**Contents**

1. MySQL
2. Java Collection Framework
3. Java Multithreading
4. Java Spring
5. Spring Boot & Microservices
6. React.js

Pre-requisites

* OOPS concepts
  + Inheritance
  + Encapsulation
  + Polymorphism – Overriding
  + Abstraction – abstract class & interface
* Exception Handling
  + try, catch, finally, throw & throws
* Object – root class
* String, LocalDate, LocalDateTime, LocalTime

Exceptions – Types

1. Checked Exceptions – Need to handle it at the compilation time
2. Unchecked Exceptions – These are ignored by the compiler

ArithmeticException, NullPointerException, ArrayIndexOutpBoundsException – Unchecked Exceptions

SQLException, IOException, Exception – Checked Exceptions

Naming conventions:

Keywords: lowercase, example: private, public, int, long, void, double, …

Classnames & Constructors: Starts with uppercase & follows the camel case

Method names & Variable names: Starts with lowercase & follows the camel case

Final variables: Every letter will be in uppercase & uses \_ for multiple words

Example: HELLO\_WORLD

Predefined-classes

1. LocalDate: It is to represent the date like doj, dob, current date
2. LocalDateTime: It is to represent the date & time both like login times
3. LocalTime: It is to represent the time

LocalDate follows ISO standard format to represent the date, i.e, yyyy-MM-dd

ISO format is followed by all the applications & devices

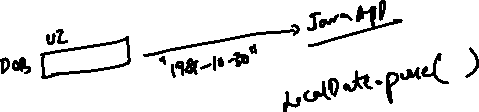
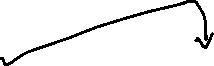
How to create LocalDate

LocalDate dob = LocalDate.of(1980, 11, 25); // 1980-11-25

LocalDate dob2 = LocalDate.parse(“1981-10-30”); // 1981-10-30

LocalDate dob3 = LocalDate.parse(“20-11-1989”, DateTimeFormatter.ofPattern(“dd-MM-yyyy”))

// dob3 = 1989-11-20



LocalDate is present in java.time package which you must import.

Note: Object, String, System and etc are part of java.lang which you don’t have to import

toString(): It is called when you print the object, by default it returns memory address & it is present in Object class, but you can override to return the object property so that when you print object it can print the object property by calling toString().

Signature of toString(): public String toString()

Creating multiple layers to maintain the user

Since we don’t have the database we are maintaining the user data in an array.

class UserService {   
 User[] users = new User[5];   
 store(User user) { // store user in the array }  
 findAll() { // returns the array }   
}

How to handle exception

You need to handle exceptions using try catch, however the code can propagate a checked exception to the caller so that caller will be notified at the compilation time to handle the exception

Scenario 1:   
User findByName(String name) {   
 try {   
 if(..) { throw check-exception }  
 } catch (…) { }  
}

Scenario 2:

User findByName(String name) throws checked-exception {   
 if(…) { throw checked-exception }  
}

You can’t throw predefined exceptions because they don’t look valid for all the business requirements, hence you must create your own checked exceptions by extending Exception class

class UserNotFoundException extends Exception {   
 UserNotFoundException(String message) { … }   
}

We can use this constructor with String to pass error messages so that caller can get those error messages.

If(…) {   
 throw new UserNotFoundException(“User with “+name+” is not found”);  
}

Note: You must create all the exception classes related to your requirement in a separate package like com.npci.exceptions

Database

* Types of SQL
* Joins
* Views
* Stored Procedures
* Indexes

SQL: Structured Query Language which is used to communicate the RDBMS

SQL types

1. DDL (Data Definition Language): CREATE, ALTER, DROP, TRUNCATE
2. DML (Data Manipulation Language): INSERT, DELETE, UPDATE
3. DQL/DRL (Data Query/Retrieval Language): SELECT
4. TCL (Transaction Control Language): COMMIT, ROLLBACK, SAVEPOINT
5. DCL (Data Control Language): GRANT, REVOKE

Constraints: These are rules applied on the table & their data

1. PRIMARY KEY: No null values & must be unique
2. UNIQUE: Supports null values
3. NOT NULL: Needs value mandatorily
4. CHECK: Conditions on the value like gender must be male or female, age must be between 18 to 60
5. FOREIGN KEY: To reference the primary key of a table

