Question 1(a) [3 marks]

Write down the difference between oop and pop.

Answer:

Aspect	OOP	POP
Approach	Bottom-up approach	Top-down approach
Focus	Objects and classes	Functions and procedures
Data Security	Data hiding through encapsulation	No data hiding
Problem Solving	Divide problem into objects	Divide problem into functions

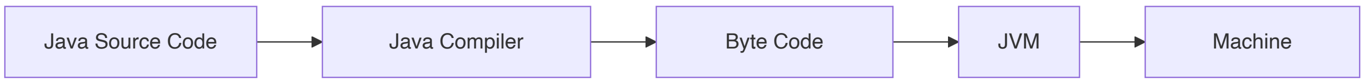
Mnemonic: "Objects Bottom, Procedures Top"

Question 1(b) [4 marks]

What is byte code? Explain JVM in detail.

Answer:

Byte Code: Platform-independent intermediate code generated by Java compiler from source code.



JVM Components:

- **Class Loader**: Loads .class files into memory
- **Memory Area**: Heap, stack, method area storage
- **Execution Engine**: Interprets and executes bytecode
- **Garbage Collector**: Automatic memory management

Mnemonic: "Byte Code Runs Everywhere"

Question 1(c) [7 marks]

Write a program in Java to sort the elements of an array in ascending order

Answer:

```java
import java.util.Arrays;

public class ArraySort {
    public static void main(String[] args) {
        int[] arr = {64, 34, 25, 12, 22, 11, 90};
        // Bubble Sort
        for(int i = 0; i < arr.length-1; i++) {
            for(int j = 0; j < arr.length-i-1; j++) {
                if(arr[j] > arr[j+1]) {
                    int temp = arr[j];
                    arr[j] = arr[j+1];
                    arr[j+1] = temp;
                }
            }
        }

        System.out.println("Sorted array: " + Arrays.toString(arr));
    }
}
```

Key Points:

- **Bubble Sort**: Compares adjacent elements
- **Time Complexity**: O(n^2)
- **Space Complexity**: O(1)

Mnemonic: "Bubble Up The Smallest"

Question 1(c OR) [7 marks]

Write a program in java to find out maximum from any ten numbers using command line argument.

Answer:

```java
public class FindMaximum {
    public static void main(String[] args) {
        if(args.length != 10) {
            System.out.println("Please enter exactly 10 numbers");
            return;
        }

        int max = Integer.parseInt(args[0]);

        for(int i = 1; i < args.length; i++) {
            int num = Integer.parseInt(args[i]);
            if(num > max) {
                max = num;
            }
        }

        System.out.println("Maximum number: " + max);
    }
}
```

Key Points:

- **Command Line**: args[] array stores arguments
- **parseInt()**: Converts string to integer
- **Validation**: Check array length

Mnemonic: "Arguments Maximum Search"

Question 2(a) [3 marks]

What is wrapper class? Explain with example.

Answer:

Wrapper Class: Converts primitive data types into objects.

Primitive	Wrapper Class
int	Integer
char	Character
boolean	Boolean
double	Double

```java
// Boxing
Integer obj = Integer.valueOf(10);
// Unboxing
int value = obj.intValue();
```

Mnemonic: "Wrap Primitives Into Objects"

Question 2(b) [4 marks]

List out different features of java. Explain any two.

Answer:

Java Features:

- **Simple**: Easy syntax, no pointers
- **Platform Independent**: Write once, run anywhere
- **Object Oriented**: Based on objects and classes
- **Secure**: No explicit pointers, bytecode verification

Detailed Explanation:

- **Platform Independence**: Java bytecode runs on any platform with JVM
- **Object Oriented**: Supports inheritance, encapsulation, polymorphism, abstraction

Mnemonic: "Simple Platform Object Security"

Question 2(c) [7 marks]

What is method overriding? Explain with example.

