Question 1(a) [3 marks]

Differentiate between Procedure Oriented Programming (POP) and object-oriented programming (OOP).

Answer:

Table:

Aspect	POP	OOP
Approach	Top-down approach	Bottom-up approach
Focus	Functions and procedures	Objects and classes
Data Security	Less secure, global data	More secure, data encapsulation
Problem Solving	Divides into functions	Divides into objects

Key Points:

- **POP**: Functions are primary building blocks
- **OOP**: Objects contain both data and methods
- **Reusability**: OOP provides better code reusability

Mnemonic: "POP Functions, OOP Objects"

Question 1(b) [4 marks]

Enlist and explain the basic concepts of OOP.

Answer:

Basic OOP Concepts:

- **Encapsulation**: Binding data and methods together in a class
- **Inheritance**: Creating new classes from existing classes
- **Polymorphism**: Same method name with different implementations
- **Abstraction**: Hiding implementation details from user

Benefits:

- **Code Reusability**: Through inheritance and polymorphism
- **Data Security**: Through encapsulation
- **Easy Maintenance**: Modular approach

Mnemonic: "Every Intelligent Person Abstracts"

Question 1(c) [7 marks]

Define Constructor. Enlist different types of Constructors and explain any 2 of them with a proper example.

Answer:

Constructor Definition:
A constructor is a special method that initializes objects when they are created. It has the same name as the class and no return type.

Types of Constructors:

- **Default Constructor**: No parameters
- **Parameterized Constructor**: Takes parameters
- **Copy Constructor**: Creates object from another object
- **Private Constructor**: Restricts object creation

Code Example:

```java
class Student {
    String name;
    int age;

    // Default Constructor
    public Student() {
        name = "Unknown";
        age = 0;
    }

    // Parameterized Constructor
    public Student(String n, int a) {
        name = n;
        age = a;
    }
}

class Main {
    public static void main(String[] args) {
        Student s1 = new Student();         // Default
        Student s2 = new Student("John", 20); // Parameterized
    }
}
```

Key Features:

- **Automatic Invocation**: Called automatically during object creation
- **No Return Type**: Constructors don't have return type

Mnemonic: "Constructors Create Objects"

Question 1(c OR) [7 marks]

Explain String class. Enlist different methods of String class and explain any 3 of them with a proper example.

Answer:

String Class:
String class in Java represents immutable character sequences. Once created, String objects cannot be modified.

String Methods:

Method	Purpose
length()	Returns string length
charAt(index)	Returns character at index
substring(start, end)	Extracts substring
indexOf(char)	Finds character position
toUpperCase()	Converts to uppercase

Code Example:

```java
public class StringDemo {
    public static void main(String[] args) {
        String str = "Hello World";

        // length() method
        System.out.println("Length: " + str.length()); // 11

        // charAt() method
        System.out.println("Char at 0: " + str.charAt(0)); // H

        // substring() method
        System.out.println("Substring: " + str.substring(0, 5)); // Hello
    }
}
```

Key Points:

- **Immutable**: String objects cannot be changed
- **Memory Efficient**: String pool for storage

Mnemonic: "Strings Store Text"

Question 2(a) [3 marks]

Define Garbage collection. Describe the importance of Garbage collection in JAVA Programming.

Answer:

Garbage Collection Definition:
Automatic memory management process that reclaims memory occupied by objects that are no longer referenced.

Importance:

- **Automatic Memory Management**: No manual memory deallocation needed
- **Prevents Memory Leaks**: Automatically frees unused memory
- **Application Performance**: Optimizes memory usage

Benefits:

- **Programmer Productivity**: Focus on logic, not memory management
- **Reliability**: Reduces crashes due to memory issues

Mnemonic: "Garbage Collector Cleans Memory"

Question 2(b) [4 marks]

List down the four ways to make an object eligible for garbage collection.

Answer:

Four Ways for GC Eligibility:

Method	Description
Nullifying Reference	Set object reference to null
Reassigning Reference	Point reference to another object
Anonymous Objects	Create objects without reference
Island of Isolation	Objects refer only to each other

Examples:

- **Nullifying**: `obj = null;`
- **Reassigning**: `obj1 = obj2;`
- **Anonymous**: `new Student();`
- **Island**: Circular references with no external access

Mnemonic: "Null References Attract Islands"

Question 2(c) [7 marks]

Write a Java Program to demonstrate a static block that gets executed before main. Explain its significance.

