Working with Abstraction

Architecture, Refactoring and Enumerations

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#java-advanced

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Project Architecture

Splitting Code into Methods

- We use **methods** to split code into functional blocks
  - Improves code **readability**
  - Allows for easier **debugging**

```
for (char move : moves){
  for (int r = 0; r < room.length; r++)
    for (int c = 0; c < room[r].length; c++)
      if (room[row][col] == 'b')
        …
}
```

```
for (char move : moves) {
    moveEnemies();
    killerCheck();
    movePlayer(move);
 }
```

Splitting Code into Methods

- **Methods** let us easily **reuse** code
- We change the **method** once to affect **all calls**

```
BankAccount bankAcc = new BankAccount();
bankAcc.setId(1);
bankAcc.deposit(20);
System.out.printf("Account %d, balance %d",
                  bankAcc.getId(),bankAcc.getBalance());
bankAcc.withdraw(10);
…
System.out.println(bankAcc.toString());
```

Override `.toString()` to set a global printing format

Splitting Code into Methods

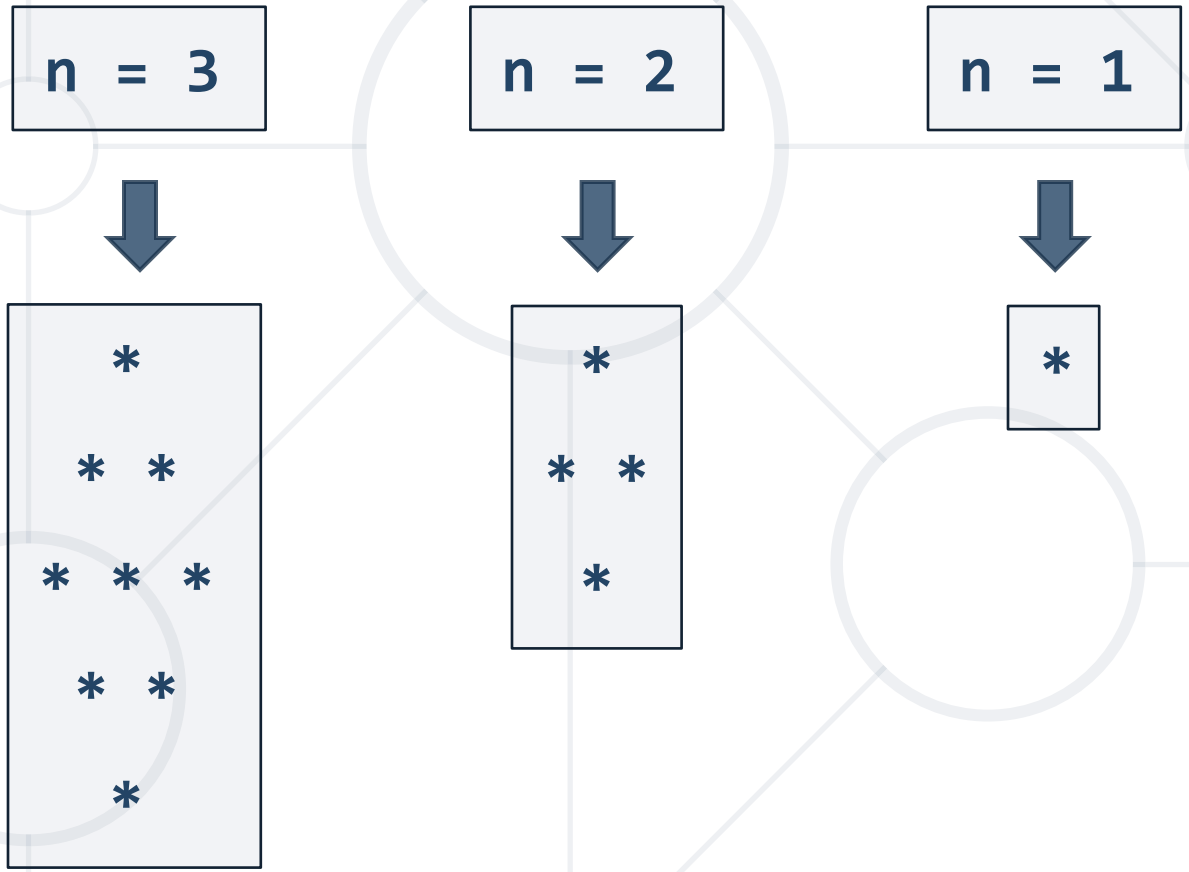
- A **single** method should complete a **single task**

```
void doMagic ( … )
void depositOrWithdraw ( … )
BigDecimal depositAndGetBalance ( … )
String parseDataAndReturnResult ( … )
```

```
void withdraw ( … )
void deposit ( … )
BigDecimal getBalance ( … )
string toString ( … )
```