Answer:

Method Overriding: Child class provides specific implementation of parent class method.

```java
class Animal {
    public void sound() {
        System.out.println("Animal makes sound");
    }
}

class Dog extends Animal {
    @Override
    public void sound() {
        System.out.println("Dog barks");
    }
}

public class Test {
    public static void main(String[] args) {
        Animal a = new Dog();
        a.sound(); // Output: Dog barks
    }
}
```

Key Points:

- **Runtime Polymorphism**: Method called based on object type
- **@Override**: Annotation for method overriding
- **Dynamic Binding**: Method resolution at runtime

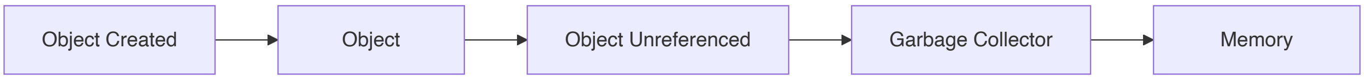
Mnemonic: "Child Changes Parent Method"

Question 2(a OR) [3 marks]

Explain Garbage collection in java.

Answer:

Garbage Collection: Automatic memory management that removes unused objects.



Key Points:

- **Automatic**: No manual memory deallocation
- **Mark and Sweep**: Identifies and removes unused objects

- **Heap Memory**: Works on heap memory area

Mnemonic: "Auto Clean Unused Objects"

Question 2(b OR) [4 marks]

Explain static keyword with example.

Answer:

Static Keyword: Belongs to class rather than instance.

```
class Student {
    static String college = "GTU";  // Static variable
    String name;

    static void showCollege() {     // Static method
        System.out.println("College: " + college);
    }
}
```

Static Features:

- **Memory**: Loaded at class loading time
- **Access**: Can be accessed without object
- **Sharing**: Shared among all instances

Mnemonic: "Class Level Memory Sharing"

Question 2(c OR) [7 marks]

What is constructor? Explain copy constructor with example.

Answer:

Constructor: Special method to initialize objects.

```
class Person {
    String name;
    int age;

    // Default constructor
    Person() {
        name = "Unknown";
        age = 0;
    }

    // Parameterized constructor
    Person(String n, int a) {
        name = n;
        age = a;
    }
```

```java
    // Copy constructor
    Person(Person p) {
        name = p.name;
        age = p.age;
    }
}
```

Constructor Types:

- **Default**: No parameters
- **Parameterized**: Takes parameters
- **Copy**: Creates object from existing object

Mnemonic: "Default Parameter Copy"

Question 3(a) [3 marks]

Explain super keyword with example.

Answer:

Super Keyword: References parent class members.

```java
class Vehicle {
    String brand = "Generic";
}

class Car extends Vehicle {
    String brand = "Toyota";

    void display() {
        System.out.println("Child: " + brand);
        System.out.println("Parent: " + super.brand);
    }
}
```

Super Uses:

- **Variables**: Access parent class variables
- **Methods**: Call parent class methods
- **Constructor**: Call parent class constructor

Mnemonic: "Super Calls Parent"

Question 3(b) [4 marks]

List out different types of inheritance. Explain multilevel inheritance.

Answer:

Inheritance Types:

Type	Description
Single	One parent, one child
Multilevel	Chain of inheritance
Hierarchical	One parent, multiple children
Multiple	Multiple parents (via interfaces)

Multilevel Inheritance:

```
class Animal {
    void eat() { System.out.println("Eating"); }
}

class Mammal extends Animal {
    void breathe() { System.out.println("Breathing"); }
}

class Dog extends Mammal {
    void bark() { System.out.println("Barking"); }
}
```

Mnemonic: "Single Multi Hierarchical Multiple"

Question 3(c) [7 marks]

What is interface? Explain multiple inheritance with example.

