PROGRAMMING LANGUAGES

Time: Three hours

Maximum Marks: 100

Answer FIVE questions, taking ANY TWO from Group A, ANY TWO from Group B and ALL from Group C.

All parts of a question (a,b,etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answers may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Differentiate between a compiler and an interpreter. 3

(b) What is a programming paradigm? Explain the main differences between two example programming paradigms. 3

(c) List five high-level programming languages. State one unique feature of each of the five high-level languages. 5

(d) Define calling a function. What is 'call by value' parameter passing in C program? How is it different from 'call by reference'? Write a program segment to show these two types of parameter passing. 5
(e) What is the difference between virtual and friend function in C++?

2. (a) Write a C/C++ program to print Fibonacci series of a given range.
(b) Write a C/C++ program to print Pascal triangle.
(c) Write a C/C++ program to split number into digits.
(d) Write a C/C++ program to count number of digits in a number.

3. (a) Write a C program to find out G.C.D of two numbers.
(b) Write a C program for swapping of two strings without using any third variable.
(c) Write a C program to convert decimal number to binary.
(d) Reverse a string using recursion in a C program.

4. (a) Write a Java program to find the distance between two given numbers in an array of size 100.
(b) Design and implement a Java class polynomial that represents a polynomial with real coefficients. The coefficients of the polynomial should be passed as an array parameter with array type double in the constructor of your class. Implement methods to add two polynomials, multiplies a double value to a polynomial, to return the degree n of a polynomial, to return the first derivative and to return the value f(x) of a polynomial for a given value x.

(c) Rational numbers are numbers that can be represented as a fraction p/q, where p is an integer number and q, a
positive integer \( q! = 0 \). Design and implement a Java class rational number for representing such numbers. Implement methods to add and multiply rational numbers.

**Group B**

5. (a) What are the basic concepts of object-oriented programming? Define polymorphism and encapsulation in respect to object-oriented programming.

(b) What are default constructor, copy constructor, and conversion constructor? What is a scope resolution operator?

(c) What is the difference between macro and inline? What is meant by namespace?

(d) What is the difference between method overloading and method overriding? Explain using an example.

(e) What is dynamic binding? Explain using an example.

6. (a) Write a C/C++ program to find the sum of series 1 \(^3\) + 2 \(^3\) + ... + \(n\) \(^3\).

(b) Write a C/C++ program which deletes the duplicate element of an array.

(c) Write a C/C++ program for concatenation two string using the pointer.

(d) Write a C/C++ program to find the volume and surface area of a cube.

7. (a) Write a Java program, called Arithmetic, that takes three command-line arguments—two integers followed by an
arithmetic operator (+, −, • or /). The program shall perform the corresponding operation on the two integers and print the result.

(b) Write a Java program to check the perfect number. A positive integer is called a perfect number, if the sum of all its factors (excluding the number itself, i.e., proper divisor) is equal to its value. For example, the number 6 is perfect because its proper divisors are 1, 2 and 3 and $6 = 1 + 2 + 3$; but the number 10 is not perfect because its proper divisors are 1, 2 and 5, and $10 \neq 1 + 2 + 5$.

(c) Write a Java program to implement bubble sort algorithm.

(d) Write a Java program to find second highest number in an integer list without sorting the array.

8. (a) Write a Lisp function to rotate a list Nth places to the left.
   For example: *(rotate '('a b c d e f g h) 3)
   Output: (D E F G H A B C)

(b) Write a Lisp function to determine the prime factors of a given positive integer.
   For example: *(prime-factors 315)
   Output: (3 3 5 7)

(c) Write a Lisp function to find whether a list is a palindrome or not.

(d) Write a Lisp function to insert an element at a given position into a list.
   Example: *(insert-at 'STAR' (a b c d) 2)
   Output: (A STAR B C D)
(e) An n-bit Gray code is a sequence of n-bit strings constructed according to certain rules. n = 3:

\[ C(3) = ['000', '001', '011', '010', '110', '111', '101', '100'] \]

Find the construction rules and write a predicate with the following specification: \( \% \) gray (N, C) : C is the N-bit Gray code.

**Group C**

9. Choose the **correct** answer for the following: \( 10 \times 2 \)

(i) Which one of the following is not a valid flow control statement?

(a) break;

(b) continue outer;

(c) return;

(d) exit();

(ii) Consider the following code:

\[
\text{int } x, y, z; \\
y = 1; \\
z = 5; \\
x = 0 - (++ y) + z++; \\
\]

After execution of this, what will be the values of \( x, y \) and \( z \)?

(a) \( x = 4, y = 1, z = 5 \)

(b) \( x = 3, y = 2, z = 6 \)

(c) \( x = -7, y = 1, z = 5 \)

(d) \( x = 4, y = 2, z = 6 \)

(iii) The connectionless sockets

(a) support only character streams.

(b) can transmit to multiple receivers at the same time.
(c) do not support two-way communication.
(d) do not guarantee delivery or order of receipt.

(iv) Constructors have return type

(a) int
(b) boolean
(c) void
(d) None of the three above.

(v) The signature of a method consists of

(a) type of parameters.
(b) number of parameters.
(c) name of the method.
(d) All the three above.

(vi) Assuming var1 has value 20. What will following code print?
Print f("%d %d\n", var1--, ++var1);

(a) 20 20
(b) 19 20
(c) 21 21
(d) 21 22

(vii) What will be the output of the following program?
Main()
{
    int val = 500;
    int*ptr = &val;
    int**ptr1 = &ptr;
    printf("val = %d", **ptr1);
}

(a) 500
(b) address of ptr
(c) contents of ptr
(d) None of the three above.
(vii) The value of variable \( x \) after executing the following code will be:

\[
\text{val} = -200; \\
x = (\text{val} >= 0) \ ? \ \text{val} : -\text{val}
\]

(a) 0  
(b) 200  
(c) -200  
(d) 1

(ix) An exception is caused by a

(a) hardware problem.  
(b) problem in the operating system.  
(c) run-time error.  
(d) syntax error.