Problem: Rhombus of Stars

- Draw on the console a rhombus of stars with size **n**



Check your solution here: https://judge.softuni.bg/Contests/1575/Working-with-Abstraction-Lab

Solution: Rhombus of Stars

```
int size = Integer.parseInt(sc.nextLine());
for (int starCount = 1; starCount <= size; starCount++) {
  printRow(size, starCount);
}
for (int starCount = size - 1; starCount >= 1; starCount--) {
  printRow(size, starCount);
}
```

Reusing code

Check your solution here: https://judge.softuni.bg/Contests/1575/Working-with-Abstraction-Lab

Solution: Rhombus of Stars

```
static void printRow(int figureSize, int starCount) {
  for (int i = 0; i < figureSize - starCount; i++)
    System.out.print(" ");
  for (int col = 1; col < starCount; col++) {
    System.out.print("* ");
  }
  System.out.println("*");
}
```

Check your solution here: https://judge.softuni.bg/Contests/1575/Working-with-Abstraction-Lab

Splitting Code into Classes

- Just like methods, **classes** should **not** know or do too much

```
GodMode master = new GodMode();
int[] numbers = master.parseAny(input);
...
int[] numbers2 = master.copyAny(numbers);
master.printToConsole(master.getDate());
master.printToConsole(numbers);
```

Splitting Code into Classes

- We can also break our code up logically into **classes**
  - Hiding implementation
  - Allow us to change the output destination
  - Helps us to avoid repeating code

Splitting Code into Classes

```
List<Integer> input = Arrays.stream(
      sc.nextLine().split(" "))
        .map(Integer::parseInt)
        .collect(Collectors.toList());
...
String result = input.stream()
                    .map(String::valueOf)
                    .collect(Collectors.joining(", "));
System.out.println(result);
```

```
ArrayParser parser = new ArrayParser();
OuputWriter printer = new OuputWriter();
int[] numbers = parser.integersParse(args);
int[] coordinates = parser.integerParse(args1);
printer.printToConsole(numbers);
```

Problem: Point in Rectangle

- Create a Point class holding the horizontal and vertical coordinates
- Create a **Rectangle class**
  - Holds 2 **points**
    - **Bottom left** and **top right**
- Add **Contains** method
  - Takes a **Point** as an argument
  - **Returns** it if it's inside the current object of the **Rectangle class**

Check your solution here: https://judge.softuni.bg/Contests/1575/Working-with-Abstraction-Lab

Solution: Point in Rectangle

```java
public class Point {
  private int x;
  private int y;
  //TODO: Add getters and setters
}
public class Rectangle {
  private Point bottomLeft;
  private Point topRight;
  //TODO: getters and setters
  public boolean contains(Point point) {
    //TODO: Implement
  }
}
```

Check your solution here: https://judge.softuni.bg/Contests/1575/Working-with-Abstraction-Lab

Solution: Point in Rectangle

```
public boolean contains(Point point)
{
  boolean isInHorizontal =
      this.bottomLeft.getX() <= point.getX() &&
      this.topRight.getX() >= point.getX();

  boolean isInVertical =
      this.bottomLeft.getY() <= point.getY() &&
      this.topRight.getY() >= point.getY();

  boolean isInRectangle = isInHorizontal &&
                          isInVertical;

  return isInRectangle;
}
```

Check your solution here: https://judge.softuni.bg/Contests/1575/Working-with-Abstraction-Lab

Refactoring

Refactoring

- **Restructures** code without changing the behaviour
- **Improves** code readability
- **Reduces** complexity

```
class ProblemSolver { public static void doMagic() { … } }
```

```
class CommandParser {
      public static <T> Function<T, T> parseCommand() { … } }
class DataModifier { public static <T> T execute() { … } }
class OutputFormatter { public static void print() { … } }
```

Refactoring Techniques

- **Breaking code** into reusable units
- **Extracting parts of methods** and **classes** into **new** ones

```
depositOrWithdraw()
```

```
deposit()
withdraw()
```

