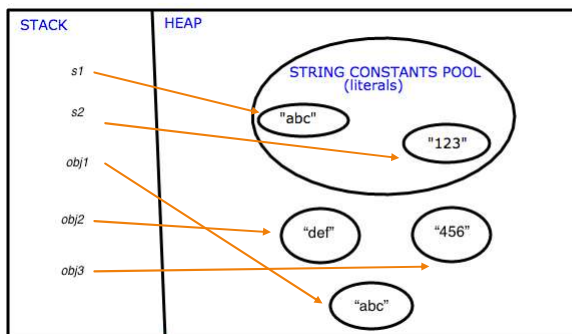


Core Java

Andy

1

Topic: String - Memory & Constant Pool



*String s1 = "abc";
String s2 = "123";
String obj1 = new String("abc");
String obj2 = new String("del");
String obj3 = new String("456");*

Pool
→ Heap

2

Topic : String

String is immutable

- String `str1` = "abc"; String `str2` = new String("abc"); String `str3` = "abc"; String `str4` = `str1` + `str2`;
 - Reference vs Value: 1) `str1 == str2` ? 2) `str1.equals(str2)` ? 3) `str1.compareTo(str2)`
 - Constant Pool: How many objects ? (Pool)
 - Built-in Functions: `charAt()`, `length()`, `substring()`, `contains()`, `equals()`, `toUpperCase()`

StringBuilder & StringBuffer

- StringBuilder `sb` = new StringBuilder("abc"); `sb.append("abc");`
 - `sb.append("abc");`; `sb.reverse();`; `sb.delete(startIndex, endIndex)`
 - Mutable
 - `toString()`
 - Synchronized vs non-synchronized

StringTokenizer

```
List<String> tokens = new ArrayList<String>();
StringTokenizer stringTokenizer = new StringTokenizer(input, delim: " , / .");
while(stringTokenizer.hasMoreTokens()) {
    tokens.add(stringTokenizer.nextToken());
}
```

3

Topic: final

- Variable : *immutable*
 - public static final String APP_NAME="testApp"
 - Purpose: define constants
- Method: *no override*
 - public final int add(int a, int b){ return a + b; }
 - Purpose: prevent override
- Class: *no inheritance*
 - final class MyClass(){}
 - Purpose: 1) prevent inheritance, like Integer, String etc; 2) Make class immutable
- Difference: final, finally, finalize

by call ——— *Garbage collection*

4

Topic: static -variable/block

- ▶ Only One Instance!

```
public class UserRepository {

    private static Set<User> users = new HashSet<>();

    static {
        users.add(new User( id: 1, email: "a@gmail.com", password: "a@gmail.com", role: "USER"));
        users.add(new User( id: 2, email: "b@gmail.com", password: "b@gmail.com", role: "ADMIN"));
    }

    public Set<User> getUsers() {
        return users;
    }

}
```

Question

1. Java Variable Scope ?
2. scope of static block ?

5

Topic: static - method

- ▶ 2) Static Method

```
public class StaticMethodTest {

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

    public static void main(String[] args) {
        int result = StaticMethodTest.add( a: 3, b: 5);
        System.out.println(result == 8);
    }

}
```

Question:

- 1) Can static method access non-static variables ?
- 2) How to call static method in/outside of enclosing class?
- 3) Common Static Methods?
- 4) When to use static Methods?

✓ No

6

Topic: static - class

► 3) Static Class

```
public class CarParts {
    //static wheel class
    public static class StaticWheel {
        public StaticWheel() { System.out.println("Static Wheel created");}
        public void drive() {System.out.println("drive static wheel");}
    }

    //Non static wheel class
    public class NonStaticWheel {
        public NonStaticWheel() {System.out.println("Non Static Wheel created");}
    }

    //default class
    public CarParts() {System.out.println("Car Parts Object Created!");}

    //static method
    public static void combine() {System.out.println("combine in car parts!");}
}
```

```
public class App {
    public static void main(String[] args){
        CarParts.StaticWheel staticWheel = new CarParts.StaticWheel();
        staticWheel.drive();
        CarParts.combine();
        CarParts.NonStaticWheel nonStaticWheel = new CarParts().new NonStaticWheel();
        nonStaticWheel.toString();
    }
}
```

7

Serializable

```
public class Employee implements Serializable {
    // private static final long serialVersionUID = -6470090944414208496L;
    private static final long serialVersionUID = 1L;

    private String name;
    transient private int salary;

    //getter and setter methods
    public String getName() {
        return name;
    }

    public void setName(String name) {
        this.name = name;
    }

    public int getSalary() {
        return salary;
    }

    public void setSalary(int salary) {
        this.salary = salary;
    }
}
```

- 1) serialVersionUID
- 2) transient: to avoid serialization
- Static field or class is not serialized