(x) Consider the following code:

\[
\text{if(number} > 0) \\
\quad \text{cout} << \text{"Number is Positive"}; \\
\text{else} \\
\quad \text{cout} << \text{"Number is Negative"};
\]

What will be the output, if `number` is equal to zero?

(a) Number is positive.  
(b) Number is negative.  
(c) Both (a) and (b) above.  
(d) None of the three above.
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Group A

1. (a) Explain language defined binding, programmer defined binding and compiler defined binding for the following expression:

   \[ x = x + 5 \; \]

   7

(b) Write a program in C or C++ which finds minimum and maximum of an array of 10 integers. 7

(c) Compare static scope with dynamic scope. 6

2. (a) Explain concept of late evaluation in context to call by name parameter passing technique. 7

(b) Explain the difference between pre-increment and post-increment (i.e. ++X, X++) operators using an appropriate example. 3
(c) Write a recursive program in LISP to compute factorial of a number.

(d) What is the role of a header file in C?

3. (a) Explain the purpose of type declaration of a variable in programming languages like C/C++.

(b) In C, declare an array of size 10, each item should be able to keep track of student information consisting of roll no., name and marks. How will you access marks of 6th student?

(c) What is the role of LISP in artificial intelligence?

4. (a) Compare the concepts of variant record and the union available in programming language C.

(b) Write a function in C to swap/exchange contents of two integer variables, and explain which parameter passing technique is used.

(c) Explain CAR, CDR and CONS operators to manipulate lists in LISP.

(d) Write the low level programming available in C.

5. (a) Compare protected access specifier in C++ with public and private access specifier.

(b) Write a method in C++ for overloading arithmetic operator + to add two objects of complex class. Assume that in class named Complex, real and imaginary parts are stored in integer form.

(c) Why is Java called a platform-independent language?

(d) Explain the purpose of break and continue programming constructs in Java.

6. (a) Explain how static declaration of member variable of a class affects its internal representation. Explain using an illustrative example.

(b) Explain how polymorphism is realized using virtual function in C++.

(c) In the following Java statement, explain the significance of static, void, public, and main():

   public void static main();

7. (a) Every class/object has member variables and member functions (methods). Does this cause more memory consumption? Give reasons to explain your answer.

(b) Write a template to compare two numbers, considering that number may be integer, real number, complex, etc.

(c) Write a method in Java to find the sum and average of all the numbers in a two-dimensional array.

(d) Mention the name and purpose of any two of Java native classes.

8. (a) What is a reference data type? How is it different from a pointer data type?

(b) Explain the role of virtual keyword in a multilevel multiple inheritance in C++.

(c) What is meant by namespace?

(d) Explain the terms Event, Event listener, and event driven programming.
Group C

9. Choose the correct answer for the following : 10 × 2

(i) Constructor is a
(a) variable.
(b) method with name of class in which it exists.
(c) method which is invoked automatically when the object is destroyed.
(d) keyword.

(ii) How is a class declared as Abstract Class ?
(a) Using keyword Abstract before class without semicolon.
(b) Using virtual fun ( ) = 0, where fun is a user defined function name.
(c) Using protected access specifier before class with semicolon.
(d) None of the three above.

(iii) Structured programming is
(a) goto-less programming.
(b) program with structure using keyword struct.
(c) both (a) and (b) above.
(d) None of the three above.

(iv) Which one of the following is not a parameter passing technique ?
(a) Pass by Value
(b) Pass by Result
(c) Pass by String
(d) Pass by Copy

(v) In the context of principles of programming language, short circuit is
(a) a method of creating exception.
(b) an expression evaluation method.
(c) a parameter passing technique.
(d) a recursive declaration.

(vi) A friend function
(a) can access private and public members from outside the class.
(b) is used for inheritance.
(c) is not possible in C++.
(d) None of the three above.

(vii) In C/C++, # define is a
(a) keyword.
(b) reserve word.
(c) library function.
(d) preprocessor.

(viii) Coersion is
(a) a library function.
(b) implicit-type conversion.
(c) a data type in JAVA.
(d) dynamic memory allocation.

(ix) In C' /C, & operator is
(a) bitwise AND.
(b) I value operator.
(c) used for reference type declaration.
(d) All of the three above.
(x) Garbage collection is
(a) Parameter Passing.
(b) Expression Evaluation.
(c) Recursion.
(d) Dynamic Memory Allocation.
W'12: 4 AN: CP 404 (1449)

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Group A

1. (a) Write a C program to print Fibonacci series of given range. 5

(b) Write a C program to print Pascal triangle. 5

(c) Write a C program to print 1 to 100 numbers without using loop. 4

(d) Write a C program to split number into digits. 4

(e) Write a C program to count number of digits in a number. 2

2. (a) Define and differentiate between a compiler and an interpreter. 3

(b) Define programming paradigm. Explain main differences between two programming paradigms. 3
(c) List five high level programming languages. State one feature of each of the five high level languages.

(d) Define calling a function. What is 'call by value' parameter passing in C program? How is it different from 'call by reference'. Write a program segment to show these two types of parameter passing.

(e) What is the difference between virtual and friend function in C++?

3. (a) Write a Java program to find the smallest distance between two neighboring numbers in an array.

(b) Design and implement a Java class polynomial that represents a polynomial with real coefficients. The coefficients of the polynomial should be passed as an array parameter with array type double in the constructor of your class. Implement methods to add two polynomials, multiplies a double value to a polynomial, to return the degree n of a polynomial, to return the first derivative, and to return the value f(x) of a polynomial for a given value of x.