Answer:

Interface: Contract that defines what class must do, not how.

```
interface Flyable {
    void fly();
}

interface Swimmable {
    void swim();
}

class Duck implements Flyable, Swimmable {
    public void fly() {
        System.out.println("Duck is flying");
    }

    public void swim() {
        System.out.println("Duck is swimming");
    }
}
```

Interface Features:

- **Multiple Inheritance**: Class can implement multiple interfaces
- **Abstract Methods**: All methods are abstract by default
- **Constants**: All variables are public, static, final

Mnemonic: "Multiple Abstract Constants"

Question 3(a OR) [3 marks]

Explain final keyword with example.

Answer:

Final Keyword: Restricts modification, inheritance, or overriding.

```java
final class Math {           // Cannot be inherited
    final int PI = 3.14;     // Cannot be modified

    final void calculate() { // Cannot be overridden
        System.out.println("Calculating");
    }
}
```

Final Uses:

- **Class**: Cannot be extended
- **Method**: Cannot be overridden
- **Variable**: Cannot be reassigned

Mnemonic: "Final Stops Changes"

Question 3(b OR) [4 marks]

Explain different access controls in Java.

Answer:

Access Modifiers:

Modifier	Same Class	Same Package	Subclass	Different Package
public	✓	✓	✓	✓
protected	✓	✓	✓	✗
default	✓	✓	✗	✗
private	✓	✗	✗	✗

Mnemonic: "Public Protected Default Private"

Question 3(c OR) [7 marks]

What is package? Write steps to create a package and give example of it.

Answer:

Package: Group of related classes and interfaces.

Steps to Create Package:

1. **Declare**: Use package statement at top
2. **Compile**: javac -d . ClassName.java
3. **Run**: java packagename.ClassName

```java
// File: mypack/Calculator.java
package mypack;

public class Calculator {
    public int add(int a, int b) {
        return a + b;
    }
}

// File: Test.java
import mypack.Calculator;

public class Test {
    public static void main(String[] args) {
        Calculator calc = new Calculator();
        System.out.println(calc.add(5, 3));
    }
}
```

Package Benefits:

- **Organization**: Groups related classes
- **Access Control**: Package-level protection
- **Namespace**: Avoids naming conflicts

Mnemonic: "Declare Compile Run"

Question 4(a) [3 marks]

Explain thread priorities with suitable example.

Answer:

Thread Priority: Determines thread execution order (1-10 scale).

```
class MyThread extends Thread {
    public void run() {
        System.out.println(getName() + " Priority: " + getPriority());
    }
}

public class ThreadPriorityExample {
    public static void main(String[] args) {
        MyThread t1 = new MyThread();
        MyThread t2 = new MyThread();

        t1.setPriority(Thread.MIN_PRIORITY);  // 1
        t2.setPriority(Thread.MAX_PRIORITY);  // 10

        t1.start();
        t2.start();
    }
}
```

Priority Constants:

- **MIN_PRIORITY**: 1
- **NORM_PRIORITY**: 5
- **MAX_PRIORITY**: 10

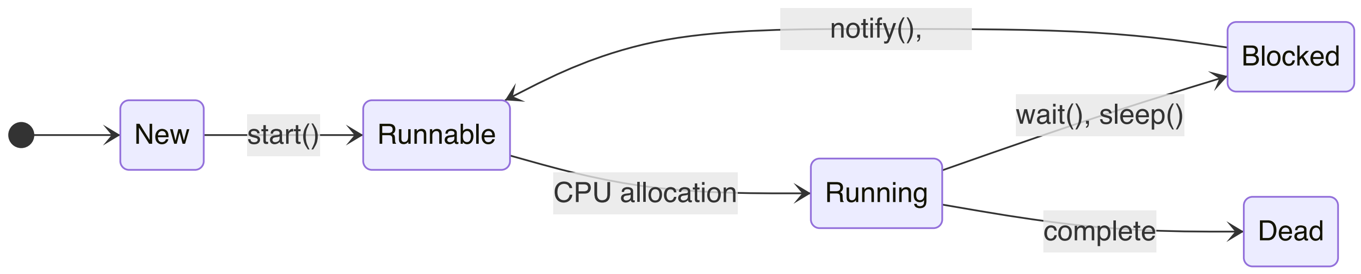
Mnemonic: "Min Normal Max"

Question 4(b) [4 marks]

What is Thread? Explain Thread life cycle.

