KB금융그룹 | 국민의 평생 금융파트너

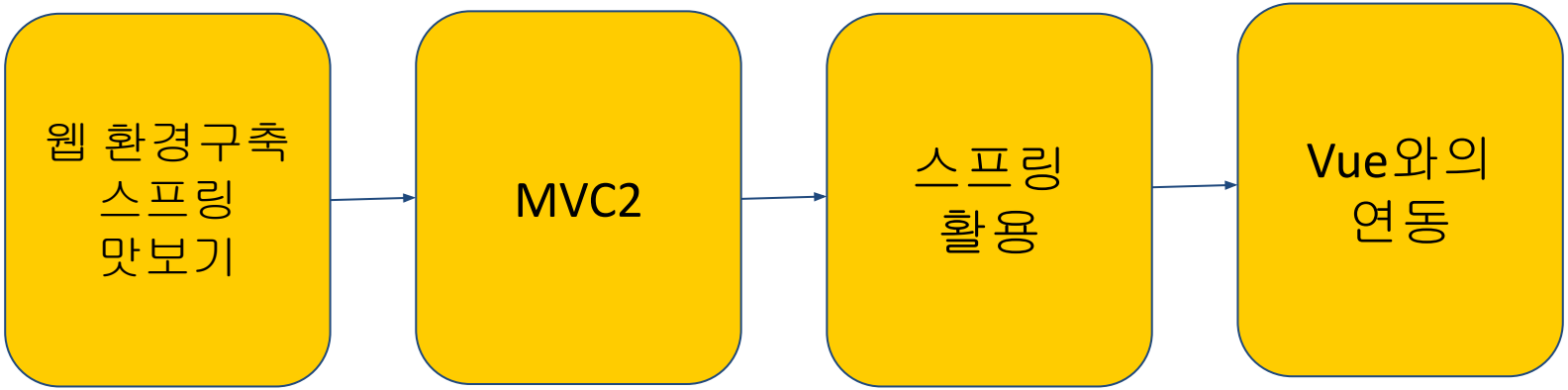
2024년 상반기 K-디지털 트레이닝

SPRING05 - AOP

[KB] IT's Your Life

KB 국민은행

커리큘럼



오늘의 목표


```
2024-08-10 12:43:09 - GET "/a3.do", parameters={}
2024-08-10 12:43:09 - Mapped to com.multi.spring2.aop.controller.AOPController#aop3()
 anotherTask>> 499500 >> ==================
ASiteService.anotherTask() called 1 times, average execution time: 1020ms
 performTask>> 499500 >> ==================
void com.multi.spring2.aop.service.ASiteService.performTask() executed in 2013ms
 anotherTask>> 499500 >> ==================
ASiteService.anotherTask() called 2 times, average execution time: 1013ms
 performTask>> 499500 >> ==================
void com.multi.spring2.aop.service.ASiteService.performTask() executed in 2011ms
```

AOP

AOP

- **관점 지향형 프로그래밍 (AOP: Aspect-Oriented Programming)**
  - AOP는 프로그램에서 핵심 기능과 공통 기능을 분리하여 관리할 수 있게 하는 프로그래밍
  - 특정 페이지에서 구현되어야 하는 핵심 기능과 여러 페이지에서 공통으로 나타나는 기능을 분리
  - 공통적으로 사용되는 기능은 하나의 클래스 파일로 모아두었다가, 실행 시 필요한 곳에 끼워 넣는 방식을 사용

AOP

- 공통 관점과 핵심 관점을 나누어 프로그래밍
  - 프로그램을 핵심 기능(핵심 관점)과 공통 기능(공통 관점)으로 나누어 작성
- 공통 관점에 해당하는 기능을 묶어 별도의 클래스로 만든다
  - 공통 기능에 해당하는 부분들을 별도의 클래스에 모아둔다.
- 핵심 관점을 가진 클래스를 만든다
  - 핵심 기능을 담당하는 클래스를 별도로 작성
- 실행 시 핵심 관점 사이에 공통 관점을 끼워 넣는다
  - 실행 시 필요한 곳에 공통 기능을 삽입

AOP

A사이트 B사이트 C사이트(

로그인 물건검색 로그인
개인정보보기 장바구니 주문정보보기
로그아웃 로그인 확인
주문 로그아웃
로그아웃

C사이트 : Order interface
COrder.java - 주문정보보기(orderView())
확인(confirm())
빈 이름: order

==========

B사이트 : Product interface
BProduct.java - String물건검색(search())
장바구니(basket())
주문(orderProduct())

1. 로그인, 로그아웃을 조립!
2. 장바구니에 error=>aop로 에러처리!
3. 물건검색 retrun이 있는 aop메시지 호출!

AOP

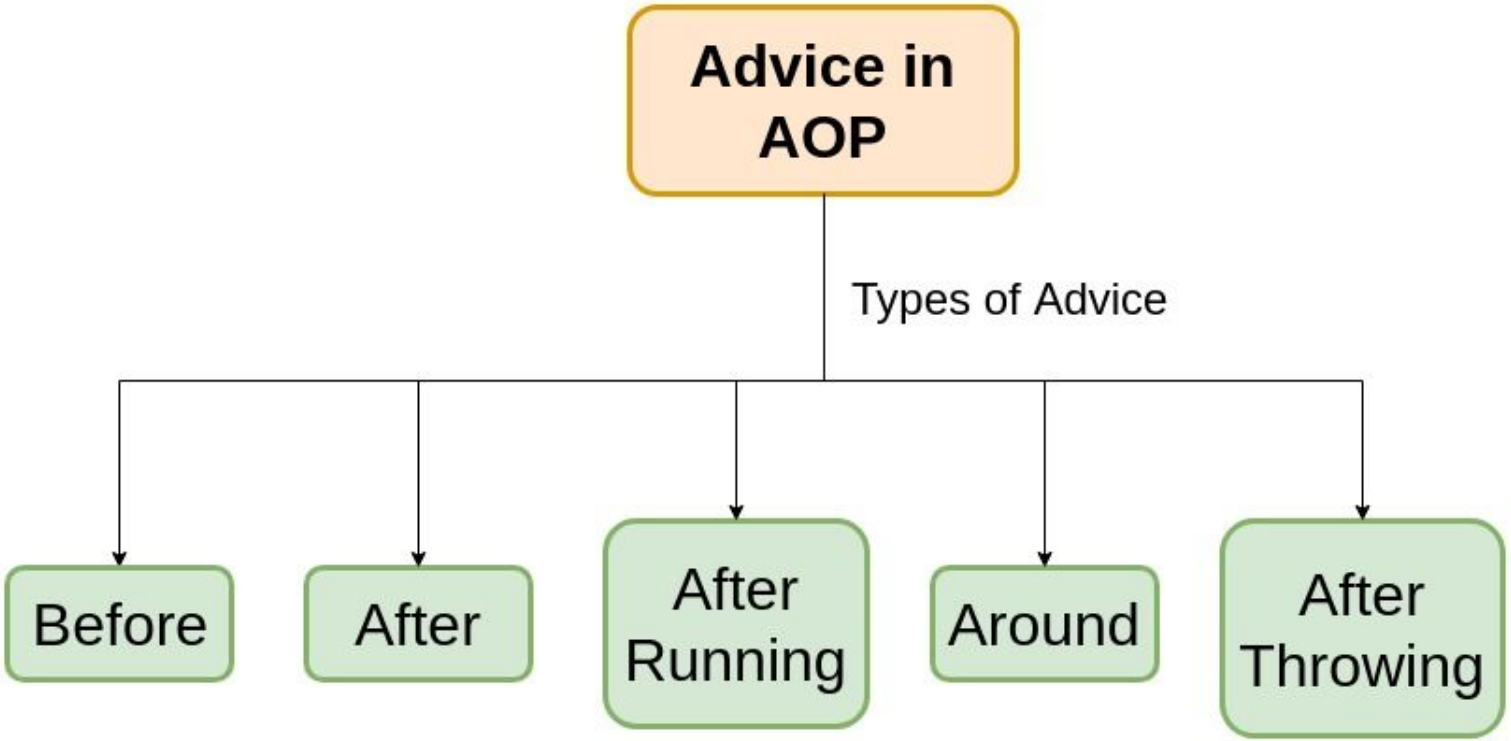
- **OOP vs. AOP**: 객체 지향형 프로그래밍(OOP)과 관점 지향형 프로그래밍(AOP)의 비교
- **OOP(객체 지향형 프로그래밍)**:
  - 클래스 기반으로 프로그램을 구성
- **AOP(관점 지향형 프로그래밍)**:
  - 메서드 기반으로 프로그램을 구성
  - 핵심적인 관점과 부가적인 관점으로 구분하여 프로그래밍
- **Aspect(관점)**:
  - **핵심적인 기능**: 그 페이지에 핵심적인 기능
  - **부가적인 기능**: 핵심적인 기능 중간에 삽입되는 기능 (횡단 관심사)
- **부가적인 기능을 가진 클래스**:
  - **관점 클래스**
  - 예: 로그인/로그아웃

