing.	(4x3)+ 3=15
11.	(a) Compare between higher order functions and abstract methods. (b) Explain functional decomposition and object oriented decomposition of a program. State the advantages of each. (c) Why do you need a "final" class in Java even when it prevents extensibility?	5+ (4+ 4)+2= 15