Answer:

Code Example:

```java
public class StaticBlockDemo {
    static int count;

    // Static block
    static {
        System.out.println("Static block executed first");
        count = 10;
        System.out.println("Count initialized to: " + count);
    }

    public static void main(String[] args) {
        System.out.println("Main method started");
        System.out.println("Count value: " + count);
    }
}
```

Output:

```
Static block executed first
Count initialized to: 10
Main method started
Count value: 10
```

Significance:

- **Early Initialization**: Executes before main method
- **Class Loading**: Runs when class is first loaded
- **One-time Execution**: Executes only once per class

Uses:

- **Static Variable Initialization**: Initialize static variables
- **Resource Loading**: Load configuration files

Mnemonic: "Static Blocks Start Before Main"

Question 2(a OR) [3 marks]

Describe Minor/Incremental and Major/Full Garbage collection in JAVA.

Answer:

Types of Garbage Collection:

Type	Description	Frequency
Minor GC	Cleans young generation	Frequent
Major GC	Cleans old generation	Less frequent

Minor GC:

- **Target**: Young generation objects
- **Speed**: Fast execution
- **Impact**: Low application pause

Major GC:

- **Target**: Old generation objects
- **Speed**: Slower execution
- **Impact**: Higher application pause

Mnemonic: "Minor Frequent, Major Slow"

Question 2(b OR) [4 marks]

Explicate the finalize() method in java with its advantages.

Answer:

finalize() Method:
Special method called by garbage collector before object destruction for cleanup operations.

Syntax:

```
protected void finalize() throws Throwable {
    // Cleanup code
}
```

Advantages:

- **Resource Cleanup**: Close files, database connections
- **Memory Management**: Free native resources
- **Safety Net**: Last chance for cleanup

Example:

```
class FileHandler {
    protected void finalize() throws Throwable {
        System.out.println("Cleanup before destruction");
        super.finalize();
    }
}
```

Mnemonic: "Finalize Frees Resources"

Question 2(c OR) [7 marks]

Explain the syntax of public static void main (String[] args). Write a Java Program to print input taken as command line argument.

Answer:

Main Method Syntax:

```
public static void main(String[] args)
```

Explanation:

- **public**: Accessible from anywhere
- **static**: Can be called without object creation
- **void**: No return value
- **main**: Method name recognized by JVM
- **String[] args**: Command line arguments array

Code Example:

```
public class CommandLineDemo {
    public static void main(String[] args) {
        System.out.println("Number of arguments: " + args.length);

        if(args.length > 0) {
            System.out.println("Command line arguments:");
            for(int i = 0; i < args.length; i++) {
                System.out.println("Arg " + i + ": " + args[i]);
            }
        } else {
            System.out.println("No arguments provided");
        }
    }
}
```

Execution:

```
java CommandLineDemo Hello World 123
```

Output:

```
Number of arguments: 3
Command line arguments:
Arg 0: Hello
Arg 1: World
Arg 2: 123
```

Mnemonic: "Public Static Void Main Args"

Question 3(a) [3 marks]

Enlist and Explain various Java access modifier(s).

Answer:

Java Access Modifiers:

Modifier	Class	Package	Subclass	World
public	✓	✓	✓	✓
protected	✓	✓	✓	✗
default	✓	✓	✗	✗
private	✓	✗	✗	✗

Usage:

- **public**: Accessible everywhere
- **protected**: Accessible in package and subclasses
- **default**: Package-level access only
- **private**: Class-level access only

Mnemonic: "Public Protected Default Private"

Question 3(b) [4 marks]

Describe interface in JAVA. Demonstrate inheritance of an interface with an executable example.

Answer:

Interface in Java:
A contract that defines method signatures without implementation. Classes implement interfaces to provide method definitions.

Interface Inheritance Example:

```java
// Parent interface
interface Animal {
    void sound();
}
```

```java
// Child interface inheriting from Animal
interface Mammal extends Animal {
    void walk();
}

// Class implementing the child interface
class Dog implements Mammal {
    public void sound() {
        System.out.println("Dog barks");
    }

    public void walk() {
        System.out.println("Dog walks on four legs");
    }
}

class Main {
    public static void main(String[] args) {
        Dog d = new Dog();
        d.sound();
        d.walk();
    }
}
```

Key Features:

- **Multiple Inheritance**: Interface supports multiple inheritance
- **Contract**: Defines what class must implement

Mnemonic: "Interfaces Inherit Contracts"

Question 3(c) [7 marks]

Define super keyword and demonstrate the use of super keyword with an executable Java Program

Answer:

super Keyword:
References immediate parent class object. Used to access parent class methods, variables, and constructors.