(c) Rational numbers are numbers that can be represented as a fraction p/q, where p is an integer number and q, a positive integer (q! = 0). Design and implement a Java class rational number for representing such numbers. Implement methods to add and multiply rational numbers.

4. (a) Write a C program to find out GCD of two numbers.

(b) Write a C program for swapping of two strings without using any third variable.

(c) Write a C program to convert decimal number to roman.

(d) Reverse a string using recursion in C program.

(e) Write a C program for addition of two complex numbers.

Group B

5. (a) Write a Lisp function to rotate a list Nth places to the left. For example: * (rotate '(a b c d e f g h) 3)
   Output: (D E F G H A B C)

(b) Write a Lisp function to determine the prime factors of a given positive integer.
   For example: * (prime-factors 315)
   Output: (3 3 5 7)

(c) Write a Lisp function to find out whether a list is a palindrome or not.

(d) Write a Lisp function to insert an element at a given position into a list.
   Example: * (insert-at 'STAR' (a b c d)2)
   Output: (A STAR B C D)

(e) An n-bit Gray code is a sequence of n-bit strings constructed according to certain rules. n = 3: C(3) = ['000', '001', '011', '010', '110', '111', '101', '100']. Find the construction rules and write a predicate with the following specification: % gray(N, C) : C is the N-bit Gray code.

6. (a) What are the basic concepts of object-oriented programming? Define polymorphism and encapsulation in respect to object-oriented programming.
(b) Write a C program which deletes the duplicate element of an array.

(c) Write a C program for concatenation two string using pointer.

(d) Write a C program to find the volume and surface area of cube.

**Group C**

9. Answer the following:

(i) What will be the output when you will execute following C code?

```c
#include<stdio.h>
void main()
{
    char arr[7]=“Network”;
    printf(“%s”,arr);
}
```

(ii) What will be the output when you will execute following C code?

```c
#include<stdio.h>
union group
{
    char xarr[2][2];
    char yarr[4];
};
void main()
{
    union group x = {‘A’, ‘B’, ‘C’, ‘D’};
    printf(“%C”, x.xarr[x.yarr[2]-67][x.yarr[3]-67]);
}
```
(iii) What will be the output when you will execute following C code?

```c
#include<stdio.h>
void main(){
    int a=5, b=10;
    if(++a|++b)
        printf("%d %d", a,b);
    else
        printf("Swami Vivekananda");
}
```

(iv) What will be the output of following program?

```c
#include<stdio.h>
int main(){
    int i = 3;
    int *j;
    int **k;
    j = & i;
    k = & j;
    printf("%u %u %d",k,*k,**k);
    return 0;
}
```

(v) What is public, protected, and private?

(vi) What is abstraction?

(vii) What are the C++ tokens?

(viii) What is a dangling pointer?

(ix) What will be the output of following program?

```java
public class Equals Test {
    public static void main(String[] args) {
        String s1 = "abc";
        String s2 = s1;
        String s3 = s1;
        String s4 = new String("abc");
        String s5 = new String("abc");
        System.out.println("==comparison for s1==s2");
        System.out.println("==comparison for s1==s3");
        System.out.println("Using equals method for s1.equals(s2)");
        System.out.println("Using equals method for s1.equals(s3)");
    }
}
```

(x) Explain implicit casting with an example.
W’11:4AN: CP404 (1449)

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Group A

1. (a) Write a program in C to replace the zero with successive number in the following arrays: 7

   int x [8] = {1, 0, 3, 0, 5, 0, 7, 0 }.

(b) Describe the manner in which an actual argument is passed to a function. What name is associated with this process? 6

(c) Write a program in C that reorders a one-dimensional, integer array from smallest to largest. 7

2. (a) Suppose a pointer variable points to a structure that contains an array as a member. How can an element of the embedded array be accessed? Explain your answer using an example. 4
(b) Describe two different methods for creating a stream-oriented data file. Can both methods be used with unformatted data files?

(c) What is the purpose of continue statement? Within which control statements can the continue statement be included?

(d) When a multidimensional array is passed to a function, how are the formal argument declaration written? Give an example. Compare it with one-dimensional array.

3. (a) Write a LISP function which uses DO loops to print out the first ten products of the multiples of 3 and 4, i.e., \((3 \times 4) = 12, (6 \times 8) = 48\).

(b) Write a LISP function that uses COND to write a function which multiplies a, number 5 if it is greater than 7, subtracts 2 if it equals 3, and adds 23 to it otherwise.

(c) What are basic LISP manipulation functions? Explain each one of them with examples.

(d) What is LISP Meta language? Give the set of rules.

4. (a) Show that the language generated by the following grammar is a regular language:

\[ S \rightarrow a Sa \]

(b) Write a BNF grammar for the language composed of all binary numbers that contain at least three consecutive 1s.

(c) What is meant by binding and binding time? Discuss various classes of binding time.

(d) Give a formula for determining the maximum number of bits required for storage of any value in the integer subrange \(M \ldots N\), where \(M\) and \(N\) are any two integers such that \(M < N\).

5. (a) Is it possible to access private data members without using member function? If yes, explain the procedure with an example.

(b) What is a parameterized constructor?

(c) Write a program in C++ to perform multiplication of an integer with an object. Use friend function.

(d) What is void pointer, wild pointer and this pointer? How can private members be accessed using a pointer?

6. (a) What are VPTR and VTABLE? Explain.

(b) Describe various error trapping functions.

(c) Explain the terms — try, catch, throw.

(d) How can you store data in a file in binary format?

7. (a) What are the applications of wrapper classes?

(b) Describe the complete life-cycle of a thread. Explain your answer using a labelled state model.

(c) Write a program in Java that accepts a shopping list of five items from the command line and stores them in a vector. The program must also accomplish the following:

- To add an item at a specified location in the list.
- To print the contents of the vector.