Spring AOP에서 프록시 동작 방식

- **프록시 생성**: Spring은 `@Aspect`로 정의된 클래스를 바탕으로 프록시 객체를 생성
  - 이 프록시 객체는 타깃 객체의 메서드를 호출하기 전에 애드바이스를 적용
- **프록시 종류**:
  - **JDK 동적 프록시**: 인터페이스를 기반으로 프록시를 생성
    a. 타깃 객체가 인터페이스를 구현한 경우 Spring은 기본적으로 JDK 동적 프록시를 사용
  - **CGLIB 프록시**: 타깃 객체가 인터페이스를 구현하지 않은 경우, CGLIB(Code Generation Library)를 사용하여 프록시 객체를 생성
    a. CGLIB는 타깃 클래스의 서브클래스를 생성하고 메서드를 오버라이드하여 애드바이스를 적용
- **프록시 실행**: 클라이언트가 타깃 객체의 메서드를 호출하면, 사실상 프록시 객체의 메서드가 호출
  - 프록시 객체는 요청을 가로채고, 정의된 애드바이스(예: `@Before`, `@After`, `@Around`)를 실행한 후, 실제 타깃 객체의 메서드를 호출
- **애드바이스 적용**: 프록시는 메서드 호출 전후에 애드바이스를 적용하거나, 메서드 실행을 제어
  - 이를 통해 애플리케이션의 핵심 로직에 영향을 주지 않고 횡단 관심사를 쉽게 추가할 수

스프링 안에서의 AOP활용

- 트랜잭션 관리
- 보안 검사
- 성능 모니터링 등 다양한 기능을 **AOP**를 통해 구현


Advice in AOP
Types of Advice
Before
After
After Running
Around
After Throwing

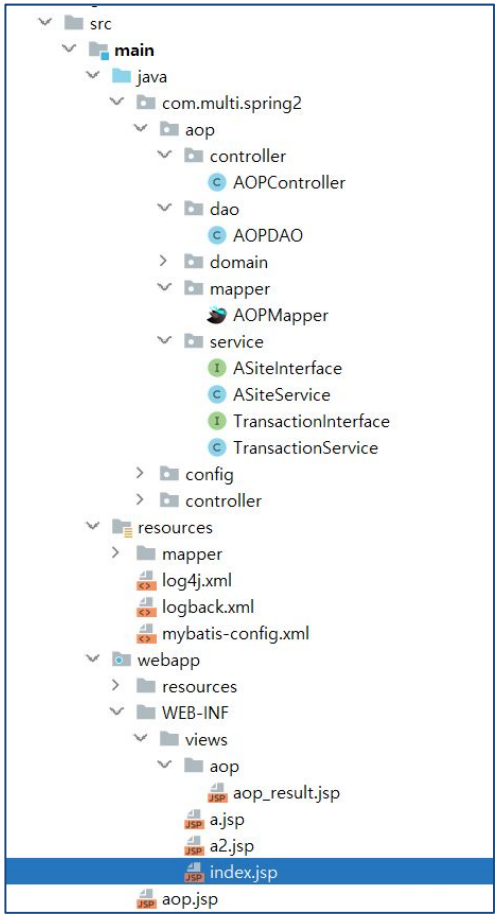
AOP

- Advice in AOP
  - AOP에서의 'Advice'는 특정 메소드가 호출될 때 실행되는 부가적인 행동을 정의하는 것을 의미
- **Before**: 대상 메소드가 실행되기 전에 실행되는 Advice
  - 예를 들어, 메소드 호출 전에 로깅을 하거나 유효성 검사를 할 때 사용
- **After**: 대상 메소드가 정상적으로 실행된 후에 실행되는 Advice
  - 메소드가 완료된 후 리소스를 정리하거나 로깅을 할 때 유용
- **After Running**: 메소드가 실행된 후, 정상적으로 종료되었을 때 실행되는 Advice
  - 메소드의 결과를 바탕으로 추가적인 작업을 수행할 때 사용
- **Around**: 메소드 실행 전과 후에 모두 실행되는 Advice
  - 메소드 실행 자체를 제어할 수 있으며, 메소드 실행 전후에 필요한 로직을 삽입할 수 있음.
- **After Throwing**: 메소드 실행 중 예외가 발생했을 때 실행되는 Advice
  - 예외 처리 로직을 통합 관리하기 위해 사용

AOP 주요 용어

- **관점(Aspect)**: 교차 관심사를 모듈화한 코드 블록으로, 여러 핵심 비즈니스 로직에 통합될 수 있음.
  - 예를 들어 보안 검증 로직은 여러 서비스에 걸쳐 존재하는 공통 로직이므로, 이를 하나의 관점으로 관리
- **조언(Advice)**: 특정 시점에 수행할 작업을 정의한 코드입니다. 조언은 주로 메서드 실행 전후, 예외 발생 시점 등에 적용
- **조인포인트(Join Point)**: 조언이 적용될 수 있는 프로그램 실행의 특정 지점.
  - 메서드 호출, 객체 생성 등 다양한 프로그램 실행 시점
- **포인트컷(Pointcut)**: AOP에서 조인포인트의 하위 집합을 지정하는 방식
  - 포인트컷에 따라 어느 부분에 조언이 적용될지 결정
- **위빙(Weaving)**: 실제 코드에 관점을 삽입하는 과정
  - 컴파일 타임, 로드 타임, 또는 런타임 중 발생할 수 있음. Spring AOP는 런타임만 지원

AOP(실습 파일 다운로드)




```
<body>
<h1></h1>
<br/>
<table>
 <tbody>
 <tr>
   <td style="background: lemonchiffon; text-align: center">
     <a href="aop.jsp">
       <button>aop.jsp</button>
     </a>
   </td>

   <td style="background: lemonchiffon; text-align: center">
     <a href="a.do">
       <button>a.do</button>
     </a>
   </td>

   <td style="background: lemonchiffon; text-align: center">
     <a href="a2.do">
     <button>a2.do</button>
   </a>
</td>

 </tr>
 </tbody>
</table>
</body>
```

AOP

```
// 스프링
implementation 'org.springframework:spring-core:5.3.37'
implementation "org.springframework:spring-context:5.3.37"
implementation "org.springframework:spring-webmvc:5.3.37"
implementation 'javax.inject:javax.inject:1'
implementation 'org.springframework:spring-web:5.3.37'
implementation 'org.springframework:spring-jdbc:5.3.37'
implementation 'com.fasterxml.jackson.core:jackson-databind:2.15.2' // Jackson 라이브러리 추가
implementation 'com.googlecode.json-simple:json-simple:1.1.1'

// AOP
implementation 'org.springframework:spring-context-support:5.3.37'
implementation 'org.aspectj:aspectjrt:1.9.20'
implementation 'org.aspectj:aspectjweaver:1.9.20'
implementation 'org.springframework:spring-tx:5.3.37'

// JSP, SERVLET, JSTL
implementation('javax.servlet:javax.servlet-api:4.0.1')
compileOnly 'javax.servlet.jsp:jsp-api:2.1'
implementation 'javax.servlet:jstl:1.2'
```