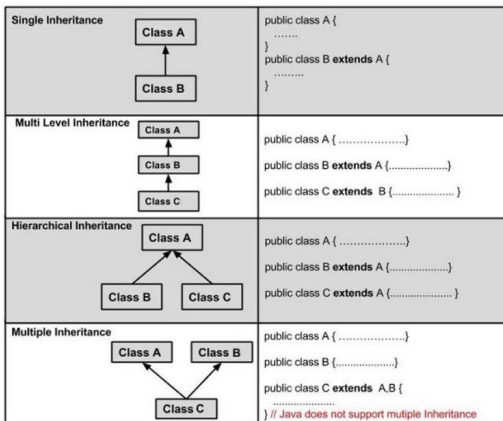
8

Topic: OOP(PIE)

► Inheritance

Extends: Class

Implements: Interface



Question:

1. Abstract Class
2. Abstract class vs Interface
3. Marker Interface (Serializable, Cloneable)

Tips:

- > Multiple Inheritance (extends) is not allowed
- > Multiple Implementation (implements) is allowed
- > Use "super()" to access parent class

Cloneable: shallow clone
shallow clone vs deep clone

9

Topic: OOP(PIE)

► Polymorphism

- Static Polymorphism / Dynamic Polymorphism
- Overload (same class) / Override (child class)

```

public class JusticeLeague {
    public JusticeLeague() {
        System.out.println("Justice League founded!");
    }

    public void fight() {
        System.out.println("All fight together");
    }

    //overload
    public void fight(String member) {
        System.out.println("Only " + member + " flight");
    }
}

public class Batman extends JusticeLeague {
    public Batman() {
        super();
        System.out.println("*****inside batman*****");
    }

    @Override
    public void fight(String member) {
        System.out.println("Batman and " + member + "will fight together");
    }
}
          
```

```

public class TestJusticeLeague {
    public void test() {
        JusticeLeague justiceLeague = new JusticeLeague();
        justiceLeague.fight();
        justiceLeague.fight(member: "Flash");
        Batman batman = new Batman();
        batman.fight(member: "superman");
    }
}
          
```

Override can NOT be applied to static method

10

Topic: OOP(PIE)

► Encapsulation

```
/* File name : EncapTest.java */
public class EncapTest {
    private String name;
    private String idNum;
    private int age;

    public int getAge() {
        return age;
    }

    public String getName() {
        return name;
    }

    public String getIdNum() {
        return idNum;
    }

    public void setAge( int newAge) {
        age = newAge;
    }

    public void setName(String newName) {
        name = newName;
    }

    public void setIdNum( String newId) {
        idNum = newId;
    }
}
```

```
/* File name : RunEncap.java */
public class RunEncap {

    public static void main(String args[]) {
        EncapTest encap = new EncapTest();
        encap.setName("James");
        encap.setAge(20);
        encap.setIdNum("12343ms");

        System.out.print("Name : " + encap.getName() + " Age : " + encap.getAge());
    }
}
```

Tips: use getter/setter instead of direct access

Industry standard code structure

11

Topic: Design Pattern (Singleton)

```
public class Singleton implements Serializable, Cloneable{
    private static Singleton instance;
    1 private Singleton(){
    2 public static synchronized Singleton getInstance(){
        if(instance == null){
            instance = new Singleton();
        }
        return instance;
    }

    //prevent Clone
    3 @Override
    protected Object clone() throws CloneNotSupportedException{
        throw new CloneNotSupportedException();
    }

    //prevent Serializable/DeSerializable
    4 protected Object readResolve(){
        return instance;
    }
}

//prevent Java Reflection *
public enum SingletonEnum{
    INSTANCE;
    private SingletonEnum(){
    }
}
```

► Steps to make singleton

- 1. private Constructor
- 2. static synchronized getInstance method
- 3. override clone() method
- 4. override readResolve() method

► Disadvantage of Singleton

- 1. it carries state of object
- 2. it prevents dependency injection and cannot be unit tested

*To Clone(): 1) class should implements Cloneable; 2) It is only a shallow clone; 3) avoid to use

12

Topic: Design Pattern (Factory)

```
public abstract class Foxconn {
    public abstract makePhones(){};
}

public class Iphone extends Foxconn {
    //make iphone
}

public class Samsung extends Foxconn {
    //make samsung phone
}

//factory class
public class PhoneFactory{
    public static Foxconn makePhone(String brand){
        if("iphone".equals(brand)){
            return new Iphone();
        }
        if("samsung".equals(brand)){
            return new Samsung();
        }
    }
}
```