8. (a) Discuss the steps involved in loading and running a remote applet.

(b) What is synchronization? When do we use it?
(c) Write a program in Java that has overloaded methods. The first method should accept no arguments, the second method will accept one string and third method a string and an integer. The first method should display the message ‘Rose is flower’ twice. The second method should display the message ‘Sunflower is a beautiful flower’. The third method should display the message ‘Beautiful flower’ four times.

Group C

9. Answer the following: 10 × 2

(i) Write the output of the following code:

```c
#include <stdio.h>
int main ()
{
    int a, b, c, d;
    a = 3;
    b = 5;
    c = a, b;
    d = (a, b);
    printf("c = %d", c);
    printf("\nand = %d", d);
    return 0;
}
```

(ii) Determine the output of following code:

```java
int main ()
{
    char for * p1, *p2;
    printf("p1 : %d\n\n p2 : %d",
            size of (p1), size of (p2));
    return 0;
}
```

(iii) Write the output of code given below:

```c
#include <stdio.h>
int main ()
{
    int a [5] = {1, 2, 3, 4, 5};
    int * ptr = (int *) (a + 1);
    printf("%d %d", * (a + 1), * (ptr - 1));
    return 0;
}
```

(iv) What is operator overloading?

(v) In C++, protected keyword is specifically useful in which situation?

(vi) public class myprog {
        public static void main (string argv[ ])
        {
            system.out.println (argv[2]);
        }
    }

What will be the output, if we execute the program with the command given in the next line:
java myprog Good Morning

(vii) What is a Java virtual machine?

(viii) Write the output of a given LISP function:

```lisp
(string = "Welcome" "Welcome")
```

(ix) Write any four attributes of a good language.

(x) Write the output:

```java
class 2008 {
    public static void main (string args []
    {  int  i = -1;
        system.out.println ((i < 0) ? - i : i );
    })
```
S'11 : 4 AN : CP 404 (1449)

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Group A

1. (a) What do you mean by orthogonality of a programming
language? For "C" programming language, give
examples of its orthogonality or otherwise. 7

(b) For a given list L = (W X Y Z), what is output/effect
of the following LISP expression?
(car L) (cadr L) (caddr L) setq (car (L),23)
(rplacd L 45) 7

(c) Write a function in C to exchange the value of two
variables, the swapped values should get reflected in
the calling program. 6
2. (a) Explain the difference between static and dynamic binding by giving suitable examples.
(b) Explain various input and output functions of LISP with appropriate description.
(c) Write a recursive function in C to print the numbers from 1 to 10.

3. (a) Explain pass by name parameter passing technique.
(b) What is property list? Explain how it is created in LISP. Create following list in LISP:
   Name : Bharat, Age: 56; Name: Mohan, Designation: Professor; Name: Singh Resi: India
   Add property for an atom having name Mohan as Age: 65
   Delete Age property of atom with name Bharat.
(c) Write a program in C to check if a given integer number has digit 2 in it or not.

4. (a) Explain what do header files contain, and their purpose in program.
(b) Draw a flow-chart to explain the semantics of switch-case statement in C programming language.
(c) Express the following expression in LISP:
   \[ A + B \cdot C + D \div (E + F) \]

Group B

5. (a) Differentiate between method overloading and method overriding using suitable examples.
(b) What is a package? Explain how a package is created and what benefit it provides?
(c) Develop a C++ class for a point in two-dimensional arena, and implement a method distance. Find its distance from origin modulus of the point \( \sqrt{x^2 + y^2}. \)

6. (a) What is portability? Explain how JAVA byte code supports this property through JVM.
(b) Write a sub-program in C++ to find maximum of two items irrespective of type of items(s) using templates.
(c) What is the role of a constructor? Write a constructor to initialize an integer array with all zero elements.

7. (a) Write a program in JAVA to compare two integer arrays and the result printed should be identical/not identical.
(b) What is run-time polymorphism? Explain how they are implemented in C++ and JAVA.
(c) Explain the difference between private, protected and public qualifiers using appropriate examples.

8. (a) What is AWT and event programming? Develop an applet to display MOUSE IN or MOUSE OUT depending on the mouse pointer with respect to a given rectangular area.
(b) Show how can you implement postfix increment \((++\)\) using operator overloading in C++ for real number, which would increment only integer part of the number.
(c) What is exception? How is it handled in JAVA?

Group C

9. Answer the following questions:

(i) For two lists \( L_1 = (A \ B \ C \ D) \) and \( L_2 = (X \ Y \ Z \ W) \), what will be the output of the following LISP:

\[
\text{cons (cons (car (L1), car (L2)), cdr (L1)), cdr (L2)).}
\]

(ii) What is thunk?

(iii) What is the difference between reference and pointer data type in C++?

(iv) What is associativity of operators? Give an example?

(v) What will be the value of \( x \), if the following program segment in C is executed?

\[
x = 5;
y = x \{\ 1 + x \ | 2 + x & 3 + x & 6;\}
\]

(vi) Can two classes be friends? [Yes/No]

(vii) Is LISP a symbolic programming language? [Yes/No]

(viii) Is union construct in C used to save storage when only one at a time is required? [Yes/No]

(ix) What is an abstract base class?

(x) What is garbage?
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Group A

1. (a) Write a LISP function that takes two arguments, an item and a list. If the item is in the list, the function returns the list unchanged. Otherwise, the function returns the list with the item entered as the first element.

(b) Write an iterative LISP function, named nth item that takes two arguments, a positive integer and a list. The function returns the item in the nth position in the list.

(c) Define a LISP function, called intersection, which takes two lists as arguments. The function should return a list containing single occurrences of all the elements which appear in both input lists.
2. (a) Write a complete program in C that asks the user to enter a list of integers. The program has to output the largest value entered and the number of times it was entered.