AOP

```
@Configuration
@EnableAspectJAutoProxy(proxyTargetClass = true)
public class AOPConfig {

    public AOPConfig(){
        System.out.println("AppConfig created");
    }

    @Bean
    public AspectClass2 aspect() {
        return new AspectClass2();
    }

    @Aspect
    public static class AspectClass2 {

        @Pointcut("execution(* com.multi.spring2.aop.controller.AOPController.aop1*(..))")
        public void tour() {
            // Pointcut method, no implementation needed
        }

        @Before("tour()")
        public void Login() {
            System.out.println("Login aspect triggered");
        }

        @After("tour()")
        public void Logout() {
            System.out.println("Logout aspect triggered");
        }
    }}
```

AOP

```java
@Configuration
@EnableAspectJAutoProxy(proxyTargetClass = true)
public class AOPConfig2 {

    public AOPConfig2(){
        System.out.println("AppConfig2 created");
    }

    @Bean
    public AspectClass2 aspect() {
        return new AspectClass2();
    }

    @Aspect
    public static class AspectClass2 {

        @Pointcut("execution(* com.multi.spring2.aop.controller.AOPController.aop2*(..))")
        public void order() {
        }

        @Before("order()")
        public void Login() {
            System.out.println("Login aspect triggered");
        }

        @After("order()")
        public void Logout() {
            System.out.println("Logout aspect triggered");
        }
    }
}
```

AOP

```java
public class WebAppInitializer extends AbstractAnnotationConfigDispatcherServletInitializer {

    public WebAppInitializer(){
        System.out.println("WebAppInitializer created");
    }

    @Override
    protected Class<?>[] getRootConfigClasses() {
        return new Class[] {
                AppConfig.class,
                AOPConfig.class,
                AOPConfig2.class
        };
    }

    @Override
    protected Class<?>[] getServletConfigClasses() {
        return new Class[] { WebConfig.class };
    }

    @Override
    protected String[] getServletMappings() {
        return new String[] { "/" };
    }

    @Override
    protected Filter[] getServletFilters() {
        CharacterEncodingFilter characterEncodingFilter = new CharacterEncodingFilter();
        characterEncodingFilter.setEncoding("UTF-8");
        characterEncodingFilter.setForceEncoding(true);
        return new Filter[] { characterEncodingFilter };
    }
}
```

AOP

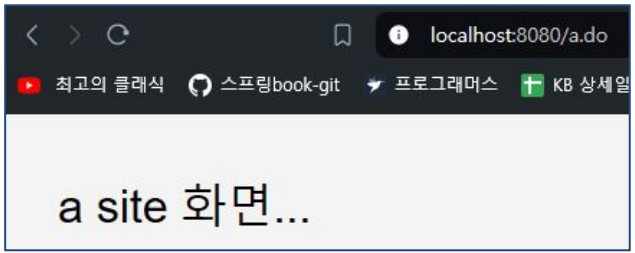
```
@Controller
public class AOPController {

    ASiteInterface aSiteService;
    TransactionInterface aopService;


    @Autowired
    public AOPController(ASiteInterface aSiteService, TransactionService aopService) {
        this.aSiteService = aSiteService;
        this.aopService = aopService;
    }

    @RequestMapping("a.do")
    public void aop1() {
        aSiteService.tour();
    }
}
```

AOP

```java
public interface ASiteInterface {
    public void tour();
}
```

```java
@Component
public class ASiteService implements
ASiteInterface {
    public void tour() {
        System.out.println("view personal
info");
    }
}
```

```jsp
<%@ page contentType="text/html;charset=UTF-8"
language="java" %>
<html>
<head>
    <title>Title</title>
    <link rel="stylesheet"
href="../resources/css/out2.css">
</head>
<body>
a site 화면...
</body>
</html>
```



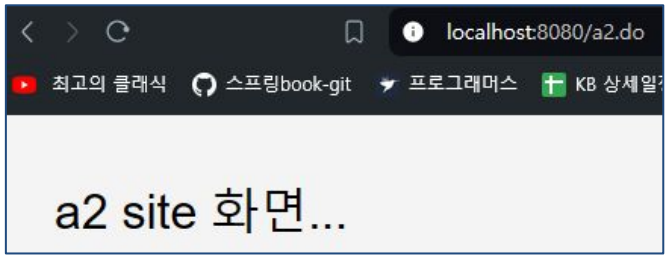

```
Login aspect triggered
view personal info
Logout aspect triggered
```

AOP

```java
public interface ASiteInterface {
    public void tour();
    public void order();
}
```

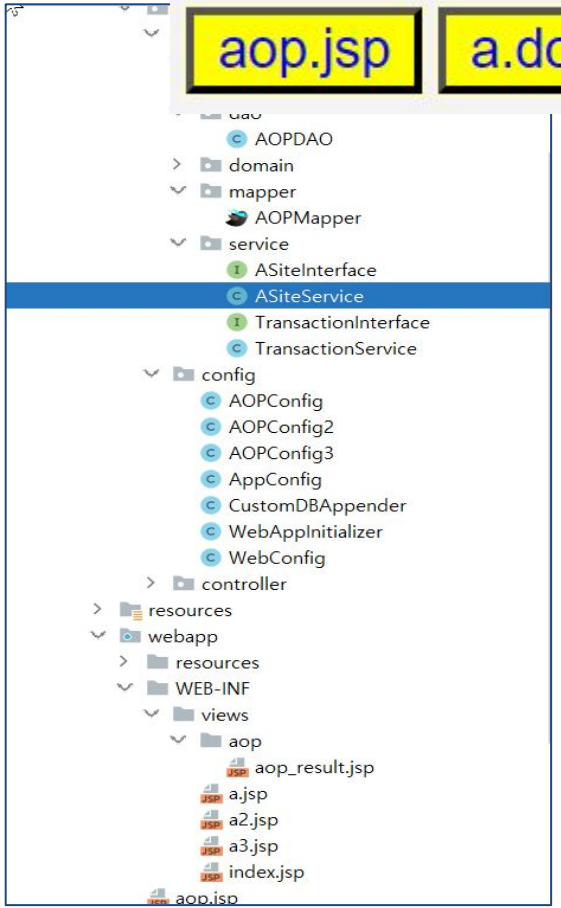
```java
@Component
public class ASiteService implements ASiteInterface {
    public void tour() {
        System.out.println("view personal info
-------");
    }

    @Override
    public void order() {
        System.out.println("order product ------ ");
    }
}
```

```jsp
<%@ page contentType="text/html;charset=UTF-8"
language="java" %>
<html>
<head>
    <title>Title</title>
    <link rel="stylesheet"
href="../resources/css/out2.css">
</head>
<body>
a2 site 화면...
</body>
</html>
```




```
Login aspect triggered
order product ------
Logout aspect triggered
```

AOP



aop.jsp | a.do(ASite) | a2.do(BSite) | a3.do(Performance)

```
<tr>
  <td style="background: lemonchiffon; text-align: center">
    <a href="aop.jsp">
      <button>aop.jsp</button>
    </a>
  </td>

  <td style="background: lemonchiffon; text-align: center">
    <a href="a.do">
      <button>a.do(ASite)</button>
    </a>
  </td>

  <td style="background: lemonchiffon; text-align: center">
    <a href="a2.do">
      <button>a2.do(BSite)</button>
    </a>
  </td>

  <td style="background: lemonchiffon; text-align: center">
    <a href="a3.do">
      <button>a3.do(Performance)</button>
    </a>
  </td>
 </tr>
 </tbody>
</table>
```