Example 1

```
public interface DBConnection{
    public Connection getConnection();
}

public class OracleConnection implements DBConnection{
    public Connection getConnection(){
        DataSource oracleDS = new OracleDataSource();
        Connection conn = driver.getConnection(oracleDS);
        return conn;
    }
}

public class SqlServerConnection implements DBConnection{
    public Connection getConnection(){
        DataSource sqlserverDS = new SQLServerDataSource();
        Connection conn = driver.getConnection(sqlserverDS);
        return conn;
    }
}

public class DBConnectionFactory{
    public DBConnection getDBConnection(String db){
        if("oracle".equals(db)){
            return new OracleConnection();
        }
        if("sqlserver".equals(db)){
            return new SqlServerConnection();
        }
    }
}
```

Example 2

13

Topic: Design Pattern (Observer)

```
//Observable
public class News {
    private List<MediaCompany> observers = new ArrayList<MediaCompany>();
    private String subject;

    public String getSubject() {
        return subject;
    }

    public void setSubject(String subject) {
        this.subject = subject;
        notifyAllObservers();
    }

    public void addObserver(MediaCompany observer){
        observers.add(observer);
    }

    public void notifyAllObservers(){
        for (MediaCompany observer : observers) {
            observer.update();
        }
    }
}
```

```
//Observer interface
public abstract class MediaCompany{
    protected News news;
    public abstract void update();
}

public class CNN extends MediaCompany{
    public CNN(News news){
        this.news = news;
        this.news.addObserver(this);
    }

    @Override
    public void update() { System.out.println("CNN");}
}

public class FOX extends MediaCompany{
    public FOX(News news){
        this.news = news;
        this.news.addObserver(this);
    }

    @Override
    public void update() { System.out.println("FOX");}
}

public class NBC extends MediaCompany{
    public NBC(News news){
        this.news = news;
        this.news.addObserver(this);
    }

    @Override
    public void update() { System.out.println("NBC");}
}
```

► It is similar to “subscribe” in Angular/Redux and Reactive Programming

```
public class ObserverPatternDemo {
    public static void main(String[] args) {
        News news = new News();

        new CNN(news);
        new FOX(news);
        new NBC(news);

        news.setSubject("News: Happy New Year!");
        news.setSubject("News: Happy July 4th!");
    }
}
```

14

Topic: Design Pattern (Others)

- ▶ Popular Design Pattern to choose:
 - ▶ Decorator, Façade, Strategy, Builder, Composite etc
- ▶ DO NOT SAY “MVC”

15

Topic: Real Scenario

- ▶ 1. Design a Vending Machine
- ▶ 2. Design an Elevator System
- ▶ 3. Design a Parking Lot

16


```
graph TD
    subgraph Collection_Framework [Collection Framework]
        Collection["<<interface>> Collection"]
        Set["<<interface>> Set"]
        List["<<interface>> List"]
        Queue["<<interface>> Queue"]
        SortedSet["<<interface>> SortedSet"]
        HashSet["HashSet"]
        LinkedHashSet["LinkedHashSet"]
        TreeSet["TreeSet"]
        ArrayList["ArrayList"]
        Vector["Vector"]
        LinkedList["LinkedList"]
        PriorityQueue["PriorityQueue"]

        Collection -- extends --> Set
        Collection -- extends --> List
        Collection -- extends --> Queue
        Set -- extends --> SortedSet
        SortedSet -- extends --> TreeSet
        HashSet -- implements --> Set
        LinkedHashSet -- implements --> Set
        TreeSet -- implements --> SortedSet
        ArrayList -- implements --> List
        Vector -- implements --> List
        LinkedList -- implements --> Queue
        PriorityQueue -- implements --> Queue
    end

    subgraph Map_Framework [Map Framework]
        Object["Object"]
        Map["<<interface>> Map"]
        SortedMap["<<interface>> SortedMap"]
        Arrays["Arrays"]
        Collections["Collections"]
        Hashtable["Hashtable"]
        LinkedHashMap["LinkedHashMap"]
        HashMap["HashMap"]
        TreeMap["TreeMap"]

        Object -- extends --> Arrays
        Object -- extends --> Collections
        Map -- extends --> SortedMap
        SortedMap -- extends --> TreeMap
        Hashtable -- implements --> Map
        LinkedHashMap -- implements --> Map
        HashMap -- implements --> Map
        TreeMap -- implements --> SortedMap
    end
```

The diagram illustrates the relationships between Java Collection Framework interfaces and classes. It is divided into two main sections: the top section for the Collection Framework and the bottom section for the Map Framework.

Collection Framework:

- Collection** (interface) is the root, extending **Set**, **List**, and **Queue** (all interfaces).
- Set** (interface) extends **SortedSet** (interface).
- SortedSet** (interface) is implemented by **TreeSet** (class).
- HashSet** (class) and **LinkedHashSet** (class) implement **Set**.
- ArrayList** (class) and **Vector** (class) implement **List**.
- LinkedList** (class) and **PriorityQueue** (class) implement **Queue**.