SQL Queries

mysql> create database npci\_db;

Query OK, 1 row affected (0.00 sec)

mysql> use npci\_db;

Database changed

mysql> create table employees(employee\_id int primary key, employee\_name varchar(15), phone\_number int unique);

Query OK, 0 rows affected (0.04 sec)

mysql> insert into employees values(500, 'Alex', 99008800);

Query OK, 1 row affected (0.01 sec)

mysql> insert into employees values(501, 'Bruce', null);

Query OK, 1 row affected (0.00 sec)

mysql> insert into employees values(502, 'Charles', null);

Query OK, 1 row affected (0.00 sec)

mysql> select \* from employees;

+-------------+---------------+--------------+

| employee\_id | employee\_name | phone\_number |

+-------------+---------------+--------------+

| 500 | Alex | 99008800 |

| 501 | Bruce | NULL |

| 502 | Charles | NULL |

+-------------+---------------+--------------+

3 rows in set (0.00 sec)

mysql> update employees set phone\_number=8899888 where employee\_id=501;

Query OK, 1 row affected (0.01 sec)

Rows matched: 1 Changed: 1 Warnings: 0

mysql> update employees set phone\_number=8899888 where employee\_id=502;

ERROR 1062 (23000): Duplicate entry '8899888' for key 'employees.phone\_number'

mysql> update employees set phone\_number=8899898 where employee\_id=502;

Query OK, 1 row affected (0.00 sec)

Rows matched: 1 Changed: 1 Warnings: 0

mysql> alter table employees add column salary double;

Query OK, 0 rows affected (0.02 sec)

Records: 0 Duplicates: 0 Warnings: 0

mysql> select \* from employees;

+-------------+---------------+--------------+--------+

| employee\_id | employee\_name | phone\_number | salary |

+-------------+---------------+--------------+--------+

| 500 | Alex | 99008800 | NULL |

| 501 | Bruce | 8899888 | NULL |

| 502 | Charles | 8899898 | NULL |

+-------------+---------------+--------------+--------+

3 rows in set (0.00 sec)

mysql> alter table employees add column email\_id varchar(20), add column pan varchar(10);

Query OK, 0 rows affected (0.01 sec)

Records: 0 Duplicates: 0 Warnings: 0

mysql> desc employees;

+---------------+-------------+------+-----+---------+-------+

| Field | Type | Null | Key | Default | Extra |

+---------------+-------------+------+-----+---------+-------+

| employee\_id | int | NO | PRI | NULL | |

| employee\_name | varchar(15) | YES | | NULL | |

| phone\_number | int | YES | UNI | NULL | |

| salary | double | YES | | NULL | |

| email\_id | varchar(20) | YES | | NULL | |

| pan | varchar(10) | YES | | NULL | |

+---------------+-------------+------+-----+---------+-------+

6 rows in set (0.01 sec)

mysql> alter table employees drop column pan, drop column email\_id, drop column salary;

Query OK, 0 rows affected (0.01 sec)

Records: 0 Duplicates: 0 Warnings: 0

mysql> desc employees;

+---------------+-------------+------+-----+---------+-------+

| Field | Type | Null | Key | Default | Extra |

+---------------+-------------+------+-----+---------+-------+

| employee\_id | int | NO | PRI | NULL | |

| employee\_name | varchar(15) | YES | | NULL | |

| phone\_number | int | YES | UNI | NULL | |

+---------------+-------------+------+-----+---------+-------+

3 rows in set (0.00 sec)

mysql> select \* from employees;

+-------------+---------------+--------------+

| employee\_id | employee\_name | phone\_number |

+-------------+---------------+--------------+

| 500 | Alex | 99008800 |

| 501 | Bruce | 8899888 |

| 502 | Charles | 8899898 |

+-------------+---------------+--------------+

3 rows in set (0.00 sec)

mysql> select databases();

ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that corresponds to your MySQL server version for the right syntax to use near 'databases()' at line 1

mysql> select database();

+------------+

| database() |

+------------+

| npci\_db |

+------------+

1 row in set (0.00 sec)

mysql> select PI();

+----------+

| PI() |

+----------+

| 3.141593 |

+----------+

1 row in set (0.00 sec)

mysql> select now();

