

# Command Design Pattern

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The the code in this tutorial is based on and modified from "Head First Design Pattern"

The UML diagram in this tutorial is referened from "Head First Design Pattern"

## Experimental Objective

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Learn how to refactor source code to command design pattern.

## 1. Introduce of source code

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### Requirement introduction :

We want to design a remote control to turn on or turn off of lights and air conditioners in different rooms. Here we provide the `Light` and `AirConditioner` class:

### How to use:

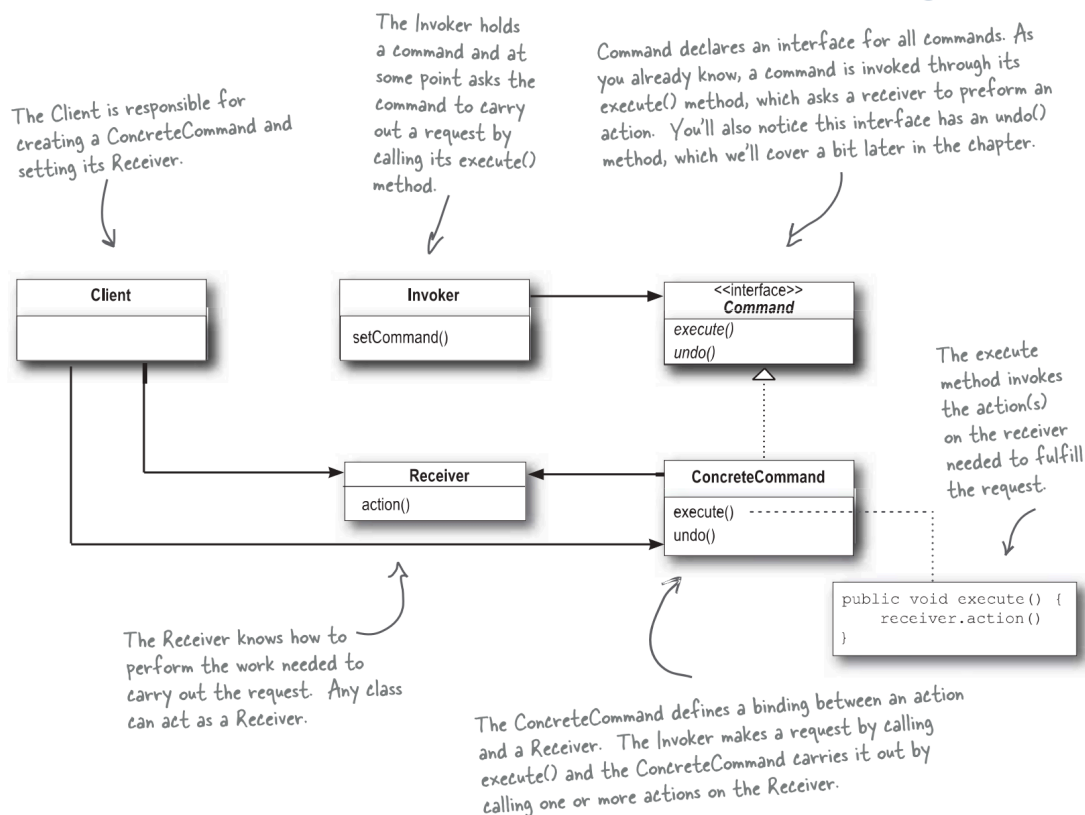
- Enter 1 to turn on the air conditioner in bedroom.
- Enter 2 to turn off the air conditioner in bedroom.
- Enter 3 to turn on the air conditioner in living room.
- Enter 4 to turn off the air conditioner in living room.
- Enter 5 to turn on the light in bedroom.
- Enter 6 to turn off the light in bedroom.
- Enter 7 to turn on the light in living room.
- Enter 8 to turn off the light in living room.
- Enter 9 to show the status of all rooms
- Enter 0 to shop the program

Please input operation number: 1-9,[1,3,5,7] is on command,[2,4,6,8] is off command, 9 is to show state terminate by 0:

```
1
bedRoom: Air Conditioner is On
2
bedRoom: Air Conditioner is Off
3
livingRoom: Air Conditioner is On
4
livingRoom: Air Conditioner is Off
5
bedRoom: Light is On
6
bedRoom: Light is Off
7
livingRoom: Light is On
8
livingRoom: Light is Off
9
bedRoom: Air Conditioner is Off
livingRoom: Air Conditioner is Off
bedRoom: Light is Off
livingRoom: Light is Off
```

## Command Design pattern

When we encapsulate the command into an object, the **sending** and **execution** of the command can be decoupled, and then we can perform more complex operations on the command. For example: queue, undo, delay, storage, logging, etc.



In original code, we only provide two command receiver class: `Light` and `AirConditioner`

## Task 1. Refactoring to Command Pattern

Our next step is to design a remote control that can separate commands creation from execution. For example: click 1-8 to create 8 different commands, click 9 to display the status, and click 10 to execute the command according to the first-in-first-out principle.