Map Framework:

- Object** (class) is the root, extending **Arrays** (class) and **Collections** (class).
- Map** (interface) extends **SortedMap** (interface).
- SortedMap** (interface) is implemented by **TreeMap** (class).
- Hashtable** (class), **LinkedHashMap** (class), and **HashMap** (class) implement **Map**.

Legend:

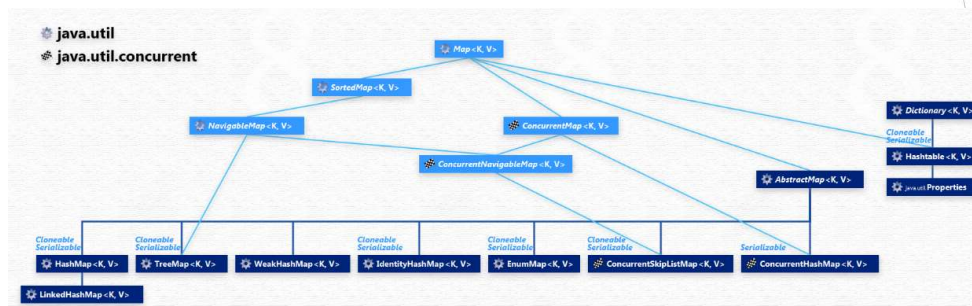
- implements:** Represented by a dashed arrow.
- extends:** Represented by a solid arrow.

```

classDiagram
    class java_util {
        class Collection {
            <<abstract>>
            <<interface>>
            +Iterable<T>
        }
        class Set {
            <<interface>>
        }
        class List {
            <<interface>>
        }
        class Queue {
            <<interface>>
        }
        class Deque {
            <<interface>>
        }
        class AbstractCollection {
            <<abstract>>
        }
        class AbstractList {
            <<abstract>>
        }
        class AbstractSet {
            <<abstract>>
        }
        class AbstractQueue {
            <<abstract>>
        }
        class BlockingQueue {
            <<interface>>
        }
        class TransferQueue {
            <<interface>>
        }
        class BlockingDeque {
            <<interface>>
        }
        class ConcurrentLinkedQueue {
            <<concrete>>
        }
        class PriorityQueue {
            <<concrete>>
        }
        class SynchronousQueue {
            <<concrete>>
        }
        class ArrayBlockingQueue {
            <<concrete>>
        }
        class DelayQueue {
            <<concrete>>
        }
        class LinkedBlockingQueue {
            <<concrete>>
        }
        class PriorityBlockingQueue {
            <<concrete>>
        }
        class LinkedTransferQueue {
            <<concrete>>
        }
        class LinkedBlockingDeque {
            <<concrete>>
        }
        class ConcurrentLinkedDeque {
            <<concrete>>
        }
    }
    java_util.Collection <|-- java_util.Set
    java_util.Collection <|-- java_util.List
    java_util.Collection <|-- java_util.Queue
    java_util.Collection <|-- java_util.Deque
    java_util.Collection <|-- java_util.AbstractCollection
    java_util.Set <|-- java_util.SortedSet
    java_util.Set <|-- java_util.NavigableSet
    java_util.Set <|-- java_util.AbstractSet
    java_util.List <|-- java_util.CopyOnWriteArrayList
    java_util.List <|-- java_util.AbstractList
    java_util.Queue <|-- java_util.AbstractQueue
    java_util.Queue <|-- java_util.BlockingQueue
    java_util.Queue <|-- java_util.TransferQueue
    java_util.Queue <|-- java_util.BlockingDeque
    java_util.Queue <|-- java_util.ConcurrentLinkedQueue
    java_util.Queue <|-- java_util.PriorityQueue
    java_util.Queue <|-- java_util.SynchronousQueue
    java_util.Queue <|-- java_util.ArrayBlockingQueue
    java_util.Queue <|-- java_util.DelayQueue
    java_util.Queue <|-- java_util.LinkedBlockingQueue
    java_util.Queue <|-- java_util.PriorityBlockingQueue
    java_util.Queue <|-- java_util.LinkedTransferQueue
    java_util.Queue <|-- java_util.LinkedBlockingDeque
    java_util.Queue <|-- java_util.ConcurrentLinkedDeque
    java_util.Deque <|-- java_util.ArrayDeque
    java_util.Deque <|-- java_util.ConcurrentLinkedDeque
    java_util.AbstractCollection <|-- java_util.AbstractList
    java_util.AbstractCollection <|-- java_util.AbstractSet
    java_util.AbstractCollection <|-- java_util.AbstractQueue
    java_util.AbstractCollection <|-- java_util.BlockingQueue
    java_util.AbstractCollection <|-- java_util.TransferQueue
    java_util.AbstractCollection <|-- java_util.BlockingDeque
    java_util.AbstractCollection <|-- java_util.ConcurrentLinkedQueue
    java_util.AbstractCollection <|-- java_util.PriorityQueue
    java_util.AbstractCollection <|-- java_util.SynchronousQueue
    java_util.AbstractCollection <|-- java_util.ArrayBlockingQueue
    java_util.AbstractCollection <|-- java_util.DelayQueue
    java_util.AbstractCollection <|-- java_util.LinkedBlockingQueue
    java_util.AbstractCollection <|-- java_util.PriorityBlockingQueue
    java_util.AbstractCollection <|-- java_util.LinkedTransferQueue
    java_util.AbstractCollection <|-- java_util.LinkedBlockingDeque
    java_util.AbstractCollection <|-- java_util.ConcurrentLinkedDeque
    java_util.AbstractList <|-- java_util.ArrayList
    java_util.AbstractList <|-- java_util.AbstractSequentialList
    java_util.AbstractList <|-- java_util.Vector
    java_util.AbstractSet <|-- java_util.HashSet
    java_util.AbstractSet <|-- java_util.TreeSet
    java_util.AbstractSet <|-- java_util.ConcurrentSkipListSet
    java_util.AbstractSet <|-- java_util.CopyOnWriteArraySet
    java_util.AbstractSet <|-- java_util.EnumSet
    java_util.AbstractQueue <|-- java_util.ConcurrentLinkedQueue
    java_util.AbstractQueue <|-- java_util.PriorityQueue
    java_util.AbstractQueue <|-- java_util.SynchronousQueue
    java_util.AbstractQueue <|-- java_util.ArrayBlockingQueue
    java_util.AbstractQueue <|-- java_util.DelayQueue
    java_util.AbstractQueue <|-- java_util.LinkedBlockingQueue
    java_util.AbstractQueue <|-- java_util.PriorityBlockingQueue
    java_util.AbstractQueue <|-- java_util.LinkedTransferQueue
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    java_util.BlockingQueue <|-- java_util.ConcurrentLinkedDeque
    java_util.TransferQueue <|-- java_util.LinkedTransferQueue
    java_util.BlockingDeque <|-- java_util.LinkedBlockingDeque
    java_util.BlockingDeque <|-- java_util.ConcurrentLinkedDeque
    java_util.ConcurrentLinkedQueue <|-- java_util.ConcurrentLinkedDeque
    java_util.PriorityQueue <|-- java_util.ConcurrentLinkedDeque
    java_util.SynchronousQueue <|-- java_util.ConcurrentLinkedDeque
    java_util.ArrayBlockingQueue <|-- java_util.ConcurrentLinkedDeque
    java_util.DelayQueue <|-- java_util.ConcurrentLinkedDeque
    java_util.LinkedBlockingQueue <|-- java_util.ConcurrentLinkedDeque
    java_util.PriorityBlockingQueue <|-- java_util.ConcurrentLinkedDeque
    java_util.LinkedTransferQueue <|-- java_util.ConcurrentLinkedDeque
    java_util.LinkedBlockingDeque <|-- java_util.ConcurrentLinkedDeque
    java_util.ConcurrentLinkedDeque <|-- java_util.ConcurrentLinkedDeque
  