Answer:

Thread: Lightweight process for concurrent execution.



Thread States:

- **New**: Thread created but not started
- **Runnable**: Ready to run
- **Running**: Currently executing
- **Blocked**: Waiting for resource
- **Dead**: Execution completed

Mnemonic: "New Runnable Running Blocked Dead"

Question 4(c) [7 marks]

Write a program in java that create the multiple threads by implementing the Runnable interface.

Answer:

```java
class MyRunnable implements Runnable {
    private String threadName;

    MyRunnable(String name) {
        threadName = name;
    }

    public void run() {
        for(int i = 1; i <= 5; i++) {
            System.out.println(threadName + " - Count: " + i);
            try {
                Thread.sleep(1000);
            } catch(InterruptedException e) {
                e.printStackTrace();
            }
        }
    }
}

public class MultipleThreads {
    public static void main(String[] args) {
        Thread t1 = new Thread(new MyRunnable("Thread-1"));
        Thread t2 = new Thread(new MyRunnable("Thread-2"));
        Thread t3 = new Thread(new MyRunnable("Thread-3"));
        t1.start();
        t2.start();
        t3.start();
    }
}
```

Key Points:

- **Runnable Interface**: Better than extending Thread class
- **Thread.sleep()**: Pauses thread execution
- **Multiple Threads**: Run concurrently

Mnemonic: "Implement Runnable Start Multiple"

Question 4(a OR) [3 marks]

List four different inbuilt exceptions. Explain any one inbuilt exception.

Answer:

Inbuilt Exceptions:

- **NullPointerException**: Accessing null object
- **ArrayIndexOutOfBoundsException**: Invalid array index
- **ArithmeticException**: Division by zero
- **NumberFormatException**: Invalid number format

ArithmeticException: Thrown when arithmetic operation fails.

```java
int result = 10 / 0; // Throws ArithmeticException
```

Mnemonic: "Null Array Arithmetic Number"

Question 4(b OR) [4 marks]

Explain Try and Catch with suitable example.

Answer:

Try-Catch: Exception handling mechanism.

```java
public class TryCatchExample {
    public static void main(String[] args) {
        try {
            int[] arr = {1, 2, 3};
            System.out.println(arr[5]); // Index out of bounds
        }
        catch(ArrayIndexOutOfBoundsException e) {
            System.out.println("Array index error: " + e.getMessage());
        }
        finally {
            System.out.println("Always executed");
        }
    }
}
```

Exception Handling Flow:

- **Try**: Code that may throw exception
- **Catch**: Handles specific exceptions
- **Finally**: Always executes

Mnemonic: "Try Catch Finally"

Question 4(c OR) [7 marks]

What is Exception? Write a program that show the use of Arithmetic Exception.

Answer:

Exception: Runtime error that disrupts normal program flow.

```java
public class ArithmeticExceptionExample {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        try {
            System.out.print("Enter first number: ");
            int num1 = sc.nextInt();

            System.out.print("Enter second number: ");
            int num2 = sc.nextInt();

            int result = num1 / num2;
            System.out.println("Result: " + result);
        }
        catch(ArithmeticException e) {
            System.out.println("Error: Cannot divide by zero!");
        }
        catch(Exception e) {
            System.out.println("General error: " + e.getMessage());
        }
        finally {
            sc.close();
        }
    }
}
```

Exception Types:

- **Checked**: Compile-time exceptions

- **Unchecked**: Runtime exceptions
- **Error**: System-level problems

Mnemonic: "Runtime Error Disrupts Flow"

Question 5(a) [3 marks]

Explain ArrayIndexOutOfBound Exception in Java with example.