For example:

```
Please input operation number to add a command: 1-9,[1,3,5,7] is on command,
[2,4,6,8] is off command, 9 is to show state. 10 is to execute command.
terminate by 0:
1 3 5 7 2 4
10
bedRoom: Air Conditioner is On
10
livingRoom: Air Conditioner is On
10
bedRoom: Light is On
10
livingRoom: Light is On
10
bedRoom: Air Conditioner is Off
10
livingRoom: Air Conditioner is Off
0
```

The client would be:

```
public class Client_Task1 {
    public static void main(String[] args) {
        AirConditioner roomAirConditioner = new AirConditioner("bedRoom");
        AirConditioner livingAirConditioner = new AirConditioner("livingRoom");
        Light roomLight = new Light("bedRoom");
        Light livingLight = new Light("livingRoom");

        Command[] commands = new Command[8];
        commands[0] = new AirConditionerOnCommand(roomAirConditioner);
        commands[1] = new AirConditionerOffCommand(roomAirConditioner);
        commands[2] = new AirConditionerOnCommand(livingAirConditioner);
        commands[3] = new AirConditionerOffCommand(livingAirConditioner);
        commands[4] = new LightOnCommand(roomLight);
        commands[5] = new LightOnCommand(roomLight);
        commands[6] = new LightOnCommand(livingLight);
        commands[7] = new LightOnCommand(livingLight);

        RemoteCommandQueue remoteCommandQueue = new RemoteCommandQueue();
        Scanner input = new Scanner(System.in);
```

```

        System.out.println("Please input operation number to add a command: 1-
9," +
        "[1,3,5,7] is on command,[2,4,6,8] is off command, " +
        "9 is to show state. 10 is to execute command. terminate by
0:");
        int op = 0;
        do {
            try {
                op = input.nextInt();
                switch (op) {
                    case 1: case 2: case 3: case 4: case 5: case 6: case 7:
case 8:
                        remoteCommandQueue.buttonPressed(commands[op-1]);
                        break;
                    case 9:
                        showState(new AirConditioner[]{roomAirConditioner,
livingAirConditioner}
                                , new Light[]{roomLight, livingLight});
                        break;
                    case 10:
                        remoteCommandQueue.commandExecute();
                        break;
                }
            } catch (InputMismatchException e) {
                System.out.println("Exception:" + e);
                input.nextLine();
            }
        } while (op != 0);
        input.close();
    }

    public static void showState(AirConditioner[] airConditioners, Light[]
lights) {
        for (AirConditioner a : airConditioners) {
            System.out.println(a);
        }
        for (Light l : lights) {
            System.out.println(l);
        }
    }
}

```

## How to implement?

## Step1: design command:

Here we provide an interface named command :

```
public interface Command {  
    public void execute();  
}
```

Then we will design four concrete command class to implement the interface, including:

```
AirConditionerOnCommand  
AirConditionerOffCommand  
LightOnCommand  
LightOffCommand
```

AirConditionerOnCommand

```
public class AirConditionerOnCommand implements Command {  
    AirConditioner airConditioner;  
  
    public AirConditionerOnCommand(AirConditioner airConditioner) {  
        this.airConditioner = airConditioner;  
    }  
  
    @Override  
    public void execute() {  
        airConditioner.on();  
    }  
}
```

## Step2: design Invoker

create a Class named `RemoteCommandQueue` and complete the following methods:

```
public class RemoteCommandQueue {  
    Queue<Command> commands;  
  
    public RemoteCommandQueue() {  
        commands = new ArrayDeque<>();  
    }  
  
    /**  
     * only add command but not execute  
     * @param command  
     */  
    public void buttonPressed(Command command) {  
        //todo: complete  
    }  
}
```

```

    }

    /**
     * execute the command in the queue by first-in-first-out principle
     * if there is no command in the queue display "no command"
     */
    public void commandExecute() {
        // todo: complete
    }
}

```

## Task 2. Add undo command

After executing a command, we want to execute the undo command again, and the command just executed is considered invalid.

Add another operation 11, which means undo previous command:

For example:

```

Please input operation number to add a command: 1-9,[1,3,5,7] is on command,
[2,4,6,8] is off command, 9 is to show state. 10 is to execute command. 11 is
undo previous command. terminate by 0:
1 3 5
10
bedRoom: Air Conditioner is On
10
livingRoom: Air Conditioner is On
11
livingRoom: Air Conditioner is Off
9
bedRoom: Air Conditioner is On
livingRoom: Air Conditioner is Off
bedRoom: Light is Off
livingRoom: Light is Off

```

## How to implement?

### Step1: Modify Command interface

```

public interface Command {
    public void execute();
    public void undo();
}

```

- Modify those four concrete Command classes. Class `AirConditionerOnCommand` servers as

an example:

```
public class AirConditionerOnCommand implements Command {
    AirConditioner airConditioner;

    public AirConditionerOnCommand(AirConditioner airConditioner) {
        this.airConditioner = airConditioner;
    }

    @Override
    public void execute() {
        airConditioner.on();
    }

    @Override
    public void undo() {
        airConditioner.off();
    }
}
```

## Step2: Modify Invoker class

```
public class RemoteCommandQueue {
    Queue<Command> commands;
    Command undoCommand;//record the previous command

    public RemoteCommandQueue() {
        commands = new ArrayDeque<>();
    }

    /**
     * only add command but not execute
     *
     * @param command
     */
    public void buttonPressed(Command command) {

    }

    /**
     * execute the command in the queue by first-in-first-out principle
     * if there is no command in the queue display "no command"
     */
    public void commandExecute() {

    }
}
```

```
/**
 * undo the previous command
 */
public void commandUndo() {

}
}
```

### Step 3: Modify Client Class

Add 11 operation number to undo the command just executed.