AOP

```java
@Configuration
@EnableAspectJAutoProxy (proxyTargetClass =  true)
public class AOPConfig3 {

    public AOPConfig3(){
        System. out.println( "AppConfig3 created");
    }

    @Bean
    public AOPConfig3.AspectClass3 aspect() {
        return new AOPConfig3.AspectClass3();
    }


    @Aspect
    public static class AspectClass3 {

        private Map<String, Long>  methodExecutionCount = new HashMap<>();
        private Map<String, Long>  methodExecutionTime = new HashMap<>();

        @Around ("execution(* com.multi.spring2.aop.service.ASiteService.ano*(..))")
        public Object recordExecutionStats(ProceedingJoinPoint joinPoint)    throws Throwable {
            String methodName = joinPoint.getSignature().toShortString();

            long start = System. currentTimeMillis();
            Object proceed = joinPoint.proceed();
            long executionTime = System. currentTimeMillis() - start;

            methodExecutionCount.put(methodName,  methodExecutionCount.getOrDefault(methodName,  0L) + 1);
            methodExecutionTime.put(methodName,  methodExecutionTime.getOrDefault(methodName,  0L) + executionTime);

            long count =  methodExecutionCount.get(methodName);
            long totalTime =  methodExecutionTime.get(methodName);
            long averageTime = totalTime / count;

            System. out.println(methodName +  " called " + count +  " times, average execution time: " + averageTime +  "ms");

            return proceed;
        }
```

```java
        @Around("execution(*
com.multi.spring2.aop.service.ASiteService.per*(..))")
        public Object logExecutionTime(ProceedingJoinPoint joinPoint)
throws Throwable {
            long start = System.currentTimeMillis();

            Object proceed = joinPoint.proceed();

            long executionTime = System.currentTimeMillis() - start;
            System.out.println(joinPoint.getSignature() + " executed in "
+ executionTime + "ms");

            return proceed;
        }
    }
}
```

```java
public class WebAppInitializer extends AbstractAnnotationConfigDispatcherServletInitializer {

    public WebAppInitializer(){
        System.out.println("WebAppInitializer created");
    }

    @Override
    protected Class<?>[] getRootConfigClasses() {
        return new Class[] {
                AppConfig.class,
                AOPConfig.class,
                AOPConfig2.class,
                AOPConfig3.class,
        };
    }

    @Override
    protected Class<?>[] getServletConfigClasses() {
        return new Class[] { WebConfig.class };
    }

    @Override
    protected String[] getServletMappings() {
        return new String[] { "/" };
    }

    @Override
    protected Filter[] getServletFilters() {
        CharacterEncodingFilter characterEncodingFilter = new CharacterEncodingFilter();
        characterEncodingFilter.setEncoding("UTF-8");
        characterEncodingFilter.setForceEncoding(true);
        return new Filter[] { characterEncodingFilter };
    }
}
```

AOP

```
@Controller
public class AOPController {

    ASiteInterface aSiteService;
    TransactionInterface aopService;


    @Autowired
    public AOPController(ASiteInterface aSiteService, TransactionService aopService) {
        this.aSiteService = aSiteService;
        this.aopService = aopService;
    }

@RequestMapping ("a3.do")
public void aop3() {
    aSiteService.anotherTask();
    aSiteService.performTask();
    aSiteService.anotherTask();
    aSiteService.performTask();
}

}
```

AOP

```java
public interface ASiteInterface {
    public void tour();
    public void order();
    public void performTask();
    public void anotherTask();
}
```

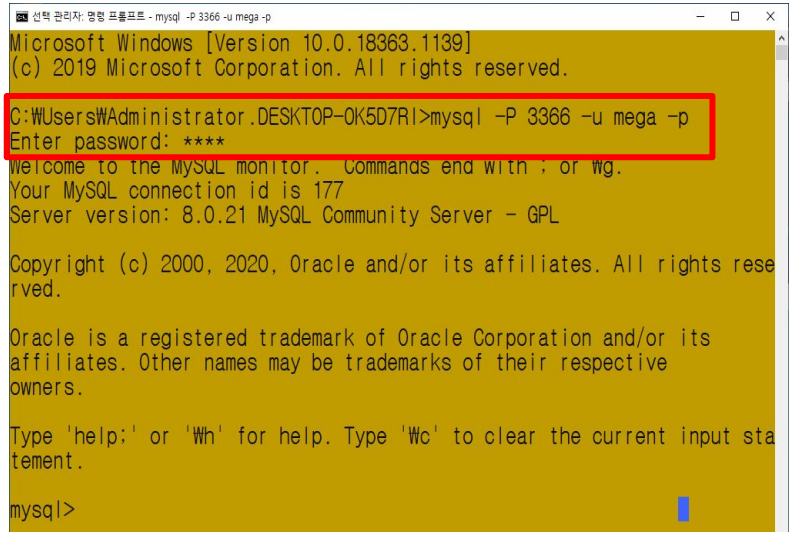
```java
@Override
public void performTask() {
    // 실제 비즈니스 로직이 여기에 위치합니다.
    int sum = 0;
    for (int i = 0; i < 1000; i++) {
        sum += i;
    }
    System.out.println(" performTask>> " + sum + " >> ==================");
    try {
        Thread.sleep(2000); // 2초간 대기
    } catch (InterruptedException e) {
        e.printStackTrace();
    }
}

@Override
public void anotherTask() {
    // 실제 비즈니스 로직이 여기에 위치합니다.
    int sum = 0;
    for (int i = 0; i < 1000; i++) {
        sum += i;
    }
    System.out.println(" anotherTask>> " + sum + " >> ==================");
    try {
        Thread.sleep(1000); // 1초간 대기
    } catch (InterruptedException e) {
        e.printStackTrace();
    }
}
```

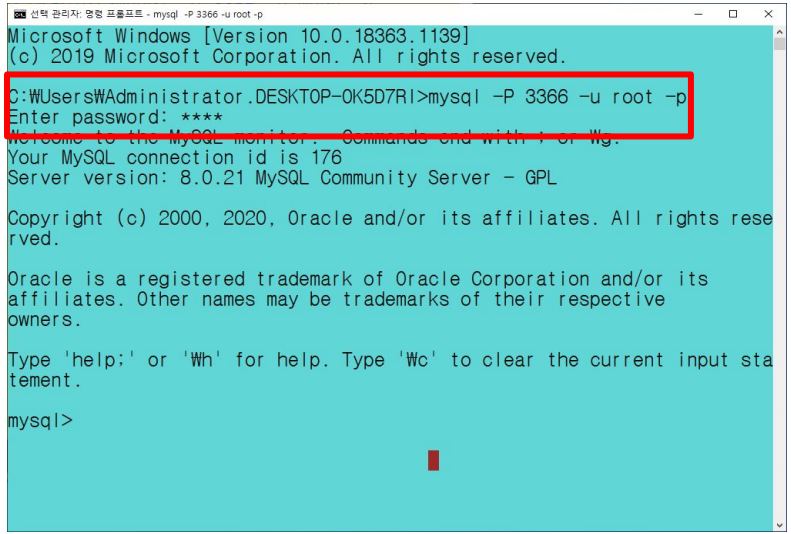
```jsp
<%@ page contentType="text/html;charset=UTF-8"
language="java" %>
<html>
<head>
    <title>Title</title>
    <link rel="stylesheet"
href="../resources/css/out2.css">
</head>
<body>
a3 site 화면...
</body>
</html>
```

```
ASiteService.anotherTask() called 1 times, average execution time: 1008ms
 performTask>> 499500 >> ==================
void com.multi.spring2.aop.service.ASiteService.performTask() executed in 2012ms
 anotherTask>> 499500 >> ==================
ASiteService.anotherTask() called 2 times, average execution time: 1005ms
 performTask>> 499500 >> ==================
void com.multi.spring2.aop.service.ASiteService.performTask() executed in 2015ms
```