- **Improving names** of variables, methods, classes, etc.

```
String str;
```

```
String name;
```

- **Moving methods** or **fields** to more appropriate classes

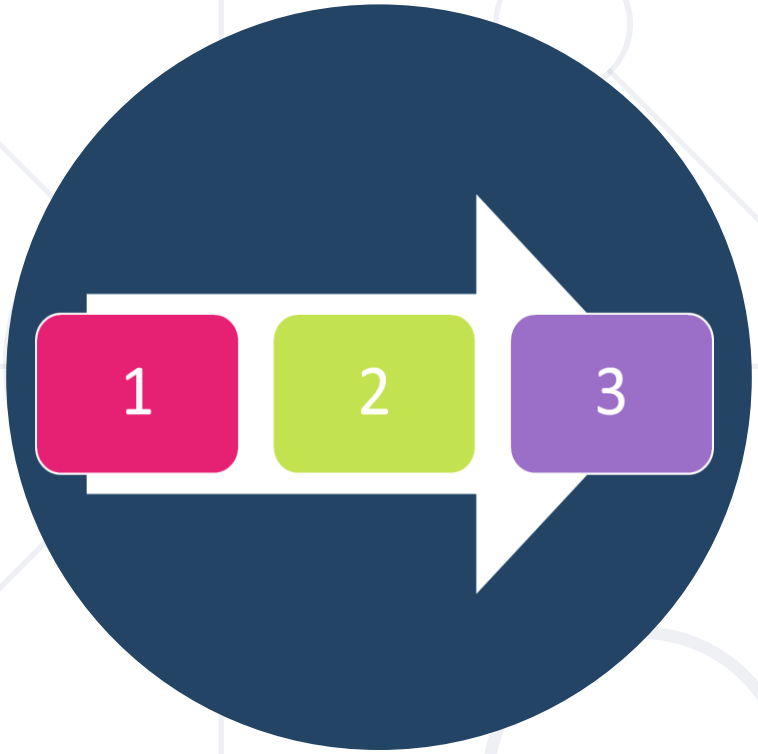
```
Car.open()
```

```
Door.open()
```

Problem: Student System

- You are given a **working** Student System project to refactor
- **Break it up** into smaller functional units and make sure it works
- It supports the following **commands**:
  - **"Create {studentName} {studentAge} {studentGrade}"**
    - creates a new student
  - **"Show {studentName}"**
    - prints information about a student
  - **"Exit"**
    - closes the program

Check your solution here: https://judge.softuni.bg/Contests/1575/Working-with-Abstraction-Lab



Enumerations

Enumerations

- Represent a numeric value from a fixed set as a text
- We can use them to pass **arguments** to **methods** without making code confusing

```
enum Day {MON, TUE, WED, THU, FRI, SAT, SUN}
```

```
getDailySchedule(0)
```

```
getDailySchedule(Day.MON)
```

- By default, **enums** start at 0
- Every next value is incremented by 1

Enumerations

- We can **customize** enum **values**

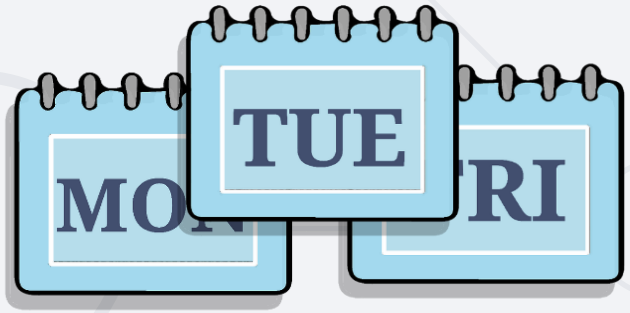
```
enum Day {

  MON(1),TUE(2),WED(3),THU(4),FRI(5),SAT(6),SUN(7);

  private int value;

  Day(int value) {
    this.value = value;
  }
}

System.out.println(Day.Sat); // SAT
```



Enumerations

- We can **customize** enum **values**

```
enum CoffeeSize {
  SMALL(100), NORMAL(150), DOUBLE(300);
  private int size;
  CoffeeSize(int size) {
    this.size = size;
  }
  public int getValue() { return this.size; }
}

System.out.println(CoffeeSize.SMALL.getValue()); // 100
```