(b) Write a complete program in C that asks the user to enter an integer and checks if it is odd (using only bitwise operators). If the entered number is odd, then it outputs the number of 1s in its binary representation (using bitwise operators), otherwise it outputs that the integer is even.

(c) Write a C function that reads two positive integers and outputs the least common multiple (LCM) of two integers.

3. (a) Give a C declaration for each of the following data items in C:

(i) an array of pointers
(ii) a pointer to an array.

(b) What is expected to happen when the following C code segment is executed on two given integers a and b? Explain how you reached your conclusion:

\[ a = a \land b ; \]
\[ b = a \land b ; \]
\[ a = a \land b ; \]

(c) Write a C program to read a positive integer and output number of 1s in its binary representation.

(d) Write a program to print all primes in the range 1 to 200.

4. (a) What are the properties of structured programming?

(b) Differentiate between procedural and object-oriented programming.

(c) Explain compile-time binding and execution-time binding with an example.

(d) Define ADT with an example.

Group B

5. (a) Write a generic sorting program using template.

(b) What is the benefit of using template?

(c) Briefly describe the functionality of ifstream class in C++.

(d) Write a program to overload both pre-decrement (--) and post-decrement operator(--) in C++. Define the class of your own choice to show pre-decrement and post-decrement.

6. (a) Design two classes, Centigrade and Fahrenheit, such that they support the following statements:

   - Centigrade c1, c2;
   - Fahrenheit f1, f2;
   - c1 = f1; // Fahrenheit to Centigrade
   - f2 = c2; // Centigrade to Fahrenheit

Write a program that does such conversions according to the following formula:

\[ C/S = (F - 32)/9 \]

(b) Explain multiple inheritance in C++ with an example.

(c) Explain abstraction and encapsulation with an example.

7. (a) Critically comment on the validity of following
ii) What will be the output for the following code segment?

```c
main()
{
    int a, asqr;
    scanf("%d", &a);
    printf("a = %d\n\t asquare = %d\n", a, square(a));
    return 0;
}
```

```c
int square(int x)
{
    return x*x;
}
```

(iii) Give the output for the following segment:

```c
main()
{
    float *ptr1, *ptr2;
    int x = 5000, y = 1000;
    int funny (float *a, float *b);
    ptr1 = (float *)(x);
    ptr2 = (float *)(y);
    printf("funny value = %d\n", funny(ptr1, ptr2));
    return 0;
}
```

```c
int funny(float *pa, float *pb)
{
    int x;
    x = (pa - pb) / 2;
    return x;
}
```
(iv) What will be printed?

```c
#define min(x, y) ((x) <= (y)) ? (x) : (y)
#define max(x, y) ((x) >= (y)) ? (x) : (y)

int a = 14, b = 21, c = 54, d = 45;
printf("Large = %d\nSmall = %d\n", max(c, d) - 1, min(a, b) + 1);
```

(v) What is for `defun` used in LISP?

(vi) Why is copy constructor used in C++?

(vii) What is abstract class in C++?

(viii) What is the result of following program?

```java
public class Test {
    public int aMethod()
    {
        static int i = 0;
        i++;
        return i;
    }
    
    public static void main (String [] args) {
        Test test = new Test();
        test.aMethod();
        int j = test.aMethod();
        System.out.println(j);
    }
}
```

(ix) Analyse the following code segment:

```java
package test1;
public class Test1 {
    static int x = 42;
}
package test2;
public class Test2 extends Test1. Test1 {
    public static void main (String[] args) {
        System.out.println("x = " + x);
    }
}
```

(x) Give the result of the following C++ code:

```java
public class Test {
    public static void main (String args[]) {
        class Foo {
            public int i = 3;
        }
        Object o = (Object)new Foo();
        Foo foo = (Foo)o;
        System.out.println("i = " + foo.i);
    }
}
```
S'10: 4 AN: CP 404 (1449)

PROGRAMMING LANGUAGES

Time: Three hours

Maximum Marks: 100

Answer five questions, taking any two from Group A, any two from Group B and all from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answers may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) What are the function prototypes? What is their purpose? Summarize the rule associated with them. 5

   (b) Explain the effect of ++ and -- operator with pointer of all data types. 5

   (c) Write a program in C to find similar elements in an array and find the occurrence of similar numbers for number of times. 5

   (d) What is the difference between (i) ‘=’ and ‘==’; (ii) % and %g; and (iii) division and modular division operations? 5
2. (a) When a multidimensional array is passed to a function, how are the formal argument declarations written? Compare with one-dimensional arrays?

(b) What is a self-referential structure? For what kind of applications are self-referential structures useful?

(c) Explain what happens when the following statement is executed:

\[ \text{if (abs (x) < x min) x = (x > 0) ? x min : -x min ;} \]

Is this a compound statement?
Is a compound statement embedded within this statement?

(d) Write a program in C to find length of a given string including and excluding spaces using pointers.

3. (a) Apply the LISP setq function to find the (real and complex) roots of the quadratic equation \( ax^2 + bx + c = 0 \) by using the following formulae. Assume that \( a \) is not 0.

\[
\text{Root 1} = \frac{-b + \sqrt{b^2 - 4ac}}{2a}
\]

\[
\text{Root 2} = \frac{-b - \sqrt{b^2 - 4ac}}{2a}
\]

Find the roots of following equations:

(i) \( 8x^2 + 8x - 126 = 0 \), which has real roots.

(ii) \( 2x^2 - 16x + 40 = 0 \), which has complex roots.

(b) Write a function that is invoked as (linear \(<a><b>\)) and returns the solution to the linear equation of the form \(<a>: x + <b> = 0\). Take all possible cases of

\(<a>\) and \(<b>\), including the case wherein there is no solution and the case wherein there are many solutions.