Transaction

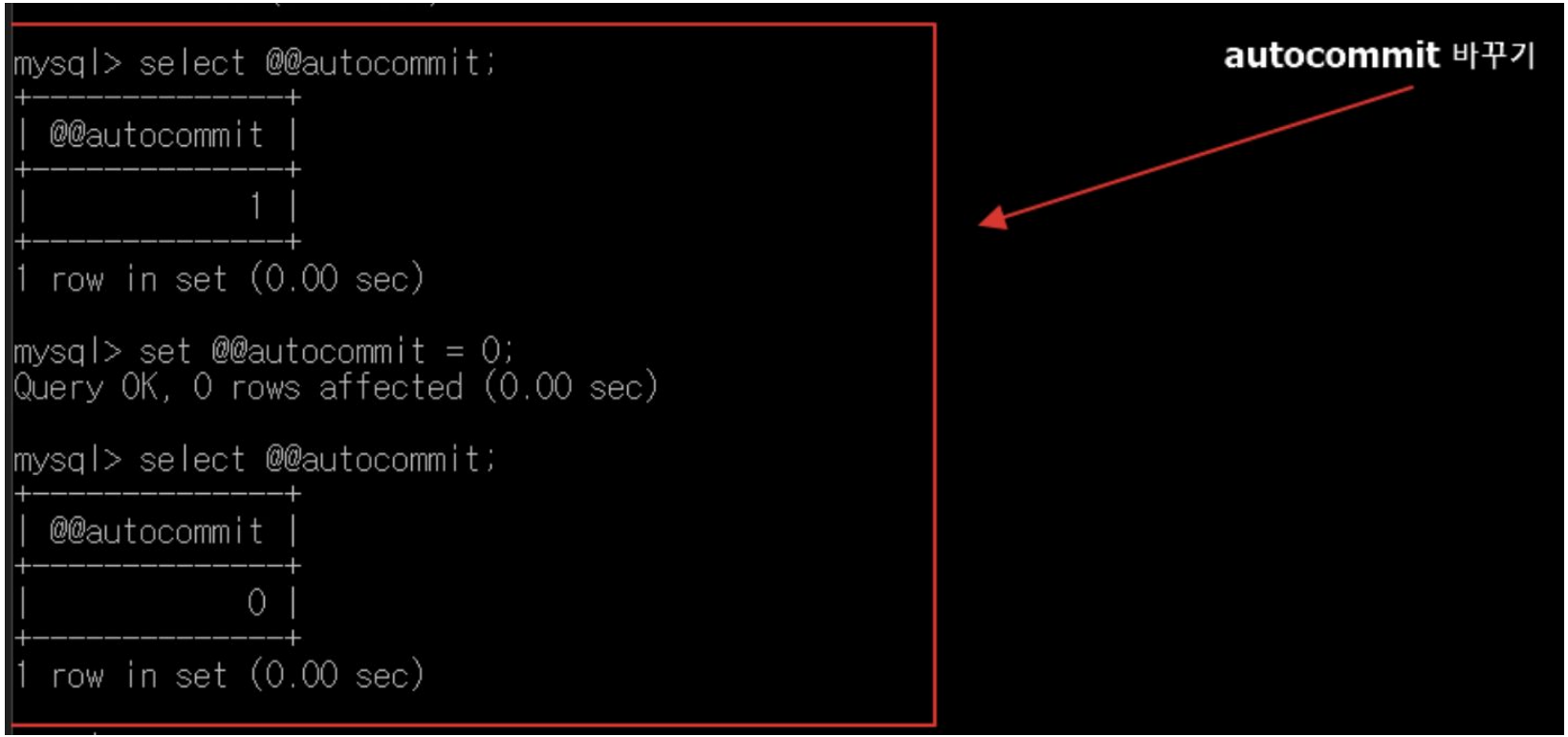
transaction



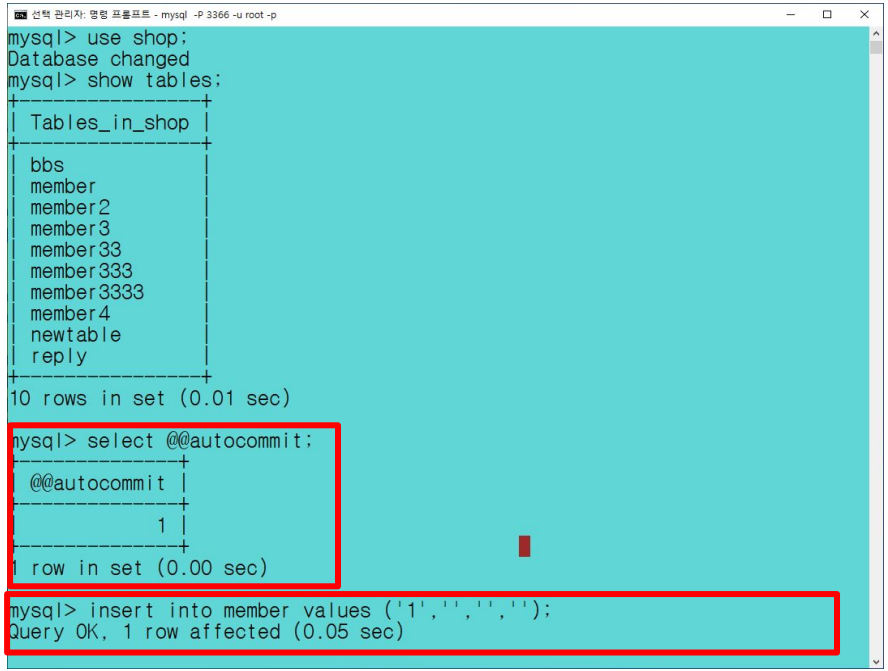


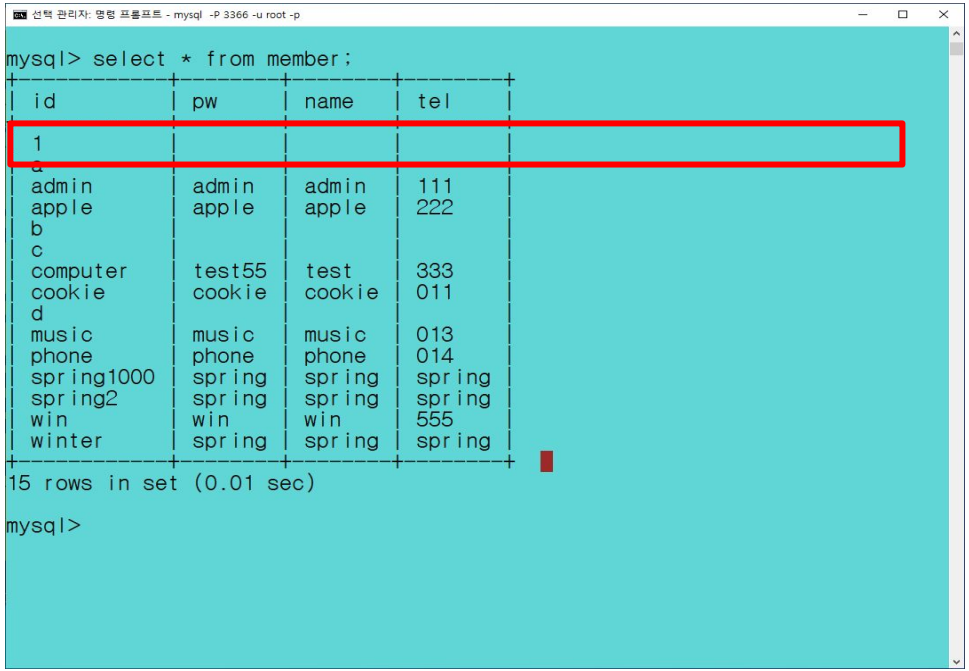

```
mysql> create user 'mega'@'localhost' identified by '1234';

mysql> grant all privileges on *.* to 'mega'@'localhost';
```

transaction

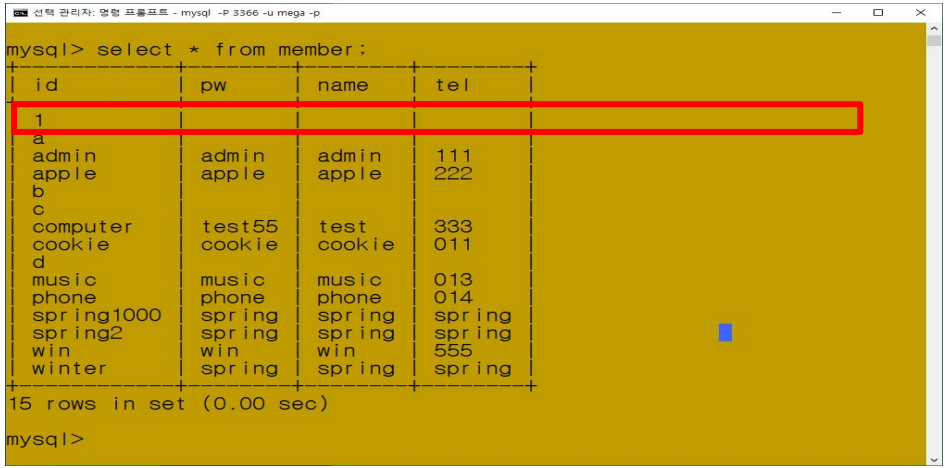


transaction(@@autocommit = 1;)