+---------------------+

| now() |

+---------------------+

| 2023-10-13 17:44:02 |

+---------------------+

1 row in set (0.00 sec)

mysql> select current\_date;

+--------------+

| current\_date |

+--------------+

| 2023-10-13 |

+--------------+

1 row in set (0.00 sec)

Day wise agenda

Day1: MySQL

Day2: MySQL & Collection Framework

Day3: Threads, Filehandling, JDBC

Day4: ORM & Spring

Day5: Spring Boot

Day6 & Day 7: Microservices

Day8 & Day9: React.js

Day 2 Agenda

Joins

Views

Procedures

Index

Joins:

It is used to join multiple tables based on some conditions

Ex: Student & Marks table

Ex: User & Roles table

Ex: Employee & Department table

Syntax:

Select column\_names from table1 join table2 on condition

[or]

Select table\_name.column\_names from table1 join table2 on condition

[or]

Select alias.column\_names from table1 alias join table2 alias on condition

Views: It is a virtual table created from the select statements

Syntax: create view view\_name as (query)

Select \* from view\_name runs the query provided while creating view

Index: it helps you to search the data quickly, because it uses binary search

Syntax:

Create table students(column, … index index\_name(column));

Alter table students add index index\_name(column));

Ex: alter table students add index student\_name(name));

Select \* from students where name = “Yuvraj”;

The above query uses index to search as name is configured with an index

Stored Procedures

These are reusable programs that you can store & call whenever you need.

Syntax:

Create procedure procedure\_name(arguments, arguments)

Statements;  
Statements;

Note: Since ; is terminal statement & its used in the procedures for terminating multiple statements we must use a different delimiter to terminate the procedure

delimiter $ - now $ is the delimiter to end

Loosely coupled applications with design patterns

Whenever the client code depends on another code it has to create an object, but if the new implementation of another code should be used, then client code must also be changed, hence client should always use interfaces at their side & abstract the object of its implementations through some design patterns like factory, singleton

Note: Create all the design pattern classes in a separate package like com.npci.utility

Drawbacks of an array

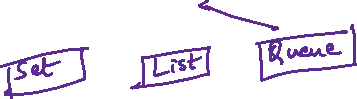
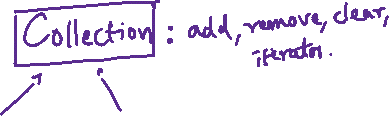
1. Size is fixed
2. It can only store similar data-types
3. No inbuilt algorithms to maintain data like maintaining unique elements, maintaining elements in sorted order, maintaining elements in FIFO, maintaining elements in random order and so on.

Collection Framework

These provide set of API’s to maintain the data in various way

* Maintaining duplicate elements, unique elements, in sorted order, random order
* You get inbuilt methods to add, remove & iterate
* Size grows and shrinks at run time as and when you add or remove elements

Collection Framework hierarchy



Set: It maintains only unique elements

List & Queue: They can maintain duplicates, List is index based, Queue maintains elements that needs to be removed either in FIFO or Sorted order

Set implementation

HashSet: It maintains the elements in random order, its retrieval is faster compare to other implementations

LinkedHashSet: it maintains the elements in insertion order

TreeSet: It maintains the elements in sorted order

Set API internal implementation

Set.add(obj) >> obj.hashCode() == if object collides >> obj.equals(obj2) adds it if equals is false else ignores it

Set.add(obj) >> obj.hashCode() == if doesn’t collide >> adds it

Test cases: These helps you to determine whether your methods are working as per your requirement.

Note: Currently we are testing save, findAll, findUserByName using main method, but we can write test cases for each methods.

Test Cases will give Green report if test passes else gives Red report when the test fails

How to test the code

Suppose we have a Calculator class

class Calculator {   
 public int add(int x, int y) { return x + y; }   
}

From main: Calculator c = new Calculator(); c.add(20, 30);

From test case Calculator c = new Calculator();

int result = c.add(20, 30);

assertEquals(50, result); // Green report or Red report

Activity 1

Create a Profile that will have the following properties: profileId, name, password, dob, phone.

Use the layered architecture and in the service layer you must be able to perform following operations

1. save
2. delete

Maintain the Profile in a Collection framework in the service layer.

Write the test cases for save, delete and also for not saving the duplicate profile.