(c) Write a LISP function, RAFFLE, which prints either 'you have won' or 'bad luck' according to the identity of the user.

4. (a) Write a function in LISP, called swap, which takes a list and swaps every two elements in the list.

(b) What is the value of the following:

\[ \text{car (cdr (ABCD))} \]
\[ \text{cdr (car ((AB )CD))} \]
\[ \text{cadadr (A (BCD } E )} \]
\[ \text{caddr (ABCD)} \]

(c) Most programming languages prohibit redeclaring the same variable name within the same scope.

(i) Explain why types alone cannot be used to distinguish such a duplication.

(ii) What is the difference between this restriction and the absence of such a restriction for overloaded functions?

(d) Using the following grammar,

\[ \text{Expr} \rightarrow \text{Term} + \text{Expr} | \text{Term} \times \text{Expr} | \text{Term} \rightarrow 0 | \ldots | 9 | (\text{Expr}) \]

draw a parse tree for the following:

(i) \( 5 + 4 \times 3 \)

(ii) \( 5 \times 4 + 3 \)

Group B

5. (a) Describe the role of keywords try, catch and throw in exception handling.
(b) Explain inheritance with class template and working of template function.

(c) Explain the uses of ostrstream and istrstream class.

(d) Write a program in C++ to display status of various error trapping functions.

6. (a) What are VPTT and VTABLE? Explain in detail.

(b) Write a program in C++ to create an array of pointers.

(c) How can private members be accessed using pointers? Why is declaration of void variable not permitted?

(d) How do structure and class provide inheritance differently?

7. (a) Explain why multiple inheritance is not possible in Java? What is the different approach to achieve it?

(b) Write notes on (i) garbage collection, (ii) static keyword, (iii) final classes, and (iv) interface.

(c) Describe various sections of a web page.

(d) Write a program in Java to multiply two complex numbers by using class approach and an appropriate method.

8. (a) What is the difference between multiprocessing and multithreading? What is to be done to implement these in a program?

(b) What is meant by initializing a file stream object? What are the ways of doing it? Give example code for each of them.

(c) Write a program in Java by using throw and throw clause in an appropriate method to find maximum roots of the equation $ax^2 + bx + c = 0$.

(d) What is a finally block? When and how is it used? Give a suitable example.

Group C

Answer the following:

(i) What is the error in the code?
   ```java
   class test
   {
    abstract void display();
   }
   ```

(ii) Which of the following will produce a value of 22, if $x = 22.9$?
   (a) ceil(x)
   (b) round(x)
   (c) rint(x)
   (d) abs(x)

(iii) What will be the output of following program code?
   ```java
   int m = 100;
   int n = 300;
   while (++m < --n);
   System.out.println(m);
   ```

(iv) What does this statement imply?
   ```java
   seekg(-4, ios::end);
   ```

(v) Suppose ‘country’ is a class. What can be done when we declare as—
   ```java
   country * ptr[20];
   ```
(vi) Which one of these constructors is correct?
   (a) base 1 ( ) { strcpy (c, ‘10’)}
   (b) base 1 ( ) { strcpy (c, “10”)}

(vii) What is the output of the following program and justify your answer?
     main ( )
     {
       int x = 5;
       while (x = = 1)
         x = x - 1;
       printf (“%d\n”, x);
     }

(viii) What is the role of typedef?

(ix) Write the equivalent pointer notation to the subscript notation pt[0][2]:

(x) What value the common LISP prints after evaluating the following expression?
    user (1): (* 2(cos0) (+ 4 6))
PROGRAMMING LANGUAGES

Time: Three hours

Maximum Marks: 100

Answer five questions, taking any two from Group A, any two from Group B and all from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answers may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) What do you mean by structured programming? State the properties of structured programs. 5

(b) Explain about linking loader and linkage editor. 5

(c) Use the construct COND to write a LISP function which multiplies a number by 5 if it is greater than 7, subtracts 2 if it is equal to 3, and adds 23 to it otherwise. 5

(d) What are predicate functions in LISP? Explain each one of them using appropriate examples. 5

(Turn Over)
2. (a) What is LISP meta language? Give the set of rules.  
(b) Write a LISP function to find the sum of the series 10 + 9 + 8 + ... + 1.  
(c) Define a function called MY-AND which acts like the LISP AND function (but takes only 2 arguments) and uses only the IF construct.  
(d) When should one use iteration and when one should use recursion? Explain using suitable LISP examples.

3. (a) Explain how an array is passed to a function using a suitable example in C.  
(b) Write a program in C to transpose a matrix.  
(c) Explain how malloc() and free() work using suitable examples.  
(d) Write a recursive function (fib(int n);) in C to print the Fibonacci series up to n terms.

4. (a) Write the meaning of the following file opening modes in C: rb, r+, w+, a+, w  
(b) Write a program in C to compare two text files specified by the user, displaying a message indicating the files are identical or not. The names of the two files should be given as command line arguments.  
(c) What is the difference between (i) structure and union, and (ii) character array and string.

5. Group B  
(a) Write a program in C++ to explain multiple inheritance.  
(b) Write a program in C++ to overload the binary operator “+”.  
(c) How are friend functions used to carry out overloading of operators? In which situation they are helpful?  
(d) Write a program in C++ to overload the binary operator “==”.

6. (a) How are constructors and destructors executed in multilevel inheritance? Explain your answer using suitable examples.  
(b) What is the difference between private and protected access specifiers? Explain your answer using suitable examples.  
(c) Explain how exception handling mechanism can be used to handle various error conditions.  
(d) What is a stream in C++? Explain, using a suitable example, how streams can be used for file I/O.