Code Example:

```java
class Animal {
    String name = "Animal";

    Animal(String type) {
        System.out.println("Animal constructor: " + type);
    }

    void sound() {
        System.out.println("Animal makes sound");
    }
}

class Dog extends Animal {
    String name = "Dog";

    Dog() {
        super("Mammal");  // Call parent constructor
        System.out.println("Dog constructor");
    }

    void sound() {
        super.sound();    // Call parent method
        System.out.println("Dog barks");
    }

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

class Main {
    public static void main(String[] args) {
        Dog d = new Dog();
        d.sound();
        d.display();
    }
}
```

Uses of super:

- **Constructor Call**: `super(parameters)`
- **Method Call**: `super.methodName()`
- **Variable Access**: `super.variableName`

Mnemonic: "Super Calls Parent"

Question 3(a OR) [3 marks]

Explain package in JAVA with workable illustration.

Answer:

Package in Java:
A namespace that organizes related classes and interfaces together. Provides access control and namespace management.

Package Structure:

```
com.company.project
├── model
│   └── Student.java
├── service
│   └── StudentService.java
└── Main.java
```

Example:

```java
// File: com/company/model/Student.java
package com.company.model;

public class Student {
    private String name;
    public String getName() { return name; }
    public void setName(String name) { this.name = name; }
}

// File: Main.java
import com.company.model.Student;

public class Main {
    public static void main(String[] args) {
        Student s = new Student();
        s.setName("John");
    }
}
```

Benefits:

- **Organization**: Groups related classes
- **Access Control**: Package-level access

Mnemonic: "Packages Organize Classes"

Question 3(b OR) [4 marks]

Explain abstract and final keywords with a viable illustration.

Answer:

Keywords Explanation:

Keyword	Purpose	Usage
abstract	Incomplete implementation	Classes and methods
final	Prevent modification	Classes, methods, variables

Code Example:

```java
// Abstract class
abstract class Shape {
    final double PI = 3.14;  // final variable

    abstract void draw();    // abstract method

    final void display() {   // final method
        System.out.println("Displaying shape");
    }
}

// Final class
final class Circle extends Shape {
    void draw() {
        System.out.println("Drawing circle");
    }
}

// Cannot extend Circle class due to final
// class Oval extends Circle { } // Error!
```

Key Points:

- **abstract**: Must be overridden in subclass
- **final**: Cannot be overridden or extended

Mnemonic: "Abstract Allows, Final Forbids"

Question 3(c OR) [7 marks]

State Dynamic Method Dispatch in Java Programming language context. Construct an executable program demonstrating Dynamic Method Dispatch.

Answer:

Dynamic Method Dispatch:
Runtime polymorphism where method call is resolved during execution based on actual object type, not reference type.

Code Example:

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

// Derived classes
class Dog extends Animal {
    void sound() {
        System.out.println("Dog barks");
    }
}

class Cat extends Animal {
    void sound() {
        System.out.println("Cat meows");
    }
}

class DynamicDispatchDemo {
    public static void main(String[] args) {
        Animal ref;  // Reference variable

        // Runtime method resolution
        ref = new Dog();
        ref.sound();  // Calls Dog's sound()

        ref = new Cat();
        ref.sound();  // Calls Cat's sound()

        ref = new Animal();
        ref.sound();  // Calls Animal's sound()
    }
}
```

Output:

```
Dog barks
Cat meows
Animal makes sound
```

Key Features:

- **Runtime Resolution**: Method determined at runtime
- **Polymorphism**: Same interface, different behavior
- **Virtual Method Table**: JVM uses vtable for method lookup

Mnemonic: "Dynamic Dispatch Decides Runtime"

Question 4(a) [3 marks]

Explain throw and finally keywords in Exception Handling.

Answer:

Exception Handling Keywords:

Keyword	Purpose	Usage
throw	Manually throw exception	`throw new Exception();`
finally	Always executed block	After try-catch

Examples:

```
// throw example
if(age < 0) {
    throw new IllegalArgumentException("Invalid age");
}

