

Java Interview Questions — Part 4

Multithreading, Collections, OOP & Design Patterns, Exception Handling,
System Design, Pattern Programs (Q99 - Q122)

Prepared for Shammi Bharti

Contents

Section A — Multithreading & Concurrency (Q99 to Q106)	2
Q99. Producer Consumer Problem	2
Q100. Create Thread Using Thread Class	3
Q101. Create Thread Using Runnable	3
Q102. Synchronization Example	4
Q103. Callable and Future Example	5
Q104. ExecutorService Example	5
Q105. ConcurrentHashMap Example	6
Q106. Avoid Deadlocks	7
Section B — Collections Framework (Q107 to Q111)	9
Q107. HashMap Internal Working	9
Q108. HashSet Internal Working	9
Q109. Remove Repeated Elements from ArrayList	10
Q110. Difference Between ArrayList and LinkedList	10
Q111. Difference Between HashMap and ConcurrentHashMap	11
Section C — OOP & Design Patterns (Q112 to Q117)	12
Q112. Singleton Design Pattern	12
Q113. Factory Design Pattern	12
Q114. Builder Design Pattern	13
Q115. Observer Design Pattern	14
Q116. Override a Non-Static Method	15
Q117. Change Order of Method Parameters (Method Overloading)	16
Section D — Exception Handling (Q118)	17
Q118. Implement Custom Exception in Java	17
Section E — System Design / LLD (Q119)	18
Q119. Design a Vending Machine	18
Section F — Pattern Printing Programs (Q120 to Q122)	21
Q120. Printing Star Patterns	21
Q121. Printing Number Patterns	21

Q122. Printing Pyramid Patterns	22
Final Notes	23

Section A — Multithreading & Concurrency (Q99 to Q106)

A **Thread** is a separate path of execution that can run alongside other threads in the same program. This topic is asked a lot in SDET interviews because of parallel test execution.

Q99. Producer Consumer Problem

What is being asked: A classic concurrency problem — one thread (Producer) creates data and puts it into a shared list/queue, while another thread (Consumer) removes and uses that data. They must not step on each other (e.g., consumer should not try to remove from an empty list).

Logic:

- Use a shared queue with a maximum capacity.
- The Producer waits (wait()) if the queue is full; otherwise it adds an item and notifies (notify()) any waiting consumer.
- The Consumer waits if the queue is empty; otherwise it removes an item and notifies any waiting producer.
- synchronized blocks are used so only one thread touches the shared queue at a time.

```
import java.util.LinkedList;
import java.util.Queue;

public class ProducerConsumer {
    static final int CAPACITY = 5;
    static Queue<Integer> queue = new LinkedList<>();

    public static void main(String[] args) {
        Thread producer = new Thread(ProducerConsumer::produce);
        Thread consumer = new Thread(ProducerConsumer::consume);
        producer.start();
        consumer.start();
    }

    static void produce() {
        int value = 0;
        while (true) {
            synchronized (queue) {
                while (queue.size() == CAPACITY) {
                    try { queue.wait(); } catch (InterruptedException e) {}
                }
                queue.add(value);
            }
        }
    }
}
```

```

        System.out.println("Produced: " + value);
        value++;
        queue.notify();
    }
}

static void consume() {
    while (true) {
        synchronized (queue) {
            while (queue.isEmpty()) {
                try { queue.wait(); } catch (InterruptedException e) {}
            }
            int value = queue.poll();
            System.out.println("Consumed: " + value);
            queue.notify();
        }
    }
}
}

```

Q100. Create Thread Using Thread Class

Logic: Make a class that extends Thread and override its run() method with the code you want to run in parallel. Call .start() (never call run() directly — that would just run it normally on the current thread, not a new one).

```

class MyThread extends Thread {
    public void run() {
        System.out.println("Thread running using Thread class");
    }
}

public class CreateThreadExample {
    public static void main(String[] args) {
        MyThread t1 = new MyThread();
        t1.start();
    }
}

```

Q101. Create Thread Using Runnable

Logic: Implement the Runnable interface and define your code inside run(). Then pass that Runnable object into a new Thread(...) and call .start(). This approach is usually preferred over extending Thread, because Java does not support multiple

inheritance — implementing an interface keeps your class free to extend something else if needed.

```
class MyRunnable implements Runnable {
    public void run() {
        System.out.println("Thread running using Runnable interface");
    }
}

public class CreateRunnableExample {
    public static void main(String[] args) {
        Thread t1 = new Thread(new MyRunnable());
        t1.start();
    }
}
```

Q102. Synchronization Example

What is being asked: Show how to prevent two threads from accessing shared data (like a bank balance) at the same time, which could cause incorrect results.