```

The diagram illustrates the class hierarchy for `java.util` and `java.util.concurrent`. It shows the inheritance and implementation relationships between various collection classes. Key classes include `Collection`, `Set`, `List`, `Queue`, `Deque`, `AbstractCollection`, `AbstractList`, `AbstractSet`, `AbstractQueue`, and their concrete implementations like `ArrayList`, `LinkedList`, `Vector`, etc. The diagram also highlights interfaces like `Iterable`, `RandomAccess`, `Cloneable`, and `Serializable`.

Map + Concurrent



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Topic: Iterator vs Enumeration

```

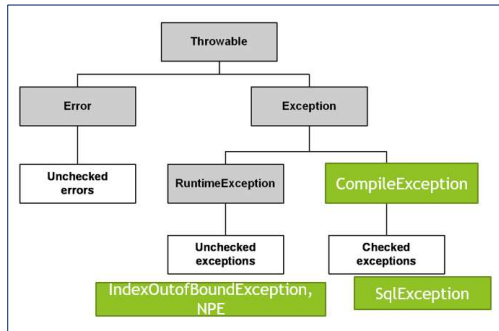
public User getUserById(int id) {
    Enumeration<User> enumUser = Collections.enumeration(userDB);
    while(enumUser.hasMoreElements()){
        User temp = enumUser.nextElement();
        if(temp.getId() == id){
            return temp;
        }
    }
    return null;
}

public void deleteUserById(int id) {
    Iterator<User> itUser = userDB.iterator();
    while(itUser.hasNext()){
        User tempUser = itUser.next();
        if(tempUser.getId() == id){
            itUser.remove();
        }
    }
}