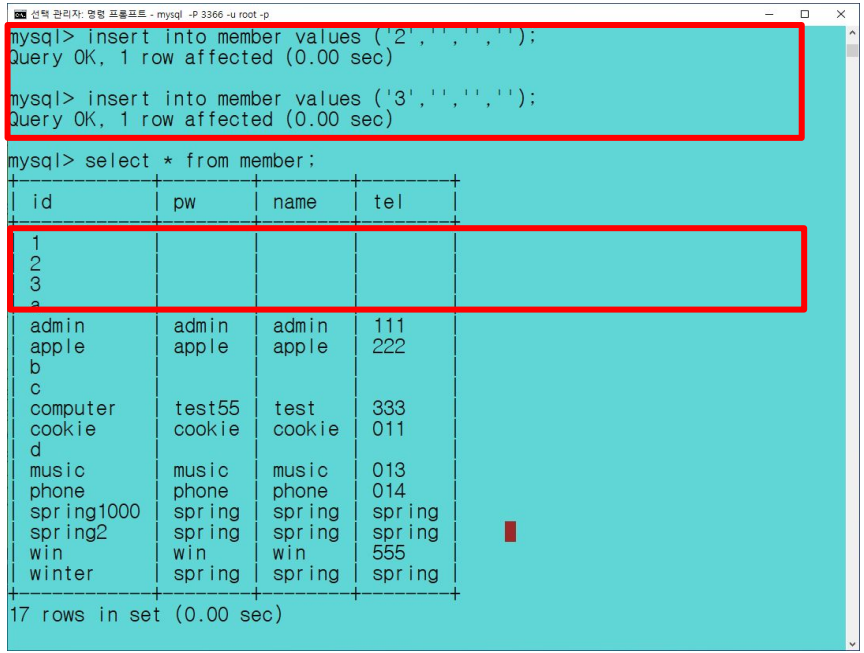




transaction(@@autocommit = 1;)

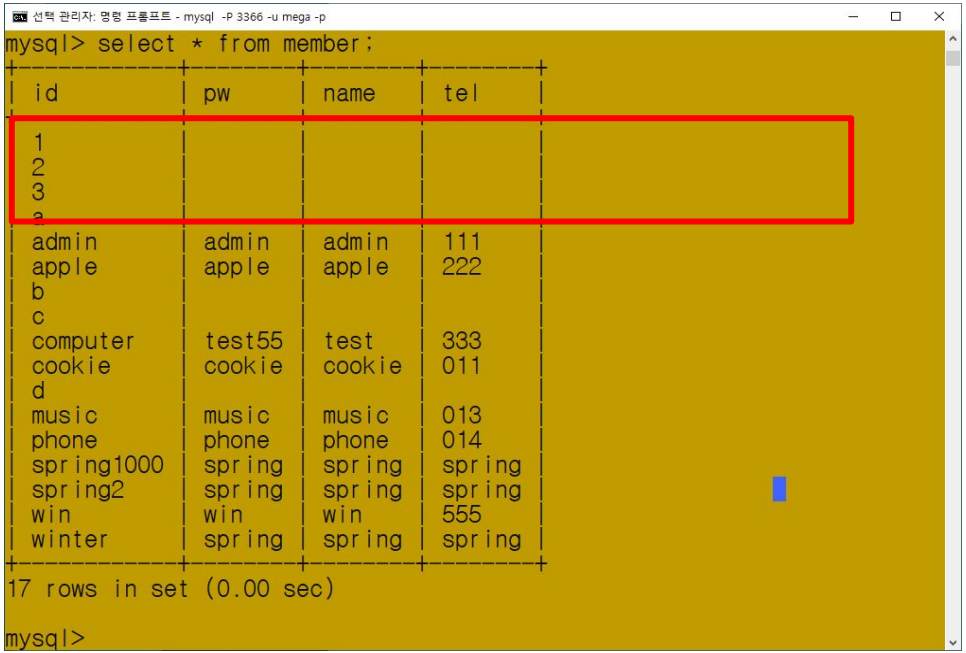


transaction(@@autocommit = 1;)



선택 관리자: 명령 프롬프트 - mysql -P 3366 -u root -p

```
mysql> insert into member values ('2','','','');
Query OK, 1 row affected (0.00 sec)

mysql> insert into member values ('3','','','');
Query OK, 1 row affected (0.00 sec)

mysql> select * from member;
+------------+--------+--------+--------+
| id         | pw     | name   | tel    |
+------------+--------+--------+--------+
| 1          |        |        |        |
| 2          |        |        |        |
| 3          |        |        |        |
| a          |        |        |        |
| admin      | admin  | admin  | 111    |
| apple      | apple  | apple  | 222    |
| b          |        |        |        |
| c          |        |        |        |
| computer   | test55 | test   | 333    |
| cookie     | cookie | cookie | 011    |
| d          |        |        |        |
| music      | music  | music  | 013    |
| phone      | phone  | phone  | 014    |
| spring1000 | spring | spring | spring |
| spring2    | spring | spring | spring |
| win        | win    | win    | 555    |
| winter     | spring | spring | spring |
+------------+--------+--------+--------+
17 rows in set (0.00 sec)
```



선택 관리자: 명령 프롬프트 - mysql -P 3366 -u mega -p

```
mysql> select * from member;
+------------+--------+--------+--------+
| id         | pw     | name   | tel    |
+------------+--------+--------+--------+
| 1          |        |        |        |
| 2          |        |        |        |
| 3          |        |        |        |
| a          |        |        |        |
| admin      | admin  | admin  | 111    |
| apple      | apple  | apple  | 222    |
| b          |        |        |        |
| c          |        |        |        |
| computer   | test55 | test   | 333    |
| cookie     | cookie | cookie | 011    |
| d          |        |        |        |
| music      | music  | music  | 013    |
| phone      | phone  | phone  | 014    |
| spring1000 | spring | spring | spring |
| spring2    | spring | spring | spring |
| win        | win    | win    | 555    |
| winter     | spring | spring | spring |
+------------+--------+--------+--------+
17 rows in set (0.00 sec)

mysql>
```

transaction(@@autocommit = 1;)