Logic: Mark the critical method with the synchronized keyword. Java will then make sure only one thread can be executing that method on a given object at any time — other threads must wait their turn.

```
class Counter {
    int count = 0;

    synchronized void increment() {
        count++;
    }
}

public class SynchronizationExample {
    public static void main(String[] args) throws InterruptedException {
        Counter counter = new Counter();

        Runnable task = () -> {
            for (int i = 0; i < 1000; i++) {
                counter.increment();
            }
        };

        Thread t1 = new Thread(task);
        Thread t2 = new Thread(task);
        t1.start();
        t2.start();
        t1.join();
    }
}
```

```

        t2.join();

        // result is always 2000, thanks to synchronized
        System.out.println("Final count: " + counter.count);
    }
}

```

Q103. Callable and Future Example

What is being asked: Runnable cannot return a value or throw a checked exception. Callable solves this — it can return a result, which you collect later using a Future.

Logic: Submit a Callable task to an ExecutorService. This immediately returns a Future object (a placeholder for the result that will be ready later). Call future.get() when you actually need the result — this will wait if the task is not finished yet.

```

import java.util.concurrent.*;

public class CallableFutureExample {
    public static void main(String[] args) throws Exception {
        ExecutorService executor = Executors.newSingleThreadExecutor();

        Callable<Integer> task = () -> {
            Thread.sleep(1000);
            return 42;
        };

        Future<Integer> future = executor.submit(task);
        System.out.println("Doing other work while task runs...");

        Integer result = future.get(); // waits here until the result is ready
        System.out.println("Result: " + result);

        executor.shutdown();
    }
}

```

Q104. ExecutorService Example

What is being asked: Instead of manually creating and managing individual Thread objects, use a thread pool to efficiently reuse a fixed number of threads for many tasks.

Logic: Create a thread pool with Executors.newFixedThreadPool(n). Submit tasks using execute() or submit(). The pool automatically assigns each task to an available thread. Always call shutdown() when done, so the program can exit cleanly.

```

import java.util.concurrent.ExecutorService;
import java.util.concurrent.Executors;

public class ExecutorServiceExample {
    public static void main(String[] args) {
        ExecutorService executor = Executors.newFixedThreadPool(3);

        for (int i = 1; i <= 5; i++) {
            int taskId = i;
            executor.execute(() -> {
                String threadName = Thread.currentThread().getName();
                System.out.println("Task " + taskId + " executed by " + threadName);
            });
        }

        executor.shutdown();
    }
}

```

Q105. ConcurrentHashMap Example

What is being asked: Show how to use a thread-safe HashMap that multiple threads can read/write at the same time without corrupting data (unlike a normal HashMap, which is not thread-safe).

Logic: ConcurrentHashMap internally divides the map into segments and only locks the small portion being modified, rather than locking the entire map (unlike the older Hashtable, which locks everything). This makes it both safe and fast for multi-threaded use.

```

import java.util.concurrent.ConcurrentHashMap;

public class ConcurrentHashMapExample {
    public static void main(String[] args) {
        ConcurrentHashMap<String, Integer> map = new ConcurrentHashMap<>();

        Runnable task = () -> {
            for (int i = 0; i < 1000; i++) {
                map.merge("count", 1, Integer::sum);
            }
        };

        Thread t1 = new Thread(task);
        Thread t2 = new Thread(task);
        t1.start();
        t2.start();
    }
}

```

```

    try {
        t1.join();
        t2.join();
    } catch (InterruptedException e) {}

    // safely reaches 2000
    System.out.println("Final count: " + map.get("count"));
}
}

```

Q106. Avoid Deadlocks

What is being asked: A deadlock happens when two or more threads are stuck forever, each waiting for a resource (lock) held by the other. Explain how to prevent this.