// finally example
try {
    // risky code
} catch(Exception e) {
    // handle exception
} finally {
    // cleanup code - always executes
}
```

Key Points:

- **throw**: Creates and throws exception explicitly
- **finally**: Executes regardless of exception occurrence

Mnemonic: "Throw Creates, Finally Cleans"

Question 4(b) [4 marks]

Write a program demonstrating try…catch block in JAVA

Answer:

Code Example:

```
public class TryCatchDemo {
    public static void main(String[] args) {
        try {
            int[] arr = {1, 2, 3};
            System.out.println("Array element: " + arr[5]); // Index out of bounds

            int result = 10 / 0; // Division by zero

        } catch(ArrayIndexOutOfBoundsException e) {
            System.out.println("Array index error: " + e.getMessage());

        } catch(ArithmeticException e) {
            System.out.println("Math error: " + e.getMessage());
        } catch(Exception e) {
            System.out.println("General error: " + e.getMessage());
        }

        System.out.println("Program continues...");
    }
}
```

Output:

```
Array index error: Index 5 out of bounds for length 3
Program continues...
```

Benefits:

- **Exception Handling**: Graceful error management
- **Program Continuity**: Program doesn't crash

Mnemonic: "Try Code, Catch Errors"

Question 4(c) [7 marks]

Define ArrayIndexOutOfBoundsException Exception. Write a workable JAVA program exhibiting it. Also mention input(s) which will raise this Exception.

Answer:

ArrayIndexOutOfBoundsException:
Runtime exception thrown when trying to access array element with invalid index (negative or >= array length).

Code Example:

```
public class ArrayExceptionDemo {
    public static void main(String[] args) {
        int[] numbers = {10, 20, 30, 40, 50}; // Array size: 5

        try {
            System.out.println("Array length: " + numbers.length);

            // Valid access
            System.out.println("Element at index 2: " + numbers[2]);

            // Invalid access - will throw exception
            System.out.println("Element at index 10: " + numbers[10]);

        } catch(ArrayIndexOutOfBoundsException e) {
            System.out.println("Exception caught: " + e.getMessage());
            System.out.println("Invalid index accessed!");
        }
        System.out.println("Program completed successfully");
    }
}
```

Inputs that raise exception:

- **Negative Index**: `arr[-1]`
- **Index >= Length**: `arr[5]` for array of size 5
- **Empty Array Access**: `arr[0]` for empty array

Prevention:

- **Bounds Checking**: Verify index before access
- **Array Length**: Use `array.length` property

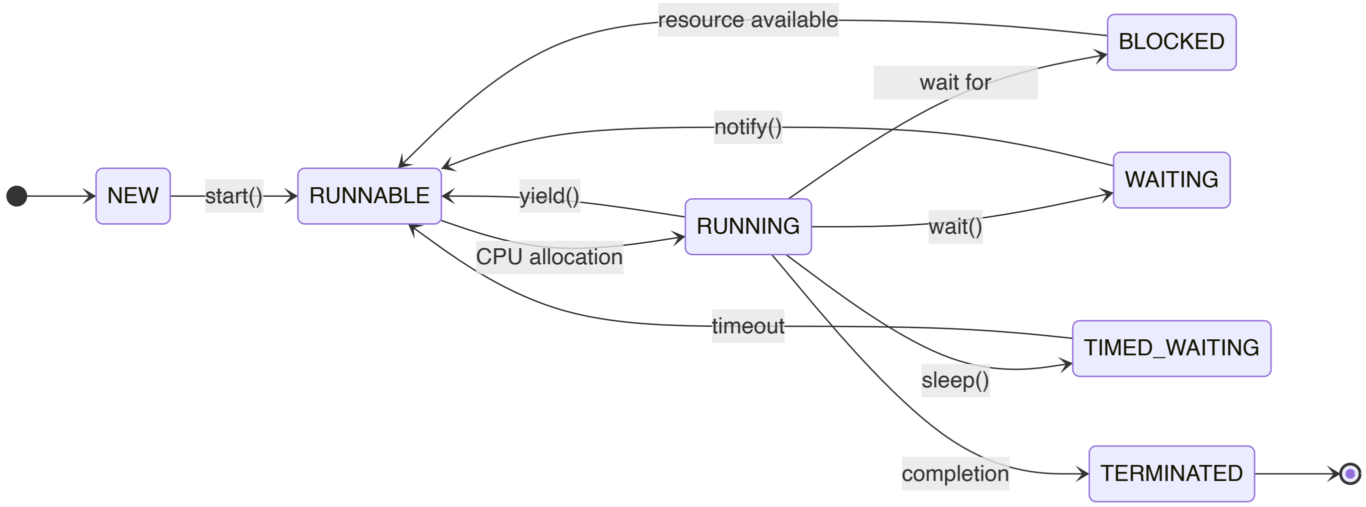
Mnemonic: "Array Bounds Break Programs"

Question 4(a OR) [3 marks]

Draw and explain the life cycle of Thread in JAVA with example.

Answer:

Thread Life Cycle:



States:

- **NEW**: Thread created but not started
- **RUNNABLE**: Ready to run or running
- **BLOCKED**: Waiting for resource
- **WAITING**: Waiting indefinitely
- **TIMED_WAITING**: Waiting for specific time
- **TERMINATED**: Thread execution completed

Mnemonic: "New Runs, Blocks Wait, Terminates"

Question 4(b OR) [4 marks]

Explain JAVA Optional class. Describe the OfNullable() method of Optional class.

Answer:

Optional Class:
Container object that may or may not contain a value. Helps avoid NullPointerException and makes code more readable.

ofNullable() Method:
Returns Optional containing value if non-null, otherwise returns empty Optional.

Code Example:

```java
import java.util.Optional;

public class OptionalDemo {
    public static void main(String[] args) {
        String name1 = "John";
        String name2 = null;

        // ofNullable() examples
        Optional<String> opt1 = Optional.ofNullable(name1);
        Optional<String> opt2 = Optional.ofNullable(name2);

        System.out.println("opt1 present: " + opt1.isPresent()); // true
        System.out.println("opt2 present: " + opt2.isPresent()); // false

        // Safe value retrieval
        System.out.println("Name1: " + opt1.orElse("Unknown"));
        System.out.println("Name2: " + opt2.orElse("Unknown"));
    }
}
```

Benefits:

- **Null Safety**: Prevents NullPointerException
- **Readable Code**: Clear indication of optional values

Mnemonic: "Optional Offers Null Safety"

Question 4(c OR) [7 marks]

Write a workable JAVA program showcasing nested try...catch block.

Answer:

Code Example:

```java
public class NestedTryCatchDemo {
    public static void main(String[] args) {
        try {
            System.out.println("Outer try block started");

            int[] numbers = {10, 20, 30};

            try {
                System.out.println("Inner try block started");

                // This will cause ArrayIndexOutOfBoundsException
                System.out.println("Accessing index 5: " + numbers[5]);

                // This line won't execute
                int result = 100 / 0;

            } catch(ArrayIndexOutOfBoundsException e) {
                System.out.println("Inner catch: Array index error - " + e.getMessage());

                // Throwing new exception from inner catch
                throw new RuntimeException("Error in inner block");
            }

            System.out.println("After inner try-catch");

        } catch(RuntimeException e) {
            System.out.println("Outer catch: Runtime error - " + e.getMessage());

        } catch(Exception e) {
            System.out.println("Outer catch: General error - " + e.getMessage());

        } finally {
            System.out.println("Outer finally: Cleanup operations");
        }

        System.out.println("Program execution completed");
    }
}
```

Output:

```
Outer try block started
Inner try block started
Inner catch: Array index error - Index 5 out of bounds for length 3
Outer catch: Runtime error - Error in inner block
Outer finally: Cleanup operations
Program execution completed
```

Key Features:

- **Multiple Levels**: Inner and outer exception handling
- **Exception Propagation**: Inner exceptions can be caught by outer blocks

- **Specific Handling**: Different exceptions at different levels

Mnemonic: "Nested Try Catches Layers"

Question 5(a) [3 marks]

Explain thread synchronization with an executable code in JAVA.

Answer:

Thread Synchronization:
Mechanism to control access to shared resources by multiple threads to prevent data inconsistency and race conditions.

Code Example:

```java
class Counter {
    private int count = 0;

    // Synchronized method
    public synchronized void increment() {
        count++;
    }

    public int getCount() {
        return count;
    }
}

class SyncDemo extends Thread {
    Counter counter;