선택 관리자: 명령 프롬프트 - mysql -P 3366 -u root -p

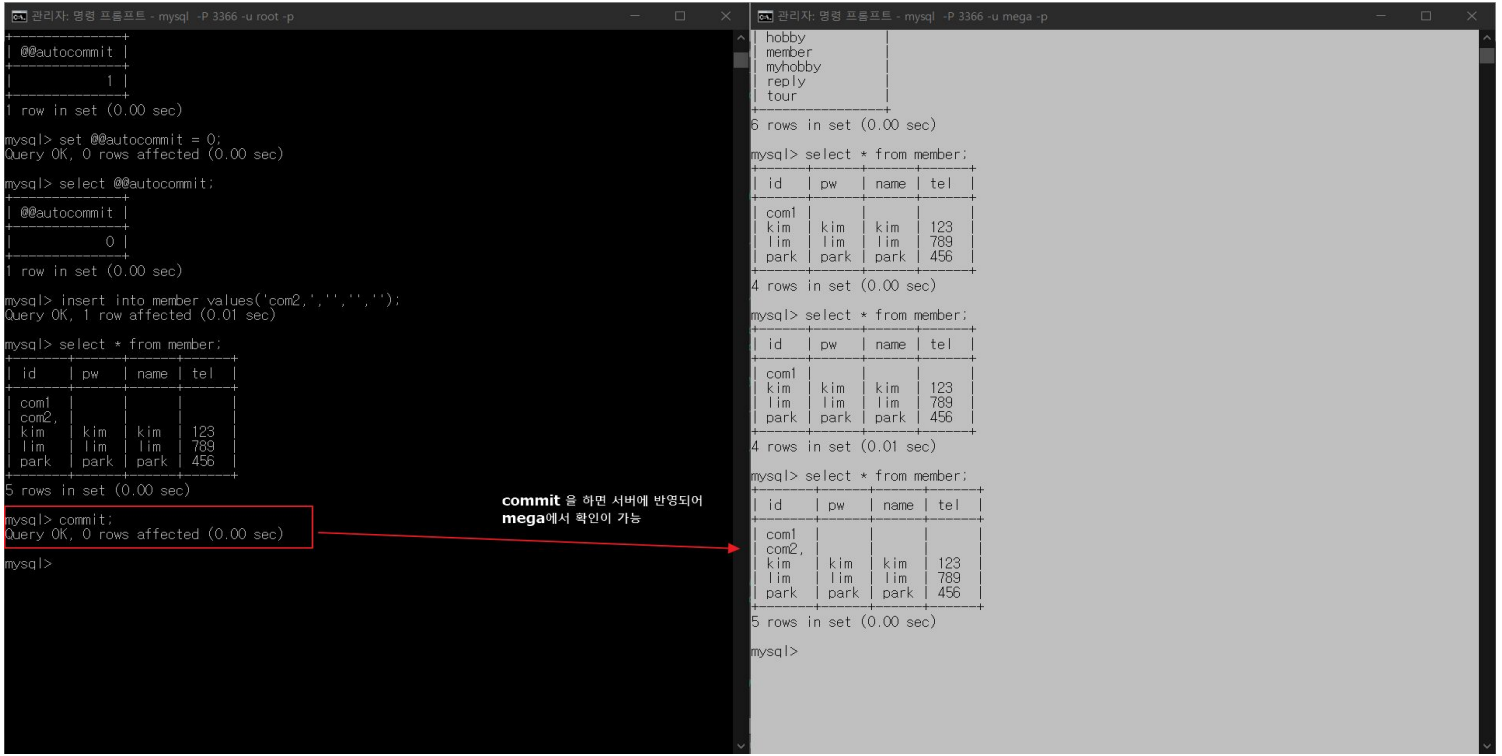
```
mysql> insert into member values ('4','','','');
Query OK, 1 row affected (0.00 sec)

mysql> insert into member values ('5','','','');
Query OK, 1 row affected (0.00 sec)

mysql> rollback;
Query OK, 0 rows affected (0.01 sec)
```

```
mysql> select * from member;
+------------+--------+--------+--------+
| id         | pw     | name   | tel    |
+------------+--------+--------+--------+
| 1          |        |        |        |
| 2          |        |        |        |
| 3          |        |        |        |
| a          |        |        |        |
| admin      | admin  | admin  | 111    |
| apple      | apple  | apple  | 222    |
| b          |        |        |        |
| c          |        |        |        |
| computer   | test55 | test   | 333    |
| cookie     | cookie | cookie | 011    |
| d          |        |        |        |
| music      | music  | music  | 013    |
| phone      | phone  | phone  | 014    |
| spring1000 | spring | spring | spring |
| spring2    | spring | spring | spring |
| win        | win    | win    | 555    |
| winter     | spring | spring | spring |
+------------+--------+--------+--------+
17 rows in set (0.00 sec)
```

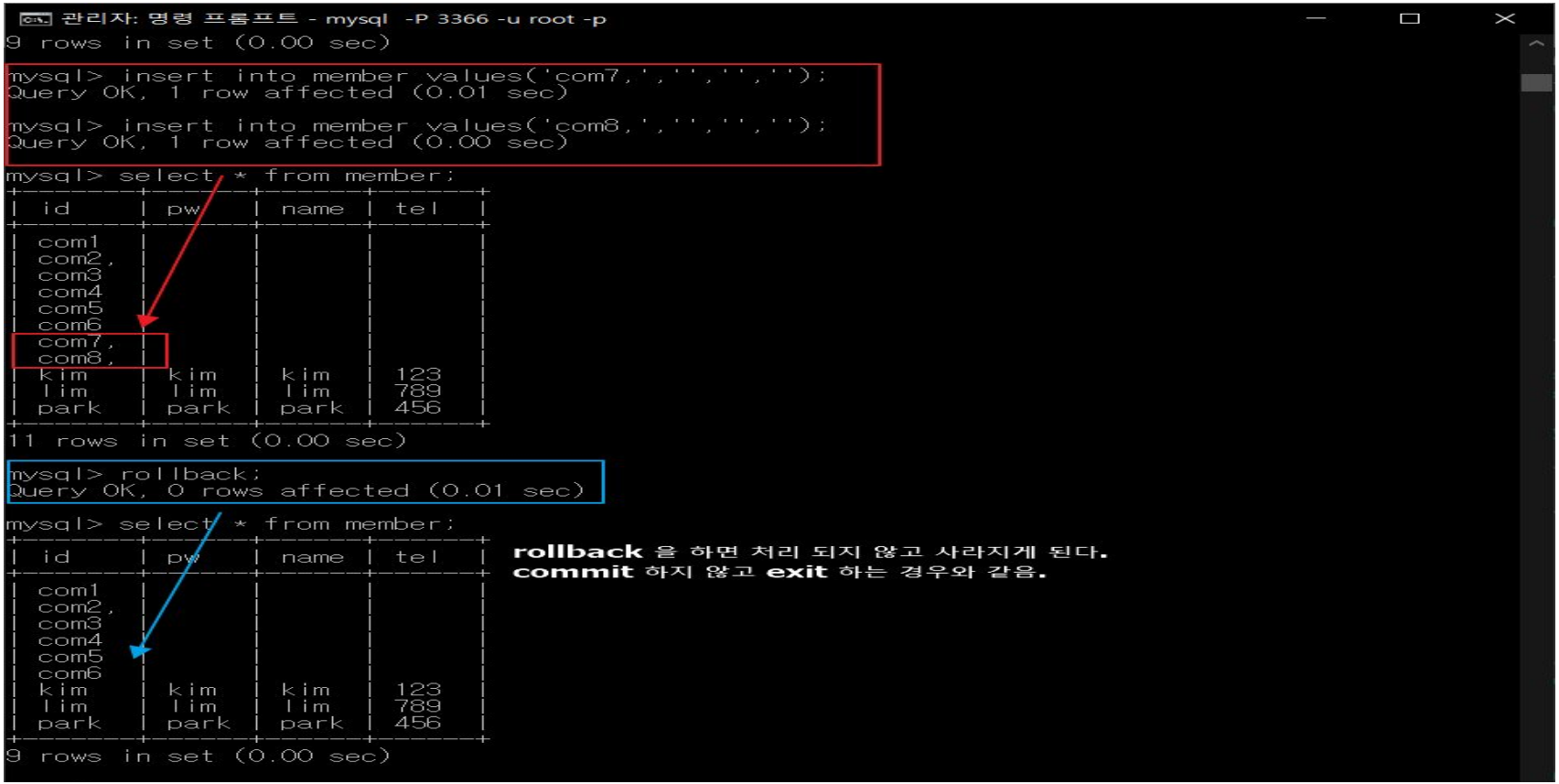
선택 관리자: 명령 프롬프트 - mysql -P 3366 -u mega -p

```
mysql> select * from member;
+------------+--------+--------+--------+
| id         | pw     | name   | tel    |
+------------+--------+--------+--------+
| 1          |        |        |        |
| 2          |        |        |        |
| 3          |        |        |        |
| a          |        |        |        |
| admin      | admin  | admin  | 111    |
| apple      | apple  | apple  | 222    |
| b          |        |        |        |
| c          |        |        |        |
| computer   | test55 | test   | 333    |
| cookie     | cookie | cookie | 011    |
| d          |        |        |        |
| music      | music  | music  | 013    |
| phone      | phone  | phone  | 014    |
| spring1000 | spring | spring | spring |
| spring2    | spring | spring | spring |
| win        | win    | win    | 555    |
| winter     | spring | spring | spring |
+------------+--------+--------+--------+
17 rows in set (0.00 sec)
```