7. (a) Illustrate the applet life cycle with its corresponding methods using a suitable example.  
(b) Explain how parameters can be passed to an applet.  
(c) What do you mean by event-driven programming? Explain how mouse events can be handled, using a suitable example.
8. (a) What is synchronization in the context of Java threads? When do we use it? Explain the use of synchronization using example code snippets.

(b) Create a try block that is likely to generate three types of exceptions and then incorporate necessary catch blocks to catch and handle them appropriately.

(c) What is an interface class in Java? Explain its use through an example.

(iii) If raf is an instance of random access file, how can we move the file pointer to the end of the file? Write the statement.

(iv) Given file is a file object. Which are of the following legal statements to create a new file?

(a) file create()
(b) file output stream fos = new file output stream(file);
(c) file write out = new file writer (file);
(d) file input stream fis = new file input stream (file);

(v) If a header of a function named operator++ (int,int), then this would perform

(a) prefix increment
(b) postfix increment
(c) None of the above
(d) This type of header is not possible.

(vi) What do you mean by static binding?

(vii) How many times will the following print statement execute?

```java
for (j = 0; i<99; i++)
    for (j = i; j<100; j++)
        printf(“Programming Languages
”);
```

Group C

9. Answer the following:

(i) Suppose you are entering following values for scanf statement: 12, 13, 14. Write the output:

```java
main()
{
    scanf("%d %d %d", &a, &b, &c);
    printf("%d %d %d", a, b, c);
}
```

(ii) Give the output of following code:

```java
int m = 100;
while (true)
{
    if (m<10)
        continue;
    m = m - 10;
}
```

system.out.print ln("m is" + m);
(viii) What would be the output of the following program?

```c
int main ()
{
    int a, b, c;
    scanf ("%d %d %d", &a, &b, &c);
    printf ("%d", a + b + c);
    return 0;
}
```

(ix) What will the output of the following program?

```c
int main ()
{
    int val = 5;
    int *ptr = &val;
    printf ("%d %d", ++val, *ptr);
    return 0;
}
```

(x) What would be the output of the given LISP function?

```lisp
(car (cdr (ABCD))
```
S'09 : 4AN : CP 404 (1449)

PROGRAMMING LANGUAGES

Time : Three hours

Maximum Marks : 100

Answer FIVE questions, taking ANY TWO from Group A, ANY TWO from Group B and ALL from Group C.

All parts of a question (a,b,etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) What is meant by 'bottom-up programming'? How does it differ from top-down programming? 5

(b) What is called binding? Explain the types of binding with examples for each. 8

(c) Write the applications of LISP in artificial intelligence. 5

(d) Define LIST and ATOM in LISP. 2

2. (a) Write a LISP function which uses loop to print out the first ten products of the multiples of 5. 8

(Turn Over)
(b) What is recursion in LISP? Write a recursive function to find the factorial of a number.

(c) What do you understand by pattern matching in LISP?

3. (a) Write a ‘C’ program which illustrates call by reference. What are called formal parameters and actual parameters?

(b) Explain multidimensional arrays. How are these stored in memory? Write a ‘C’ program to sort names in alphabetic order.

(c) Write a ‘C’ program which uses pointers to structure variables to print the employees details. Assume that the employee details include name of employee and employee id.

4. (a) Write the difference between structure and union in ‘C’ language using appropriate examples.

(b) Explain command line arguments. Explain how these can be accessed within the program.

(c) Write a ‘C’ program to read a line of text as command line arguments and write the text to the file.

Group B

5. (a) What do you mean by overloading? Write a C++ program which overloads the post-increment and post-decrement operators.

(b) Explain the types of templates. How can templates be used for generic programming?

(c) Describe the role of keywords by catch and throw in exception handling. Explain your answer with suitable code snippets.

(d) What are the advantages of multilevel inheritance? Explain using an example.

6. (a) How does a C++ compiler support dynamic binding? Explain your answer with a suitable code snippet.

(b) Explain istream, ostream classes and write a code snippet which writes an object to the disk.

(c) Explain the use of “this” pointer with an example.

(d) Explain the use of access specifiers in C++.

7. (a) Explain JVM. How does JVM help make Java machine independent and secure?

(b) Explain how Java supports multilevel inheritance with an example.

(c) Describe the complete life-cycle of a thread in the context of Java.

(d) What can be achieved by method overriding in Java?

8. (a) Explain how exception handling mechanism can be used for debugging a program.
(b) What is an applet? Write an applet code which displays a simple moving banner.

(c) How do we add a class or an interface to a package? Discuss various levels of access protection available for packages and their implication in Java.

(ix) Define what is interface class in Java.

(x) What is an event and how event handling is done in Java?

Group C

9. Answer the following : 2 x 10

(i) What is the output generated by the following code segment?

\[
\begin{align*}
\text{int} & \quad a = 1, b ; \\
\text{b} & \quad = \quad + + a \quad + \quad a + ; \\
\text{printf} & \quad (\text{" % d "}, \text{b});
\end{align*}
\]

(ii) What is the role of the keyword virtual in C++?

(iii) What is multithreading?

(iv) What is LISPM?

(v) What is object slicing in C++?

(vi) What is the difference between class template and function template?

(vii) What are the uses of exceptions in Java?

(viii) What is the difference between FUNCALL and APPLY?
W'08 : 4 AN : CP 404 (1449)

PROGRAMMING LANGUAGES

Time : Three hours

Maximum Marks : 100

Answer FIVE questions, taking ANY TWO from Group A, ANY TWO from Group B and ALL from Group C.

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Figures on the right-hand side margin indicate full marks.

Group A

1. (a) What are stepping, isolation and breakpoints? For what purposes are they used? In general terms, how are they defined? 9

(b) What is meant by ‘bottom-up programming’? How does it differ from top-down programming? 5

(c) Write a LISP function RAFFLE which prints either ‘you have won’ or ‘bad luck’ according to the identity of the user. 6
2. (a) Write a LISP function which uses an array to keep a record of phone calls and their duration.