```

20

Topic: Exception Handling



Exception Structure

```

class MyOwnException extends Exception {
    MyOwnException(String msg) {
        super(msg);
    }
}

class Javaapp {
    public static void main(String[] args) {
        try {
            int age = 130;
            if (age > 100) {
                throw new MyOwnException("Age = " + age + " It's not possible");
            }
        } catch (MyOwnException ex) {
            System.out.println(ex);
        }
        System.out.println("Execution Complete");
    }
}
  
```

Define your own Exception
(try-catch, throw, throws)

21

Topic: Multithreading(thread - java18)

► 1. Create a thread

```

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

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

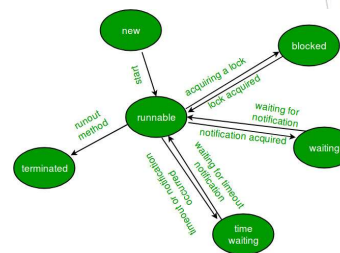
► 2. Race Condition

Multiple Threads try to change the same object status.

► 3. Start() vs Run()

A: t.start() create and run a new thread.
t.run() run the thread in current thread

► 4. Thread LifeCycle



► 5. ThreadLocal vs Volatile

A: ThreadLocal: create thread level copy of object
Volatile: All threads share and update same object

22

Topic: Multithreading

- ▶ 6. join(s) tells other threads to wait until this thread is completed or just wait for the given s seconds

Question: Given three threads, how to let them run in order?

```
public class ThreadSequence {

    public static void main(String[] args) {
        SeqRun sr = new SeqRun();
        // Three threads
        Thread t1 = new Thread(sr);
        Thread t2 = new Thread(sr);
        Thread t3 = new Thread(sr);

        try {
            // First thread
            t1.start();
            t1.join();
            // Second thread
            t2.start();
            t2.join();
            // Third thread
            t3.start();
            t3.join();
        } catch (InterruptedException e) {
            // TODO Auto-generated catch block
            e.printStackTrace();
        }
    }
}
```

23

Topic: Synchronized

- ▶ Synchronized on Method;
- ▶ Synchronized on Block
- ▶ Static synchronized vs Synchronized
(Analyze 4 scenarios)

```
public class SynchronizedScope{

    public Employee employee;
    public EmployeeService service;

    public synchronized void modifyEmployee(){
        service.modify();
    }

    public void modifyEmployee(boolean isValid){
        if(!isValid){
            return;
        }

        synchronized(employee){
            service.modify();
        }
    }
}

public SynchronizedTest{
    public static synchronized method1(){}
    public synchronized method2(){}
    public synchronized method3(){}
}

SynchronizedTest s1 = new SynchronizedTest();
SynchronizedTest s2 = new SynchronizedTest();

//scenario 1:
thread1.run(s1.method1);
thread2.run(s1.method2);

//scenario 2:
thread1.run(s1.method2);
thread2.run(s1.method3);

//scenario 3:
thread1.run(s1.method2);
thread2.run(s2.method2);

//scenario 4:
thread1.run(s1.method1);
thread2.run(s2.method1);
```

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Topic: Concurrency

-- 1) ExecutorService

- ▶ `ExecutorService` maintains thread pool
- ▶ `Executors.newCachedThreadPool()`
`newFixedThreadPool()`
- ▶ `execute()`, `submit()`, `invokeAny()`, `invokeAll()`
- ▶ `Runnable` vs `Callable`

```
ExecutorService executorService = Executors.newSingleThreadExecutor();
executorService.execute(new Runnable() {
    public void run() {
        System.out.println("Asynchronous task");
    }
});
executorService.shutdown();
```

```
Future future = executorService.submit(new Callable(){
    public Object call() throws Exception {
        System.out.println("Asynchronous Callable");
        return "Callable Result";
    }
});
System.out.println("future.get() = " + future.get());
```

- ▶ `Future.get(*time)`, `Future.isDone()`, `Future.cancel()`
- ▶ `Executor.shutdown()`

```
public static void runSameTime() {
    //TODO: finish and print "B.getMethod A.getMethod"
    ExecutorService service = Executors.newFixedThreadPool(2);

    try {
        Future<String> aFuture = service.submit(() -> new tmobile_2019_06_03_i2.A().getMethod());
        Future<String> bFuture = service.submit(() -> new tmobile_2019_06_03_i2.B().getMethod());

        boolean allDone = false;
        while(!allDone) {
            if(aFuture.isDone() && bFuture.isDone()) {
                System.out.println(bFuture.get() + " " + aFuture.get());
                allDone = true;
            }
        }
    } catch (InterruptedException e) {
        e.printStackTrace();
    } catch (Exception e) {
        e.printStackTrace();
    } finally {
        service.shutdown();
    }
}
```

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Topic: Concurrency

-- 2) Semaphore and Mutex

- ▶ Semaphore - limits the number of threads to access one resource concurrently

Semaphore semaphore = new Semaphore(4)

- ▶ Mutex - limits only 1 thread to access one resource concurrently

Mutex is not native in java, Semaphore(1) is Mutex

