Low Level Design (LLD) :-

⇒ Breaking down or designing the real logic into extensible, testable, readable code.

SOLID PRINCIPLES :-

↳ Single Responsibility Principle (SRP) :-

⇒ A class should only have one responsibility

OR

A class should have only one reason to change.

Example :-

Task Manager :-

① Manages tasks ② Sends Notifications

③ Logs notification events.

PROBLEM ??

⇒ Let's say the logging logic or notification logic changes, in that case we would have to change the task manager class. Which is a bad design.

* Solution :-

Break the class into 3 different components

TaskService NotificationService LoggingService

* SOLID :-

↳ Open/Close Principle (OCP)

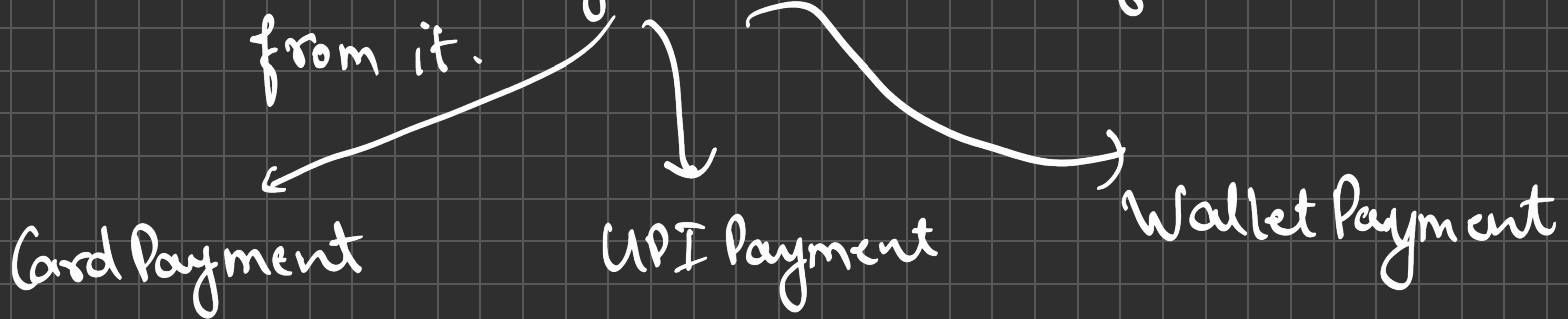
⇒ A class should be open for extension but closed for modification.

Example :- Payment Service :-

```
class PaymentService {
    void pay(String type) {
        if(type.equals("UPI")) { .... }
        else if(type.equals("Card")) { ... }
    }
}
```

*PROBLEM?? ⇒ On adding a new type the OCP is violated.

*Solution :- Create PaymentMethod interface & extend from it.



*Why? Adding new types doesn't affect the previous types code. Less Bugs, Modular.

* SOLID :-

↳ Liskov Substitution Principle (LSP)

⇒ Subtypes must be suitable for their base type.

```
class Rectangle {
    void setWidth(w);
    void setHeight(w);
}

class Square extends Rectangle {
    void setWidth(int w) {
        setHeight(w);
    }
    void setHeight(int w) {
        setWidth(w);
    }
}

public void resize(Rectangle r) {
    r.setWidth(5);
    r.setHeight(10);
    print(r.area());
}
```

Output:- For rectangle → 50

For square → 100 (X)

⇒ Solution :- Keep Rectangle And Square Separately.

* SOLID :-

↳ Interface Segregation Principle (ISP)

⇒ Clients should not be forced to depend on interfaces that they do not use.

Example :-

```
interface MediaPlayer{
    void playVideo();
    void playAudio();
}
```

```
class AudioPlayer implements VideoPlayer{
    void playVideo(){
    }
    void playAudio(){
        ----
        ----
    }
}
```

Problem :- Bad design as we would either make playVideo in the above example as empty or throw an exception.

Solution :- Create 2 separate interfaces

```
interface AudioPlayer{
    void play();
}
```

```
interface VideoPlayer{
    void play();
}
```

* SOLID

↳ Dependency Inversion Principle (DIP)

⇒ High level modules should not depend on low level modules. Both should depend on abstractions (like interfaces)

* Example :-

```
class UserService {
    FileLogger logger = new FileLogger();
    void createUser() {
        logger.log("user created");
    }
}
```

Problem :- If you want to test the class & test the logger it would be difficult to do.

Also changing logger to something like database logger would require code changes in UserService.

* Solution :-

```
interface Logger {
    void log(String message);
}

class FileLogger implements Logger { ... }

class DBLogger implements Logger { ... }

class UserService {
    Logger logger;
    UserService(Logger logger) {
        this.logger = logger;
    }
    void createUser() {
        logger.log("user created");
    }
}
```