(b) Write a LISP function which uses DO loop to print out the first ten products of the multiples of 3 and 4 [e.g. (3 x 4) = 12, (6 x 8) = 48].

(c) What is LISP Meta language? Give the set of rules.

(d) What do you understand by pattern matching in LISP?

3. (a) Write a C program that illustrates the difference between ordinary arguments passed by value and pointer arguments and passed by reference. Explain your answer.

(b) Using bitwise operator AND, write a program in C to test whether a given number is odd or even. Explain your answer.

(c) Describe the basic structure of a C program.

4. (a) Write the differences between getch(), getche(), getchar(), cgets() and gets() functions.

(b) How in C a multidimensional array defined in terms of a pointer to a collection of contiguous array of lower dimensionality? How can you use pointer arithmetic to access the elements of the array?

(c) Describe the syntax for defining a structure in C. Can the period operator be used with an array of structures? Explain.

(d) Distinguish between the following file access modes in C:

(i) w and w+

(ii) r and r+

(iii) a and a+

Group B

5. (a) Describe the role of keywords try, catch and throw in exception handling. What do you mean by re-throwing of an exception in context of C++? Explain your answers with suitable code snippets.

(b) How can normal function and member function be declared as template function in C++? How can templates be used for generic programming? What do you mean by overloading of template function?

(c) Describe file manipulators with their syntaxes in C++. Also, describe various error trapping functions.

(d) How in C++ do we write a data in file in binary format?

6. (a) How does C++ compiler support dynamic binding? Explain your answer using a suitable code snippet.

(b) What do you mean by operator overloading? Explain overloading of 'new' and 'delete' operators.
(c) What are pointers, void pointers, and this pointer in C++?

(d) Describe the use of public, private and protected access specifiers in C++.

(e) Write a program in C++ to access private member variables of a base class using pointers.

7. (a) Describe the steps involved in implementing a standalone program in Java.

(b) Describe the syntax of single inheritance in Java. What do you understand by method overriding in this context?

(c) Describe various forms of implementing interfaces. Give examples of Java code for each case.

(d) Describe the complete life-cycle of a thread in the context of Java.

8. (a) Explain how exception handling mechanism can be used for debugging a program. Is it essential to catch all types of exceptions in Java?

(b) Discuss the steps involved in developing and running a local applet, and loading and running a remote applet.

(c) How do we add a class or an interface to a package? Discuss various levels of access protection available for packages and their implication in Java.

9. Answer the following:

(i) What is the difference between int *p(int a) and int (*p)(int a).

(ii) What is the output generated by the following code segment?

```c
int a = 1, b;
b = ++a + ++a + a++;
printf("\%d", b);
```

(iii) What will be returned by the following function when invoked by the parameter 6?

```c
int try(int data){
    if(data > 2)
        return (try(data - 1) - try(data - 2));
    else return 1;
}
```

(iv) What is role of keyword virtual in C++?

(v) What is the role of sleep() function?

(vi) Write the cause of security exceptions in Java.

(vii) Write the task performed by the following method call:

```c
(a) s1. index of (\'x\', n)
(b) list. size ()
```

(viii) What is LISPM?

(ix) What is the difference between FUNCALL and APPLY?

(x) What is object slicing in C++?
PROGRAMMING LANGUAGES

Time: Three hours
Maximum Marks: 100

Answer five questions, taking any two from Group A, any two from Group B and all from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answers may result in loss of marks.

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Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Explain different parameter passing mechanisms using suitable examples.  
   (b) Implement insertion operation in a singly linked list using C. Your code should be adequately commented.  
   (c) What is type casting? Explain with an example.  

2. (a) Explain macros with an example in LISP.  
   (b) What is an array? Implement the matrix multiplication using arrays in C. Consider two 10 x 10 floating point matrices. Your code should be adequately commented.
3. (a) What is recursion? Give a suitable example for recursion in LISP.

(b) Implement a calculator, which performs addition, multiplication, subtraction and division operations as per user choice in C using switch statement.

(c) What is the advantage of using functions, rather than using one large main program? Write a C function for factorial computation using functions without recursion.

4. (a) What are pointers? Write a C code segment to show how a pointer to an array of integers can be passed to a function to short 'n' numbers present in the array.

(b) What is a List? Give LISP syntax to represent a list. Explain ‘JOIN’ operation in LISP.

(c) What is an ‘enumerated’ type in C? Give the syntax for it. Explain its use using a suitable example.

6. (a) Explain the different mechanisms supported in C++ to restrict access to data and methods of a class. How is access restrictions useful?

(b) Explain friend function and polymorphism in C++ with examples for each.

(c) Explain how multiple inheritance is useful and write a code fragment in C++ to explain its use.

7. (a) What is an applet? Show how parameters are passed to applets with an example.

(b) Write short notes on the following features of Java.

(i) Static member function;

(ii) Abstract class;

(iii) Destructor method.

(c) Write a thread for a class named ‘clock’ in JAVA to display the time stored as a data member of the class.

8. (a) Explain, using suitable examples, how read and write to files can be performed in Java.

(b) Explain the keywords, try, catch and exception in JAVA by using a suitable example.

(c) Explain multithreading concept with a suitable example in Java.
Group C

9. Answer the following : 2x10

(i) What is a 'thunk'?

(ii) What is the difference between formal parameters and actual parameters?

(iii) Define different binding types for method calls.

(iv) Differentiate between union and strut in C language.

(v) Give an example of method overriding in JAVA.

(w) What are the 'various types of inheritance in C++ ?

(vii) What do you mean by a template class in C++?

(viii) What is a constructor? What is its role?

(ix) What is JVM? What is the role of JVM in running a JAVA program?

(x) State the applications of LISP.