Problem: Hotel Reservation

- Create a class PriceCalculator that calculates the total price of a holiday, by given **price per day**, **number of days**, **the season** and a **discount type**
- The discount type and season should be **enums**
- The price multipliers will be:
  - 1x for Autumn, 2x for Spring, etc.
- The discount types will be:
  - None – 0%
  - SecondVisit – 10%
  - VIP – 20%

Check your solution here: https://judge.softuni.bg/Contests/1575/Working-with-Abstraction-Lab

Solution: Hotel Reservation

```
public enum Season {
  SPRING(2), SUMMER(4), AUTUMN(1), WINTER(3);
  private int value;
  Season(int value) {
    this.value = value;
  }
  public int getValue() {
    return this.value;
  }
}
```

Check your solution here: https://judge.softuni.bg/Contests/1575/Working-with-Abstraction-Lab

Solution: Hotel Reservation

```
public enum Discount {
  NONE(0), SECOND_VISIT(10), VIP(20);
  private int value;
  Discount(int value) {
    this.value = value;
  }
  public int getValue() {
    return this.value;
  }
}
```

Check your solution here: https://judge.softuni.bg/Contests/1575/Working-with-Abstraction-Lab

Solution: Hotel Reservation

```
public class PriceCalculator {
  public static double calculatePrice(double pricePerDay,
            int numberOfDays, Season season, Discount discount) {
    int multiplier = season.getValue();
    double discountMultiplier = discount.getValue() / 100.0;
    double priceBeforeDiscount = numberOfDays * pricePerDay * multiplier;
    double discountedAmount = priceBeforeDiscount * discountMultiplier;
    return priceBeforeDiscount - discountedAmount;
  }
}
```

Check your solution here: https://judge.softuni.bg/Contests/1575/Working-with-Abstraction-Lab

Static Keyword in Java

Static Keyword

- Used for **memory management** mainly
- Can apply with:
  - Nested class
  - Variables
  - Methods
  - Blocks

```
static int count;
static void increaseCount() {
  count++;
}
```

- Belongs to the class than an instance of the class

Static Class

- A **top level** class is a class that is not a nested class
- A **nested** class is any class whose declaration occurs within the body of another class or interface
- Only nested classes can be **static**

```
class TopClass {
  static class NestedStaticClass {


  }
}
```

Static Variable

- Can be used to refer to the **common** variable of all objects
- Example
  - The company name of employees
  - College name of students
    - The name of the college is common for all students
- Allocate memory only once in the class area at the time of class loading

Example: Static Variable

```
class Counter {
  int count = 0;   static int staticCount = 0;
  public Counter() {
    count++;          // incrementing value
    staticCount++;  // incrementing value
  }
  public void printCounters() {
    System.out.printf("Count: %d%n", count);
    System.out.printf("Static Count: %d%n", staticCount);
  }
}
```

Example: Static Variable

```java
// Inside the Main Class
public static void main(String[] args) {
  Counter c1 = new Counter();
  c1.printCounters();
  Counter c2 = new Counter();
  c2.printCounters();
  Counter c3 = new Counter();
  c3.printCounters();
  int counter = Counter.staticCount; // 3
}
```

```
Count: 1
Static Count: 1
Count: 1
Static Count: 2
Count: 1
Static Count: 3
```

Static Method

- Belongs to the class rather than the object of a class
- Can be **invoked** without the need for creating an instance of a class
- Can **access** static data member and can **change** the value of it
- Can **not use non-static** data member or call a **non-static method** directly
- **`this`** and **`super`** cannot be used in a static context

Example: Static Method

```
class Calculate {
  static int cube(int x) { return x * x * x; }
  public static void main(String args[]) {
    int result = Calculate.cube(5);
    System.out.println(result);          // 125
    System.out.println(Math.pow(2, 3)); // 8.0
  }
}
```

Static Block

- A set of **statements**, which will be executed by the JVM before execution of the **`main`** method
- Executing **static block** is at the time of class loading
- A class can take any number of the static block but all blocks will be executed **from top to bottom**

Example: Static Block

```
class Main {
  static int n;
  public static void main(String[] args) {
    System.out.println("From main");
    System.out.println(n);
  }
  static {
    System.out.println("From static block");
    n = 10;
  }
}
```

```
From static block
From main
10
```