Answer:

ArrayIndexOutOfBoundsException: Thrown when accessing invalid array index.

```java
public class ArrayIndexExample {
    public static void main(String[] args) {
        int[] numbers = {10, 20, 30};

        try {
            System.out.println(numbers[5]); // Invalid index
        }
        catch(ArrayIndexOutOfBoundsException e) {
            System.out.println("Invalid array index: " + e.getMessage());
        }
    }
}
```

Key Points:

- **Valid Range**: 0 to array.length-1
- **Negative Index**: Also throws exception
- **Runtime Exception**: Unchecked exception

Mnemonic: "Array Index Range Check"

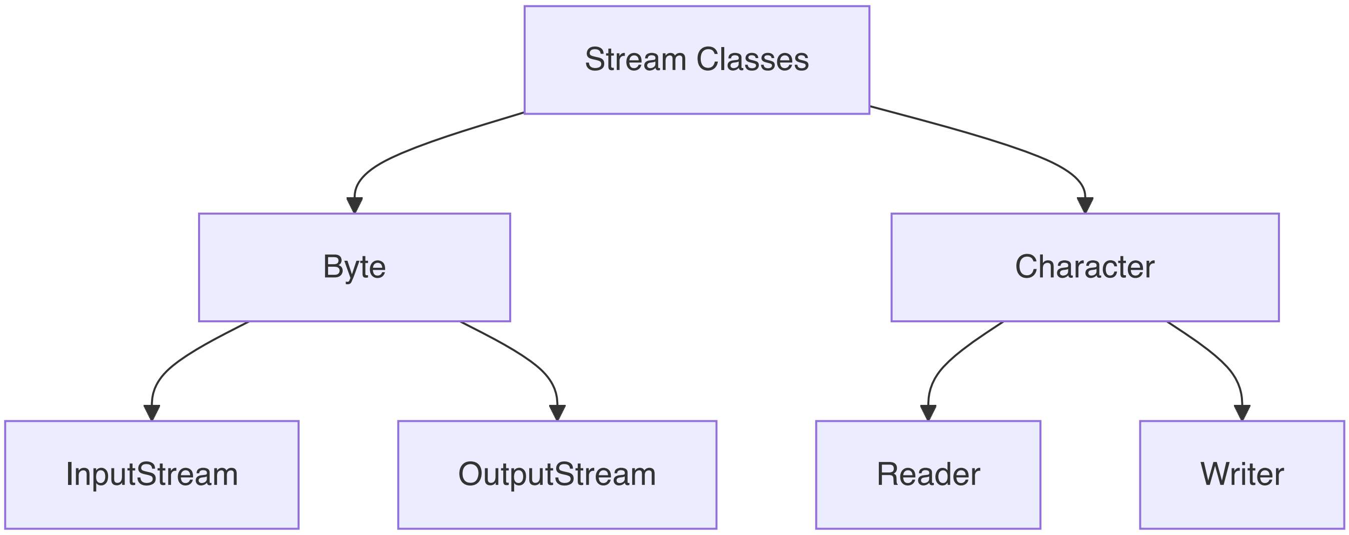
Question 5(b) [4 marks]

Explain basics of stream classes.

Answer:

Stream Classes: Handle input/output operations.

Stream Type	Classes
Byte Streams	InputStream, OutputStream
Character Streams	Reader, Writer
File Streams	FileInputStream, FileOutputStream
Buffered Streams	BufferedReader, BufferedWriter



Stream Features:

- **Sequential**: Data flows in sequence
- **One Direction**: Either input or output
- **Automatic**: Handles low-level details

Mnemonic: "Byte Character File Buffered"

Question 5(c) [7 marks]

Write a java program to create a text file and perform read operation on the text file.