    SyncDemo(Counter c) {
        counter = c;
    }

    public void run() {
        for(int i = 0; i < 1000; i++) {
            counter.increment();
        }
    }
}
```

Benefits:

- **Data Consistency**: Prevents race conditions
- **Thread Safety**: Safe access to shared resources

Mnemonic: "Synchronize Secures Shared Data"

Question 5(b) [4 marks]

Enlist various stream classes in JAVA. Explain anyone with an executable example.

Answer:

Stream Classes:

Class	Purpose	Type
FileInputStream	Read bytes from file	Input
FileOutputStream	Write bytes to file	Output
BufferedReader	Buffered character reading	Input
PrintWriter	Formatted text output	Output

FileInputStream Example:

```java
import java.io.*;

public class StreamDemo {
    public static void main(String[] args) {
        try {
            // Create file and write data
            FileOutputStream fos = new FileOutputStream("test.txt");
            String data = "Hello World";
            fos.write(data.getBytes());
            fos.close();

            // Read file using FileInputStream
            FileInputStream fis = new FileInputStream("test.txt");
            int ch;
            while((ch = fis.read()) != -1) {
                System.out.print((char)ch);
            }
            fis.close();

        } catch(IOException e) {
            e.printStackTrace();
        }
    }
}
```

Stream Features:

- **Byte-oriented**: Handles binary data
- **Character-oriented**: Handles text data

Mnemonic: "Streams Send Data"

Question 5(c) [7 marks]

Write a JAVA program extending Thread class to display odd numbers between given two integer numbers using thread.

Answer:

Code Example:

```
class OddNumberThread extends Thread {
    private int start;
    private int end;

    public OddNumberThread(int start, int end) {
        this.start = start;
        this.end = end;
    }

    @Override
    public void run() {
        System.out.println("Thread started: " + Thread.currentThread().getName());
        System.out.println("Finding odd numbers between " + start + " and " + end);

        for(int i = start; i <= end; i++) {
            if(i % 2 != 0) {  // Check if number is odd
                System.out.println("Odd number: " + i);
                try {
                    Thread.sleep(500);  // Pause for 500ms
                } catch(InterruptedException e) {
                    System.out.println("Thread interrupted");
                }
            }
        }

        System.out.println("Thread completed: " + Thread.currentThread().getName());
    }
}

public class OddNumberDemo {
    public static void main(String[] args) {
        // Create thread objects
        OddNumberThread thread1 = new OddNumberThread(1, 10);
        OddNumberThread thread2 = new OddNumberThread(11, 20);

        // Set thread names
        thread1.setName("OddThread-1");
        thread2.setName("OddThread-2");

        // Start threads
        thread1.start();
        thread2.start();

        try {
            // Wait for threads to complete
            thread1.join();
            thread2.join();
        } catch(InterruptedException e) {
            e.printStackTrace();
        }

        System.out.println("All threads completed!");
    }
}
```

Output:

```
Thread started: OddThread-1
Finding odd numbers between 1 and 10
Thread started: OddThread-2
Finding odd numbers between 11 and 20
Odd number: 1
Odd number: 11
Odd number: 3
Odd number: 13
...
```

Thread Features:

- **Concurrent Execution**: Multiple threads run simultaneously
- **Thread Extension**: Extends Thread class for custom behavior

Mnemonic: "Threads Take Turns"

Question 5(a OR) [3 marks]

Explain join() and alive() methods of Thread class in JAVA.

Answer:

Thread Methods:

Method	Purpose	Return Type
join()	Wait for thread completion	void
isAlive()	Check if thread is running	boolean

Method Explanations:

- **join()**: Current thread waits until the specified thread completes execution
- **isAlive()**: Returns true if thread is still running, false if completed

Code Example:

```
class TestThread extends Thread {
    public void run() {
        for(int i = 1; i <= 3; i++) {
            System.out.println("Running: " + i);
            try { sleep(1000); } catch(InterruptedException e) {}
        }
    }
}

public class Main {
    public static void main(String[] args) throws InterruptedException {
        TestThread t = new TestThread();
        System.out.println("Before start: " + t.isAlive()); // false

        t.start();
        System.out.println("After start: " + t.isAlive()); // true

        t.join(); // Wait for completion
        System.out.println("After join: " + t.isAlive()); // false
    }
}
```

Mnemonic: "Join Waits, Alive Checks"

Question 5(b OR) [4 marks]

Define user-defined exceptions in JAVA. Write a program to show user defined exception.

Answer:

User-defined Exceptions:
Custom exception classes created by extending Exception class or its subclasses to handle specific application errors.

Code Example:

```
// Custom exception class
class AgeValidationException extends Exception {
    public AgeValidationException(String message) {
        super(message);
    }
}

class Person {
    private int age;

    public void setAge(int age) throws AgeValidationException {
        if(age < 0) {
            throw new AgeValidationException("Age cannot be negative: " + age);
        }
        if(age > 150) {
            throw new AgeValidationException("Age cannot exceed 150: " + age);
        }
        this.age = age;
        System.out.println("Valid age set: " + age);
    }

    public int getAge() {
        return age;
    }
}

public class UserDefinedExceptionDemo {
    public static void main(String[] args) {
        Person person = new Person();

        try {
            person.setAge(25);    // Valid age
            person.setAge(-5);    // Invalid age - throws exception

        } catch(AgeValidationException e) {
            System.out.println("Custom Exception: " + e.getMessage());
        }

        try {
            person.setAge(200);   // Invalid age - throws exception
        } catch(AgeValidationException e) {
            System.out.println("Custom Exception: " + e.getMessage());
        }
    }
}
```

Output:

```
Valid age set: 25
Custom Exception: Age cannot be negative: -5
Custom Exception: Age cannot exceed 150: 200
```

Benefits:

- **Specific Error Handling**: Handle application-specific errors
- **Better Code Organization**: Separate exception logic

Mnemonic: "Custom Exceptions Catch Specific Errors"

Question 5(c OR) [7 marks]

Write a JAVA program to copy content of file a.txt to b.txt.

Answer:

Code Example:

```
import java.io.*;
```

```java
public class FileCopyDemo {
    public static void main(String[] args) {
        String sourceFile = "a.txt";
        String targetFile = "b.txt";

        // Method 1: Using FileInputStream and FileOutputStream
        copyUsingStream(sourceFile, targetFile);

        // Method 2: Using BufferedReader and PrintWriter
        copyUsingBuffered(sourceFile, targetFile);
    }

    // Method 1: Byte-by-byte copy
    public static void copyUsingStream(String source, String target) {
        try {
            // Create source file with sample data
            FileOutputStream createFile = new FileOutputStream(source);
            String data = "Hello World!\nThis is sample text.\nJava File Operations.";
            createFile.write(data.getBytes());
            createFile.close();
            System.out.println("Source file created with sample data");

            // Copy file
            FileInputStream fis = new FileInputStream(source);
            FileOutputStream fos = new FileOutputStream(target);

            int ch;
            while((ch = fis.read()) != -1) {
                fos.write(ch);
            }

            fis.close();
            fos.close();
            System.out.println("File copied successfully using Stream");

        } catch(IOException e) {
            System.out.println("Error during file copy: " + e.getMessage());
        }
    }

    // Method 2: Line-by-line copy with buffering
    public static void copyUsingBuffered(String source, String target) {
        try {
            BufferedReader reader = new BufferedReader(new FileReader(source));
            PrintWriter writer = new PrintWriter(new FileWriter("buffered_" + target));

            String line;
            while((line = reader.readLine()) != null) {
                writer.println(line);
            }
            reader.close();
            writer.close();
            System.out.println("File copied successfully using BufferedReader");

            // Display copied content
            displayFileContent("buffered_" + target);

        } catch(IOException e) {
            System.out.println("Error during buffered copy: " + e.getMessage());
        }
    }

    // Helper method to display file content
    public static void displayFileContent(String filename) {
        try {
            System.out.println("\nContent of " + filename + ":");
            BufferedReader reader = new BufferedReader(new FileReader(filename));
            String line;
            while((line = reader.readLine()) != null) {
                System.out.println(line);
            }
            reader.close();

        } catch(IOException e) {
            System.out.println("Error reading file: " + e.getMessage());
        }
    }
}
```

Output:

```
Source file created with sample data
File copied successfully using Stream
File copied successfully using BufferedReader

Content of buffered_b.txt:
Hello World!
This is sample text.
Java File Operations.
```

File Operations:

- **FileInputStream/FileOutputStream**: Byte-level operations
- **BufferedReader/PrintWriter**: Line-level operations with buffering
- **Exception Handling**: Proper error management

Key Features:

- **Multiple Methods**: Different approaches for file copying
- **Error Handling**: Try-catch blocks for IOException

- **Resource Management**: Proper closing of file streams

Best Practices:

- **Close Streams**: Always close file streams after use
- **Exception Handling**: Handle IOException properly
- **Buffer Usage**: Use buffered streams for better performance

Mnemonic: "Files Flow From Source To Target"