Design the classes & interfaces accordingly, write the code such that it must be loosely coupled apply appropriate design patterns so that the client must able to get the multiple implementation of the service layer without changing the code

Activity 2

To the existing Profile activity provide a login method in the service layer which must accept profileId & password on a valid profileId and password it must return the Profile else throw a checked exception

Ensure you have a test case to pass profileId and password that expects Profile on those inputs or assert the error messages you are expecting when profileId or password is wrong.

Day Agenda

Comparable & Comparator

Spring Framework

TreeSet: It is used to store elements in sorted order

Note: Complex objects can’t be sorted unless it implements Comparable & Comparator

Note: Simple types can be sorted automatically

Hello, Test, Demo, Apple, Grapes – String

15, 7, 3, 8, 9, 12 – Integer

String, Integer and other classes implements Comparable.

Implementing Comparator

Comparator<String> comparator = new Comparator<String>() {   
 public int compare(String s1, Strings s2) { return s1.compareTo(s2)}  
};

Implementing with Lambda expression

Comparator<String> comparator2 = (a, b) -> b.compareTo(a) // return b.compareTo(a) // -ve goes towards right side

Pass the comparator to the TreeSet

Set<String> string1 = new TreeSet() // uses Comparable of String  
Set<String> string2 = new TreeSet(comparator2) // uses Comparator

Note: You can directly pass the lambda expression as below

Set<String> string3 = new TreeSet( (a, b) -> b.compareTo(a) );

Comparable vs Comparator

|  |  |
| --- | --- |
| Comparable | Comparator |
| It is implemented in the same class that needs to be sorted  Ex: class Employee implements Comparable<Employee> Ex: class String implements Comparable<String> | It is implemented in a separate class |
| It has a method compareTo(T t) | It has a method compare(T t1, T t2) |
| It is for natural ordering as it is part of the class that needs to be sorted | It is to customize the natural ordering into various types of sorting  Ex: sort based in ascending / descending & sort based on other properties like price, ratings |

Spring Framework

Framework: It is a semi-implemented application with lot of common features which every application needs, you don’t have to write codes for those common features like-

1. Design patterns
2. Handling all the predefined checked exceptions
3. Creating database connections & closing their resources
4. Type conversions

Spring Framework: It is an application framework used to develop various types of applications for different platforms like web, mobile, cloud, desktop and so on

The main thing in spring framework is Spring Container

Spring Container: It is an environment where spring creates & maintains all the reusable objects and supplies those objects to another objects if required (Supplying Dao to the Service)

Without spring how this Dependency Injection works

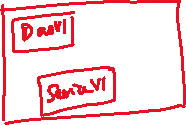
// Dao layer code  
class EmployeeDaoV1 implements EmployeeDao { }   
  
//Service layer code

class EmployeeServiceV1 implements EmployeeService {   
 EmployeeDao dao = factory.getInstance();  
}



With spring how this dependency injection works

// Dao layer code  
class EmployeeDaoV1 implements EmployeeDao { }   
//Service layer code



class EmployeeServiceV1 implements EmployeeService {   
 EmployeeDao dao;  
 setDao(EmployeeDao dao) { this.dao = dao; } // spring supplies the DAO object  
}



Two important things in spring framework

1. Spring Container or IoC (Inversion of Control): It takes care of maintaining the beans(objects)
2. Dependency Injection: process of supplying an object to another object

Ex: Dao is supplied to Service, then service is supplied to controller

Spring framework modules: These are to add features to your application

1. Spring Context: It takes care of all the design patterns & DI
2. Spring Web: It is to create REST & Web based applications
3. Spring Data JPA: It is to interact with the database using ORM framework
4. Spring Boot: It is to automate the spring features in your application
5. Spring Cloud: It is to create microservices
6. Spring Security: It is to apply Authentication & Authorization features in the application

Maven project

Dependencies: spring-context, junit

How to get the object from the spring container

1. Using ApplicationContext context = new ClassPathXmlApplicationContext(“beans.xml”);

context.getBean(“b1”);

1. Using Dependency Injection

EmployeeDao: save, findById, findAll, remove methods

EmployeeDaoListImpl: Use List<Employee> to maintain employee

TestCases: To test all the 4 methods

Employee: id, name, salary with constructors, setters & getters

Day 4 Agenda

ORM Framework

Spring Boot & Annotation configurations

ORM (Object Relational Mapping):

It is a Java framework for the database which takes care of

* converting Java objects to SQL objects & vice versa
* establishing connections to the database based on the datasource information’s & closing them when not in use
* separates the application logic from the database configuration logic(url, username, password, driver-class)
* ORM users HQL/JPQL(database independent) instead of SQL queries (which are database dependent)
* ORM takes care of generating the SQL queries based on the database its connected to
* HQL/JPQL: Hibernate Query / Java Persistence Query language: They are the queries written for the java objects which are mapped to the table

How to create an object that maps to the table?