```
package com.bht.aop.main;
import java.util.concurrent.Semaphore;

public class SemaphoreMain {
    static Semaphore semaphore = new Semaphore(3);
    //static Semaphore semaphore = new Semaphore(1);
    static class MyATMThread extends Thread {
        String name;
        MyATMThread(String name){ this.name = name; }
        public void run(){
            try {
                semaphore.acquire();
                System.out.println(name + " : got the permit!");
                try {
                    System.out.println(name + " is doing work now! ");
                    Thread.sleep(5000);
                } finally {
                    System.out.println(name + " : releasing lock...");
                    semaphore.release();
                }
            } catch (InterruptedException e){e.printStackTrace();}
        }
    }

    public static void main(String[] args) {
        System.out.println("Total available Semaphore permits : " +
            semaphore.availablePermits());
        MyATMThread t1 = new MyATMThread("A");
        t1.start();
        MyATMThread t2 = new MyATMThread("B");
        t2.start();
        MyATMThread t3 = new MyATMThread("C");
        t3.start();
        MyATMThread t4 = new MyATMThread("D");
        t4.start();
        MyATMThread t5 = new MyATMThread("E");
        t5.start();
    }
}
```

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Topic: Java 8(default & static methods)

- ▶ Problem with java interfaces: children must implements all methods in interface, if adding new definitions to interface, all children have to update.
- ▶ Solution: **default** methods in interface

```
interface MyInterface{
    default void newMethod(){
        System.out.println("Newly added default method");
    }
    void existingMethod(String str);
}

interface MyInterface2{
    default void newMethod(){
        System.out.println("Newly added default method");
    }
    void disp(String str);
}
```

```
public class Example implements MyInterface, MyInterface2{
    // implementing abstract methods
    public void existingMethod(String str){
        System.out.println("String is: "+str);
    }
    public void disp(String str){
        System.out.println("String is: "+str);
    }
    //Implementation of duplicate default method
    public void newMethod(){
        System.out.println("Implementation of default method");
    }
    public static void main(String[] args) {
        Example obj = new Example();

        //calling the default method of interface
        obj.newMethod();
    }
}
```

- ▶ Problem: multiple implementations -> override
- ▶ **Static** methods: the same as defaults method, but does not allow override

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Topic: Java 8(lambda)

Why introducing lambda?

- To replace anonymous inner class
- Work with functional interface (next slide)

Tooltips:

- Avoid large block of code and "return"
- Avoid () around single input
- Avoid input type

```
public class ComparatorTest {
    public static void main(String[] args) {
        List<Person> personList = Person.createShortList();

        // Sort with Inner Class
        Collections.sort(personList, new Comparator<Person>(){
            public int compare(Person p1, Person p2){
                return p1.getSurName().compareTo(p2.getSurName());
            }
        });

        System.out.println("=== Sorted Asc SurName ===");
        for(Person p:personList){
            p.printName();
        }

        // Use Lambda instead

        // Print Asc
        System.out.println("=== Sorted Asc SurName ===");
        Collections.sort(personList, (Person p1, Person p2) -> p1.getSurName().compareTo(p2.getSurName()));

        for(Person p:personList){
            p.printName();
        }

        // Print Desc
        System.out.println("=== Sorted Desc SurName ===");
        Collections.sort(personList, (p1, p2) -> p2.getSurName().compareTo(p1.getSurName()));

        for(Person p:personList){
            p.printName();
        }
    }
}
```

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Topic: Java 8(Functional Interface)

- ▶ has one Single Abstract Method
- ▶ @FunctionalInterface - for sanity check
- ▶ Can have default methods
- ▶ Lambda is the implementation of the abstract method

```
@FunctionalInterface
public interface ITrade {
    public boolean check(Trade t);
}
```

```
// Lambda for big trade
ITrade bigTradeLambda = (Trade t) -> t.getQuantity() > 10000000;

// Lambda that checks if the trade is a new large google trade
ITrade issuerBigNewTradeLambda = (t) -> {
    return t.getIssuer().equals("GOOG") &&
        t.getQuantity() > 10000000 &&
        t.getStatus().equals("NEW");
};
```

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Topic: Java 8(stream)

- ▶ filter

```
public class NowJava8 {

    public static void main(String[] args) {

        List<Person> persons = Arrays.asList(
            new Person("mkyong", 30),
            new Person("jack", 20),
            new Person("lawrence", 40)
        );

        Person result1 = persons.stream()
            .filter((p) -> "jack".equals(p.getName()) && 20 == p.getAge())
            .findAny()
            .orElse(null);

        System.out.println("result 1 : " + result1);

        //or like this
        Person result2 = persons.stream()
            .filter(p -> {
                if ("jack".equals(p.getName()) && 20 == p.getAge()) {
                    return true;
                }
                return false;
            })
            .findAny()
            .orElse(null);