Logic / How to avoid it:

- **Lock ordering:** Always acquire multiple locks in the same, consistent order across all threads, so no two threads can be holding one lock while waiting for another in a circular way.
- **Lock timeout:** Use tryLock() with a timeout instead of waiting forever for a lock.
- **Avoid nested locks** where possible, or keep the locked sections as small as possible.

```

public class DeadlockExample {
    static final Object lockA = new Object();
    static final Object lockB = new Object();

    public static void main(String[] args) {
        // Both threads acquire locks in the SAME order to avoid deadlock
        Thread t1 = new Thread(() -> {
            synchronized (lockA) {
                System.out.println("Thread 1 holds Lock A");
                synchronized (lockB) {
                    System.out.println("Thread 1 holds Lock A and Lock B");
                }
            }
        });

        Thread t2 = new Thread(() -> {
            synchronized (lockA) { // same order as t1: A then B
                System.out.println("Thread 2 holds Lock A");
                synchronized (lockB) {
                    System.out.println("Thread 2 holds Lock A and Lock B");
                }
            }
        });
    }
}

```

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

Interview tip: If both threads had locked lockA and lockB in *different* orders, a deadlock could occur. Keeping the order consistent is the simplest fix.

Section B — Collections Framework (Q107 to Q111)

Q107. HashMap Internal Working

What is being asked: Explain how HashMap stores and retrieves data internally — a very common theory question.

Explanation (in simple words):

- A HashMap internally uses an array of “buckets.”
- When you call `put(key, value)`, Java calculates a `hashCode()` for the key, and uses that to decide which bucket it goes into.
- If two different keys land in the same bucket (called a “collision”), they are stored together as a small linked list inside that bucket (in modern Java, if a bucket gets too many collisions, it converts to a balanced tree for better performance).
- When you call `get(key)`, Java again calculates the hash, jumps straight to the right bucket, then compares keys using `equals()` to find the exact match.
- This is why HashMap lookups are very fast on average — close to $O(1)$ — instead of having to check every single entry.

```
import java.util.HashMap;

public class HashMapDemo {
    public static void main(String[] args) {
        HashMap<String, Integer> map = new HashMap<>();
        map.put("apple", 1);
        map.put("banana", 2);

        // internally: hashCode("apple") decides the bucket index
        System.out.println(map.get("apple"));
    }
}
```

Q108. HashSet Internal Working

What is being asked: Explain how HashSet works internally.

Explanation: A HashSet is internally built on top of a HashMap. Every value you add to a HashSet is actually stored as a **key** in a hidden internal HashMap, with a fixed dummy value (a constant Object) attached to every key. This is exactly why a HashSet does not allow duplicates and does not guarantee order — it inherits these properties directly from HashMap.

```
import java.util.HashSet;

public class HashSetDemo {
    public static void main(String[] args) {
        HashSet<String> set = new HashSet<>();
        set.add("apple");
    }
}
```

```

        set.add("apple");    // ignored, already exists as a "key"

        System.out.println(set.size());    // prints 1
    }
}

```

Q109. Remove Repeated Elements from ArrayList

Logic: Convert the list into a LinkedHashSet (removes duplicates while keeping order), then convert it back into a list.

```

import java.util.*;

public class RemoveDuplicatesFromArrayList {
    public static void main(String[] args) {
        List<Integer> list = new ArrayList<>(Arrays.asList(1, 2, 2, 3, 4, 4, 5));

        List<Integer> result = new ArrayList<>(new LinkedHashSet<>(list));

        System.out.println(result);
    }
}

```

Output: [1, 2, 3, 4, 5]

Q110. Difference Between ArrayList and LinkedList

Explanation (theory, in simple words):

Point	ArrayList	LinkedList
Internal structure	Backed by a resizable array	Backed by a doubly-linked chain of nodes
Access by index get(i)	Fast — $O(1)$, jumps straight there	Slow — $O(n)$, must walk from the start
Insert/Delete in the middle	Slow — $O(n)$, must shift elements	Fast — $O(1)$ once you have the node, just relink pointers
Memory usage	Less overhead per element	More overhead (stores extra next/prev pointers per node)
Best used when	You read/access elements a lot	You insert/delete a lot, especially at the ends

```

import java.util.ArrayList;
import java.util.LinkedList;

```

```

public class ArrayListVsLinkedList {
    public static void main(String[] args) {
        ArrayList<Integer> arrayList = new ArrayList<>(); // fast random access
        LinkedList<Integer> linkedList = new LinkedList<>(); // fast insert/delete

        arrayList.add(1);
        linkedList.add(1);
    }
}

```

Q111. Difference Between HashMap and ConcurrentHashMap

Explanation (theory, in simple words):