Answer:

```
import java.io.*;

public class FileReadExample {
    public static void main(String[] args) {
        // Create and write to file
        try {
            FileWriter writer = new FileWriter("sample.txt");
            writer.write("Hello World!\n");
            writer.write("Java File Handling\n");
            writer.write("GTU Exam 2024");
            writer.close();
            System.out.println("File created successfully");
        }
        catch(IOException e) {
            System.out.println("Error creating file: " + e.getMessage());
        }

        // Read from file
        try {
            BufferedReader reader = new BufferedReader(new FileReader("sample.txt"));
            String line;
```

```java
            System.out.println("\nFile contents:");
            while((line = reader.readLine()) != null) {
                System.out.println(line);
            }
            reader.close();
        }
        catch(IOException e) {
            System.out.println("Error reading file: " + e.getMessage());
        }
    }
}
```

Key Points:

- **FileWriter**: Creates and writes to file
- **BufferedReader**: Efficient reading
- **Exception Handling**: Handle IOException

Mnemonic: "Create Write Read Close"

Question 5(a OR) [3 marks]

Explain Divide by Zero Exception in Java with example.

Answer:

ArithmeticException: Thrown during divide by zero operation.

```java
public class DivideByZeroExample {
    public static void main(String[] args) {
        try {
            int a = 10;
            int b = 0;
            int result = a / b;  // Throws ArithmeticException
            System.out.println("Result: " + result);
        }
        catch(ArithmeticException e) {
            System.out.println("Cannot divide by zero: " + e.getMessage());
        }
    }
}
```

Key Points:

- **Integer Division**: Only integer division by zero throws exception
- **Floating Point**: Returns Infinity for floating point division
- **Runtime Exception**: Unchecked exception

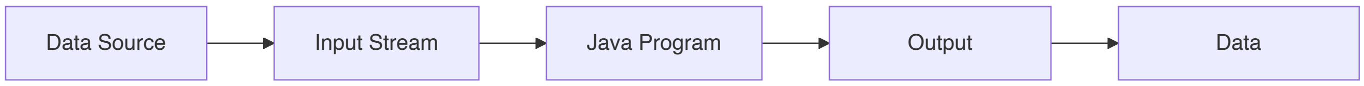
Mnemonic: "Zero Division Arithmetic Error"

Question 5(b OR) [4 marks]

Explain java I/O process.

Answer:

Java I/O Process: Mechanism for reading and writing data.



I/O Components:

- **Stream**: Sequence of data
- **Buffer**: Temporary storage for efficiency
- **File**: Persistent storage
- **Network**: Remote data transfer

I/O Types:

- **Byte-oriented**: Raw data (images, videos)
- **Character-oriented**: Text data
- **Synchronous**: Blocking operations
- **Asynchronous**: Non-blocking operations

Mnemonic: "Stream Buffer File Network"

Question 5(c OR) [7 marks]

Write a java program to create a text file and perform write operation on the text file.

Answer:

```java
import java.io.*;
import java.util.Scanner;

public class FileWriteExample {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        try {
            // Create file with FileWriter
            FileWriter writer = new FileWriter("student.txt");

            System.out.println("Enter student details:");
            System.out.print("Name: ");
            String name = sc.nextLine();

            System.out.print("Roll Number: ");
            String rollNo = sc.nextLine();

            System.out.print("Branch: ");
            String branch = sc.nextLine();

            // Write data to file
            writer.write("Student Information\n");
            writer.write("==================\n");
            writer.write("Name: " + name + "\n");
            writer.write("Roll Number: " + rollNo + "\n");
            writer.write("Branch: " + branch + "\n");
            writer.write("Date: " + new java.util.Date() + "\n");

            writer.close();
            System.out.println("\nData written to file successfully!");

        }
        catch(IOException e) {
            System.out.println("Error writing to file: " + e.getMessage());
        }
        finally {
            sc.close();
        }
    }
}
```

Key Points:

- **FileWriter**: Writes character data to file
- **BufferedWriter**: More efficient for large data
- **Auto-close**: Use try-with-resources for automatic closing

Mnemonic: "Create Write Close Handle"