        System.out.println("result 2 : " + result2);

    }

}
```

Predicate

- ▶ map

```
public class NowJava8 {

    public static void main(String[] args) {

        List<Staff> staff = Arrays.asList(
            new Staff("mkyong", 30, new BigDecimal(10000)),
            new Staff("jack", 27, new BigDecimal(20000)),
            new Staff("lawrence", 33, new BigDecimal(30000))
        );

        // convert inside the map() method directly.
        List<StaffPublic> result = staff.stream().map(temp -> {
            StaffPublic obj = new StaffPublic();
            obj.setName(temp.getName());
            obj.setAge(temp.getAge());
            if ("mkyong".equals(temp.getName())) {
                obj.setExtra("this field is for mkyong only!");
            }
            return obj;
        }).collect(Collectors.toList());

        System.out.println(result);

    }

}
```

Function

Output

```
[
  StaffPublic(name='mkyong', age=30, extra='this field is for mkyong only!'),
  StaffPublic(name='jack', age=27, extra='null'),
  StaffPublic(name='lawrence', age=33, extra='null')
]
```

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Topic: Java 8(stream)

► Joining

```
//joining -- concatenate list into string
//replace "wal" with "Sams"

String s = "walabcwALexyWALxzsfxwalmx";
Arrays.asList(s.split("(?i)Wal")).stream().collect(Collectors.joining("Sams"));
```

► GroupingBy

```
//GroupingBy - split list into multiple categories, return map
//GroupingBy takes two parameters: a)grouping key; b)how to group the list according to key

List<String> strList = Arrays.asList("Jan", "Feb", "Jan", "July");

Map<String, List<String>> map1 = strList.stream()
    .collect(Collectors.groupingBy(o -> o));

Map<String, Integer> map2 = strList.stream()
    .collect(Collectors.groupingBy(o->o, Collectors.summingInt(o->1)));
```

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Topic: Java 8(optional)

► To avoid Null checks and run time NullPointerExceptions

```
public class Mobile{
    private long id;
    private String brand;
    private String name;
    private Optional<DisplayFeatures> displayFeatures;
}

public class DisplayFeatures{
    private String size;
    private Optional<ScreenResolution> resolution;
}

public class ScreenResolution{
    private int width;
    private int height;
}
```

```
//Non - Java 8
public class MobileService {
    public int getMobileScreenWidth(Mobile mobile){
        if(mobile != null){
            DisplayFeatures df = mobile.getDisplayFeatures();
            if(df != null){
                ScreenResolution sr = df.getResolution();
                if(sr != null){
                    return sr.getWidth();
                }
            }
        }
        return 0;
    }
}

//Java 8
public class MobileService {
    public int getMobileScreenWidth(Mobile mobile){
        return mobile.flatMap(Mobile::getDisplayFeatures)
            .flatMap(DisplayFeatures::getResolution)
            .map(ScreenResolution::getWidth)
            .orElse(0);
    }
}
```

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Topic: Java 8(forEach)

1.1 Normal way to loop a Map.

```
Map<String, Integer> items = new HashMap<>();
items.put("A", 10);
items.put("B", 20);
items.put("C", 30);
items.put("D", 40);
items.put("E", 50);
items.put("F", 60);

for (Map.Entry<String, Integer> entry : items.entrySet()) {
    System.out.println("Item : " + entry.getKey() + " Count : " + entry.getValue());
}
```

1.2 In Java 8, you can loop a Map with `forEach` + lambda expression.

```
Map<String, Integer> items = new HashMap<>();
items.put("A", 10);
items.put("B", 20);
items.put("C", 30);
items.put("D", 40);
items.put("E", 50);
items.put("F", 60);

items.forEach((k,v)->System.out.println("Item : " + k + " Count : " + v));

items.forEach((k,v)->{
    System.out.println("Item : " + k + " Count : " + v);
    if("E".equals(k)){
        System.out.println("Hello E");
    }
});
```

2.1 Normal for-loop to loop a List.

```
List<String> items = new ArrayList<>();
items.add("A");
items.add("B");
items.add("C");
items.add("D");
items.add("E");

for(String item : items){
    System.out.println(item);
}
```

2.2 In Java 8, you can loop a List with `forEach` + lambda expression or method reference.

```
List<String> items = new ArrayList<>();
items.add("A");
items.add("B");
items.add("C");
items.add("D");
items.add("E");

//Lambda
//Output : A,B,C,D,E
items.forEach(item->System.out.println(item));

//Output : C
items.forEach(item->{
    if("C".equals(item)){
        System.out.println(item);
    }
});

//method reference
//Output : A,B,C,D,E
items.forEach(System.out::println);

//Stream and filter
//Output : B
items.stream()
    .filter(s->s.contains("B"))
    .forEach(System.out::println);
```