Point	HashMap	ConcurrentHashMap
Thread safety	Not thread-safe — multiple threads can corrupt data	Thread-safe — designed for multi-threaded use
Locking	No locking at all	Locks only a small segment/bucket being modified, not the whole map
Null keys/values	Allows one null key and multiple null values	Does not allow null keys or null values at all
Performance in multi-threading	Will break or behave unpredictably	Safe and reasonably fast under concurrent access
When to use	Single-threaded programs	Multi-threaded programs, like parallel test execution frameworks

```

import java.util.HashMap;
import java.util.concurrent.ConcurrentHashMap;

public class HashMapVsConcurrentHashMap {
    public static void main(String[] args) {
        // use in single-threaded code
        HashMap<String, Integer> normalMap = new HashMap<>();

        // use when multiple threads write to it
        ConcurrentHashMap<String, Integer> safeMap = new ConcurrentHashMap<>();
    }
}

```

Section C — OOP & Design Patterns (Q112 to Q117)

Q112. Singleton Design Pattern

What is being asked: Ensure that a class can have **only one object (instance)** created in the entire application, and provide a single global way to access it. Commonly used for things like a configuration manager, a logger, or a WebDriver instance in a test framework.

Logic:

- Make the constructor private so no other class can create a new object directly using new.
- Keep a private static reference to the single instance.
- Provide a public static method (commonly named `getInstance()`) that creates the object only the first time it is called, and returns the same object every time after that.

```
public class Singleton {
    private static Singleton instance;

    private Singleton() {
        // private constructor - prevents "new Singleton()" from outside
    }

    public static Singleton getInstance() {
        if (instance == null) {
            instance = new Singleton();
        }
        return instance;
    }
}
```

Q113. Factory Design Pattern

What is being asked: Create objects without exposing the exact creation logic to the caller — the caller just asks for a “type,” and a Factory class decides which actual object to build and return.

Logic: Define a common interface/abstract class for the product family. Create a Factory class with a method that takes some input (like a type name) and returns the correct concrete object based on that input.

```
interface Shape {
    void draw();
}

class Circle implements Shape {
    public void draw() { System.out.println("Drawing Circle"); }
}
```

```

}

class Square implements Shape {
    public void draw() { System.out.println("Drawing Square"); }
}

class ShapeFactory {
    Shape getShape(String type) {
        if (type.equalsIgnoreCase("circle")) return new Circle();
        if (type.equalsIgnoreCase("square")) return new Square();
        return null;
    }
}

public class FactoryPatternDemo {
    public static void main(String[] args) {
        ShapeFactory factory = new ShapeFactory();
        Shape shape = factory.getShape("circle");
        shape.draw();
    }
}

```

Q114. Builder Design Pattern

What is being asked: Construct a complex object step by step, especially useful when an object has many optional fields (avoids having a constructor with 10 parameters, most of which might be empty/default).

Logic: Create a nested Builder class inside the main class. Each “set” method on the Builder returns the Builder itself (this), which allows chaining calls together. A final build() method creates the actual object using the values collected.

```

public class User {
    private String name;
    private int age;
    private String email;

    private User(Builder builder) {
        this.name = builder.name;
        this.age = builder.age;
        this.email = builder.email;
    }

    public static class Builder {
        private String name;
        private int age;
        private String email;
    }
}

```

```

        public Builder setName(String name) { this.name = name; return this; }
        public Builder setAge(int age) { this.age = age; return this; }
        public Builder setEmail(String email) { this.email = email; return this; }

        public User build() {
            return new User(this);
        }
    }
}

class BuilderPatternDemo {
    public static void main(String[] args) {
        User user = new User.Builder()
            .setName("Shammi")
            .setAge(28)
            .setEmail("shammi@example.com")
            .build();
    }
}

```

Q115. Observer Design Pattern

What is being asked: Set up a system where one object (the “Subject”) notifies a list of other objects (the “Observers”) automatically whenever something changes — like a YouTube channel notifying all its subscribers when a new video is uploaded.

Logic: The Subject keeps a list of Observers. It provides methods to addObserver() and notifyObservers(). When notifyObservers() is called, it loops through the list and calls an update() method on every registered Observer.

```

import java.util.ArrayList;
import java.util.List;

interface Observer {
    void update(String message);
}

class Subscriber implements Observer {
    String name;
    Subscriber(String name) { this.name = name; }
    public void update(String message) {
        System.out.println(name + " received notification: " + message);
    }
}

class YouTubeChannel {

```

```

List<Observer> subscribers = new ArrayList<>();

void addObserver(Observer observer) {
    subscribers.add(observer);
}

void notifyObservers(String message) {
    for (Observer observer : subscribers) {
        observer.update(message);
    }
}
}

public class ObserverPatternDemo {
    public static void main(String[] args) {
        YouTubeChannel channel = new YouTubeChannel();
        channel.addObserver(new Subscriber("Shammi"));
        channel.addObserver(new Subscriber("Rahul"));

        channel.notifyObservers("New video uploaded!");
    }
}

```

Q116. Override a Non-Static Method

What is being asked: Demonstrate **method overriding** — when a child class provides its own specific version of a method already defined in its parent class.