Packages

Packages in Java

- Used to group related classes
  - Like a folder in a file directory
- Use packages to avoid name conflicts and to write a better maintainable code
- Packages are divided into two categories:
  - **Built-in Packages** (packages from the **Java API**)
  - User-defined Packages (create own packages)

Build-In Packages

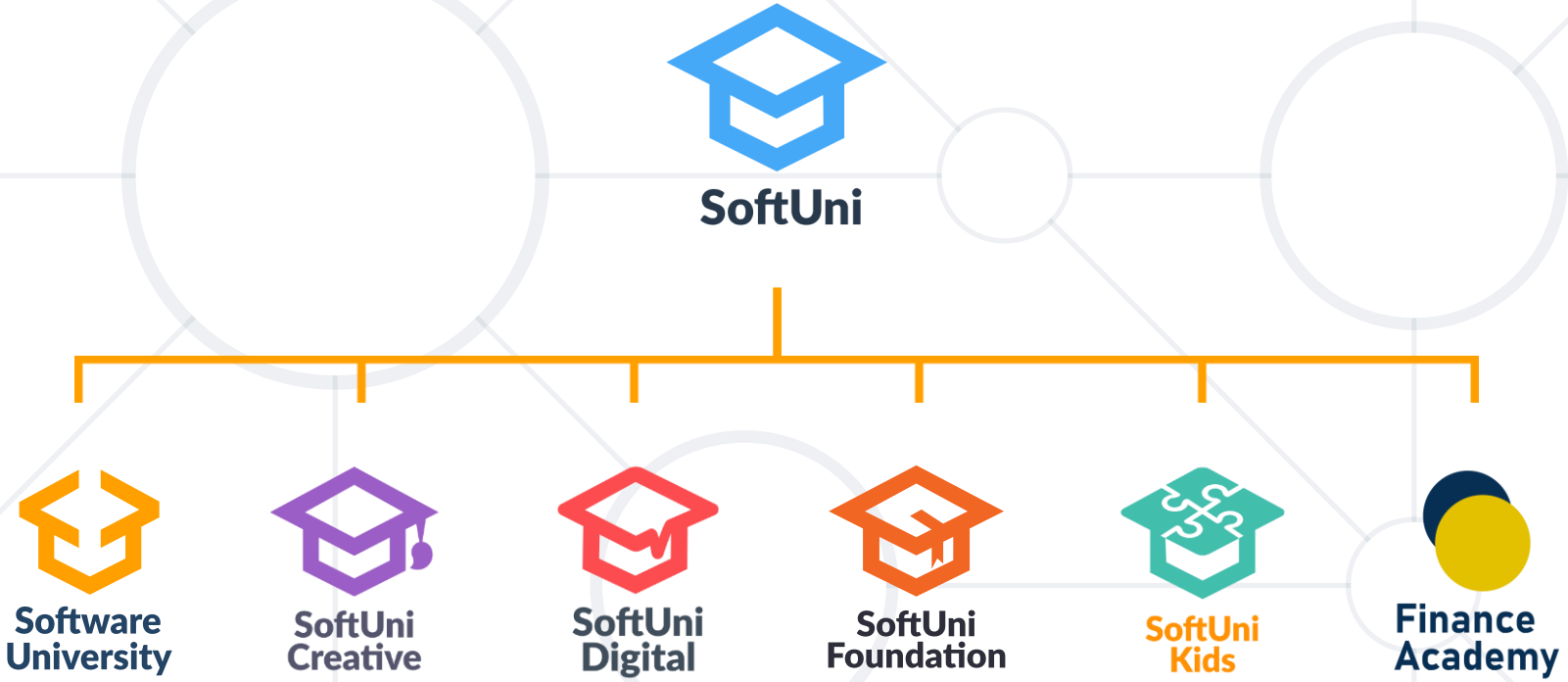
- The library is divided into packages and classes
- Import a single class or a whole package that contain all the classes
- To use a class or a package, use the import keyword
- The complete list can be found at Oracles website: https://docs.oracle.com/en/java/javase/

```
import package.name.Class; // Import a single class
import package.name.*;     // Import the whole package
```

Summary

- Well organized code is easier to work with
- We can reduce complexity using Methods, Classes and Projects
- We can refactor existing code by breaking code down
- Enumerations define a fixed set of constants
  - Represent numeric values
  - We can easily cast enums to numeric types
- Static members and Packages

Questions?



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