Entity class must be created which is a Java bean with setters, getters, constructors but maps to the database table

Table employee – id(int - primarykey), name(varchar), birthday(date), salary(double)

@Entity // convert java to sql & sql to java  
@Table(name = “employee”) // optional if table & class names are same  
class Employee {   
 @Column(name = “id”) // optional if column name is same as variable name  
 @Id // to determine primary key variable   
 int employeeId;  
 @Column(name = “name”) // optional because variable & column names are same.  
 String name;  
 @Column(name = “birthday”)  
 LocalDate dob; // maps to birthday column  
 double salary; // maps to salary column  
}

ORM – crud operations without using any queries

Spring with ORM framework

1. Spring-orm library – classes & interfaces to perform CRUD operations
2. Hibernate-core library - @Entity, @Table, @Id and so on
3. Spring-context library
4. Mysql-connector-j library – provides jdbc driver to interact with mysql database
5. XML file with – datasource information – username, password, url, driver-class name
6. HibernateTemplate – it is an object that provides save, delete, find methods, it uses the database connection created in the spring container

Note: HibernateTemplate object is created in spring-container, we must create <bean> for it

Steps to interact with the database

1. Create employee table
2. Add necessary libraries in the pom
3. Configure XML with DriverManagerDataSource, LocalSessionFactoryBean, HibernateTemplate, EmployeeDaoORMImpl
4. Create EmployeeDaoORMImpl that performs the CRUD operations via HibernateTemplate
5. Entity class - @Entity, @Table, @Id, @Column
6. Main method that acts like a Service layer and needs an object of the DAO

Hibernate Template has methods to perform CRUD operations

1. save(T t): saves the entity
2. get(ID, T): returns the entity based on the primary

Business layer / Service layer

It will have business logics which are run before or after accessing the DAO

1. adding one or more entities
2. transactions
3. calculating some results like applying tax on the total price
4. throwing the exceptions on some conditions

Service layer must have an interface that is used by the controller

1. Create a checked exception EmployeeNotFoundException
2. Create an interface EmployeeService that will have methods
   1. void createEmployees(Employee employee1, Employee… employee);
   2. Employee createEmployee(Employee employee);
   3. Employee findEmployee(int id) throws EmployeeNotFoundException
   4. void deleteEmployee(int id) throws EmployeeNotFoundException
   5. List<Employee> findEmployeesByName(String name);
   6. List<Employee> findEmployees();
3. Implement EmployeeService that depends on EmployeeDao

DDD: Domain Driven Design helps you to analyze the requirements and create models, tables, interfaces as per the business needs.

Note: You will not be creating the DAO layer implementation however you will create DAO layer interface in the Spring Boot because Spring Boot provides an auto-implementation for the DAO layer

As per the DDD we need to create following resources

1. Table & their relationship between other tables
2. Models – Java Beans / Entity classes
3. DAO interface – this will have CRUD methods
4. Service interface – this will have all the operations client wants to do

Table creation

1. Profile / User – profileId, name, emailId, password, dob, phone, wallet\_id\_ref, account\_ref
2. Wallet – wallet\_id, account\_number, wallet\_amount
3. Account – account\_number, amount
4. Contact – contact\_id, profile\_id\_ref , wallet\_id\_ref

Note: When Profile is registered, Account & Wallet entries should be created

Account table – account\_number(primary key), amount

Wallet table – wallet\_id(primary key), account\_number(foreign key), wallet\_amount

Profile table – profile\_id(primary key), name, email\_id, password, dob, phone, wallet\_id\_ref(foreign key), account\_ref(foreign key)

Contact – contact\_id(primary key), profile\_id\_ref(foreign key), wallet\_id\_ref(foreign key)