Logic: The method in the child class must have the exact same name, return type, and parameters as the parent's method. Use the `@Override` annotation (good practice, helps catch mistakes at compile time). When you call the method on a child object, Java runs the child's version — this is called **runtime polymorphism**.

```

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

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

public class MethodOverridingDemo {

```

```

    public static void main(String[] args) {
        Animal animal = new Dog();    // parent reference, child object
        // Dog's version runs - this is runtime polymorphism
        animal.makeSound();
    }
}

```

Output: Dog barks

Q117. Change Order of Method Parameters (Method Overloading)

What is being asked: This demonstrates **method overloading** — having multiple methods with the **same name** in the same class, but with different parameter lists (different number, type, or order of parameters). Java decides which one to call based on the arguments you pass.

Logic: Define several methods with identical names but different parameter signatures. Java picks the matching version at compile time based on the arguments used in the call — this is called **compile-time polymorphism**.

```

public class MethodOverloadingDemo {

    void show(int a, String b) {
        System.out.println("int first: " + a + ", " + b);
    }

    void show(String b, int a) {
        System.out.println("String first: " + b + ", " + a);
    }

    public static void main(String[] args) {
        MethodOverloadingDemo obj = new MethodOverloadingDemo();
        obj.show(5, "Hello");    // calls the first version
        obj.show("Hello", 5);    // calls the second version (order differs)
    }
}

```

Section D — Exception Handling (Q118)

Q118. Implement Custom Exception in Java

What is being asked: Create your own exception class for situations specific to your application, instead of always using Java's built-in exceptions. Example: an `InvalidAgeException` for a registration form.

Logic:

- Create a class that extends `Exception` (for a checked exception, which the caller must handle) or extends `RuntimeException` (for an unchecked exception).
- Provide a constructor that accepts a message and passes it to the parent class using `super(message)`.
- throw your custom exception wherever the invalid condition occurs, and handle it using try-catch where needed.

```
class InvalidAgeException extends Exception {
    public InvalidAgeException(String message) {
        super(message);
    }
}

public class CustomExceptionDemo {
    static void checkAge(int age) throws InvalidAgeException {
        if (age < 18) {
            String msg = "Age must be 18 or above. Given age: " + age;
            throw new InvalidAgeException(msg);
        }
        System.out.println("Age is valid.");
    }

    public static void main(String[] args) {
        try {
            checkAge(15);
        } catch (InvalidAgeException e) {
            System.out.println("Caught exception: " + e.getMessage());
        }
    }
}
```

Output: Caught exception: Age must be 18 or above. Given age: 15

Section E — System Design / LLD (Q119)

Q119. Design a Vending Machine

What is being asked: A Low-Level Design (LLD) question. You need to design the classes and states for a simple vending machine that accepts money, lets the user select a product, dispenses it, and gives change.

Logic / Approach (this is the answer interviewers are really looking for):

- **Identify the entities:** Product (name, price, quantity), Inventory (holds all products), VendingMachine (the main controller), and the machine's State.
- **Identify the states** the machine moves through: Idle -> HasMoney (waiting for selection) -> Dispensing -> back to Idle. This is a great place to mention the **State Design Pattern** if asked about patterns.
- **Identify the main actions:** insertCoin(), selectProduct(), dispenseProduct(), returnChange().
- Keep responsibilities separate: Inventory only manages stock, VendingMachine only manages flow/state, and Product only stores data — this follows the **Single Responsibility Principle**.

```
import java.util.HashMap;
import java.util.Map;

class Product {
    String name;
    double price;
    int quantity;

    Product(String name, double price, int quantity) {
        this.name = name;
        this.price = price;
        this.quantity = quantity;
    }
}

class Inventory {
    Map<String, Product> products = new HashMap<>();

    void addProduct(Product product) {
        products.put(product.name, product);
    }

    Product getProduct(String name) {
        return products.get(name);
    }

    void reduceStock(String name) {
        Product product = products.get(name);
```

```

        if (product != null && product.quantity > 0) {
            product.quantity--;
        }
    }
}

class VendingMachine {
    Inventory inventory = new Inventory();
    double insertedAmount = 0;

    void insertCoin(double amount) {
        insertedAmount += amount;
        System.out.println("Inserted: " + amount + ", Total: " + insertedAmount);
    }

    void selectProduct(String name) {
        Product product = inventory.getProduct(name);

        if (product == null || product.quantity == 0) {
            System.out.println("Product unavailable.");
            return;
        }
        if (insertedAmount < product.price) {
            System.out.println("Insufficient amount. Please insert more.");
            return;
        }

        dispenseProduct(product);
    }

    void dispenseProduct(Product product) {
        inventory.reduceStock(product.name);
        double change = insertedAmount - product.price;
        insertedAmount = 0;

        System.out.println("Dispensing: " + product.name);
        if (change > 0) {
            System.out.println("Returning change: " + change);
        }
    }
}

public class VendingMachineDemo {
    public static void main(String[] args) {
        VendingMachine machine = new VendingMachine();
        machine.inventory.addProduct(new Product("Coke", 25, 5));

        machine.insertCoin(30);
    }
}

```

```
        machine.selectProduct("Coke");  
    }  
}
```

pdfsent.com

Section F — Pattern Printing Programs (Q120 to Q122)

These questions test your control over nested loops, which is a basic but important skill interviewers check early on.

Q120. Printing Star Patterns

What is being asked: Print a simple right-angled triangle made of stars:

```
*
* *
* * *
* * * *
* * * * *
```

Logic: Use two loops — the outer loop controls the row number, and the inner loop prints stars equal to the current row number.

```
public class StarPattern {
    public static void main(String[] args) {
        int rows = 5;
        for (int i = 1; i <= rows; i++) {
            for (int j = 1; j <= i; j++) {
                System.out.print("* ");
            }
            System.out.println();
        }
    }
}
```

Q121. Printing Number Patterns

What is being asked: Print a number triangle where each row repeats its row number:

```
1
2 2
3 3 3
4 4 4 4
5 5 5 5 5
```

Logic: Same structure as Q120, but instead of printing a fixed "*", print the outer loop variable *i* itself.

```
public class NumberPattern {
    public static void main(String[] args) {
        int rows = 5;
        for (int i = 1; i <= rows; i++) {
            for (int j = 1; j <= i; j++) {

```

```

        System.out.print(i + " ");
    }
    System.out.println();
}
}
}

```

Q122. Printing Pyramid Patterns

What is being asked: Print a centred pyramid of stars:

```

    *
  * * *
 * * * * *
* * * * * * *
* * * * * * * * *

```

Logic: For each row, you need two things: leading spaces (which decrease as rows increase) and stars (which increase as $2 \times \text{row} - 1$).

- Spaces needed in row i (out of rows total) = rows - i .
- Stars needed in row $i = 2 \times i - 1$.

```

public class PyramidPattern {
    public static void main(String[] args) {
        int rows = 5;

        for (int i = 1; i <= rows; i++) {
            // print leading spaces
            for (int s = 1; s <= rows - i; s++) {
                System.out.print(" "); // two spaces to keep stars aligned
            }
            // print stars
            for (int j = 1; j <= (2 * i - 1); j++) {
                System.out.print("* ");
            }
            System.out.println();
        }
    }
}

```

Final Notes

That covers all 122 questions from your list — Strings, Numbers, Arrays, Searching & Sorting, Matrix, Linked List, Stack & Queue, Binary Tree, Graph, Multithreading, Collections, OOP & Design Patterns, Exception Handling, System Design, and Pattern Printing.

How to revise effectively before your interview:

1. Don't memorise the code character by character — memorise the **logic steps** for each question. If you understand the steps, you can rebuild the code from scratch even under pressure.
2. Practice writing 5-10 of these programs daily **on paper or a plain text editor** (no auto-complete), since that is closer to a real whiteboard/online-assessment interview.
3. Pay special attention to the **theory questions** (HashMap internal working, ArrayList vs LinkedList, HashMap vs ConcurrentHashMap, BFS vs DFS) — these often decide if the interviewer feels you “really understand” Java, not just copy-paste code.
4. For Design Patterns and the Vending Machine LLD question, focus on being able to **explain your design out loud** — interviewers care more about your reasoning than perfect code in these rounds.

All the best for your Automation QA / SDET interviews, Shammi!