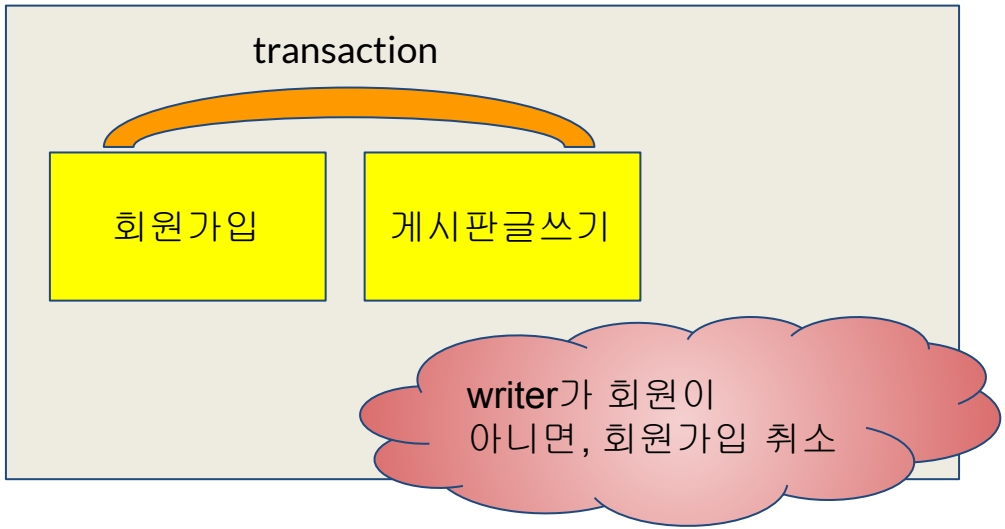
transaction(@@autocommit = 0;)

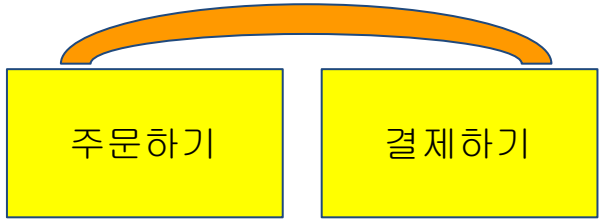


transaction(@@autocommit = 0;)

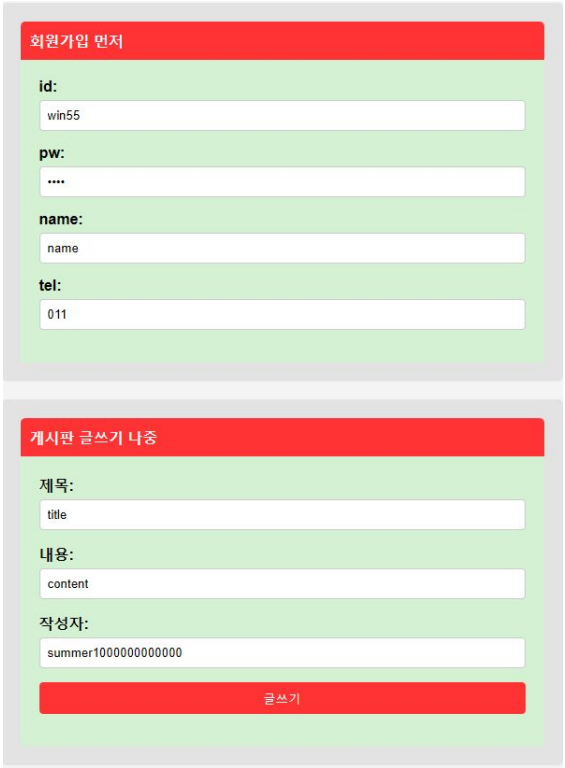


transaction test(시나리오)

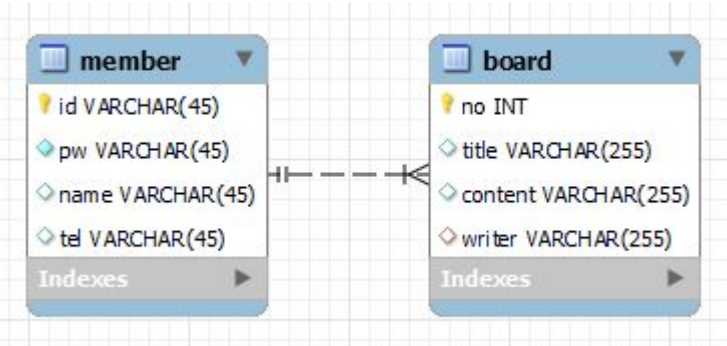




AOP

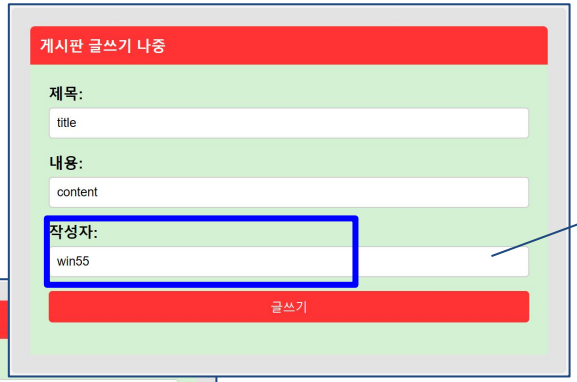


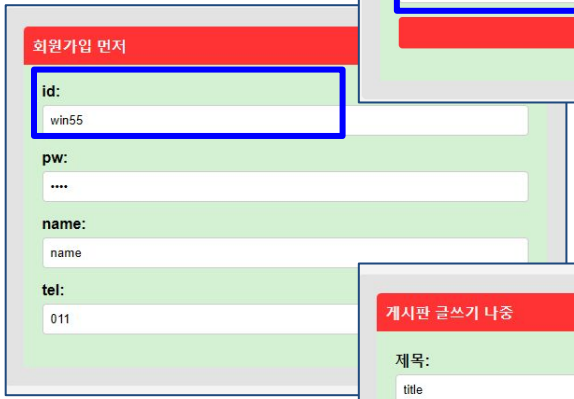

```
<div class="container">
    <div class="section">
        <div class="section-header">회원가입 먼저</div>
        <div class="section-content">
            <form action="/transaction.do" method="POST">
                <div class="form-group">
                    <label for="id">id:</label>
                    <input type="text" id="id" name="id" required value="win55">
                </div>
                <div class="form-group">
                    <label for="pw">pw:</label>
                    <input type="password" id="pw" name="pw" required value="1234">
                </div>
                <div class="form-group">
                    <label for="name">name:</label>
                    <input type="text" id="name" name="name" required value="name">
                </div>
                <div class="form-group">
                    <label for="tel">tel:</label>
                    <input type="text" id="tel" name="tel" value="011">
                </div>
        </div>
    </div>

    <div class="section">
        <div class="section-header">게시판 글쓰기 나중</div>
        <div class="section-content">
                <div class="form-group">
                    <label for="title">제목:</label>
                    <input type="text" id="title" name="title" required value="title">
                </div>
                <div class="form-group">
                    <label for="content">내용:</label>
                    <input type="text" id="content" name="content" required value="content">
                </div>
                <div class="form-group">
                    <label for="writer">작성자:</label>
                    <input type="text" id="writer" name="writer" required value="summer1000000000000">
                </div>
                <div class="form-group">
                    <input type="submit" value="글쓰기">
                </div>
            </form>
        </div>
    </div>
</div>
```

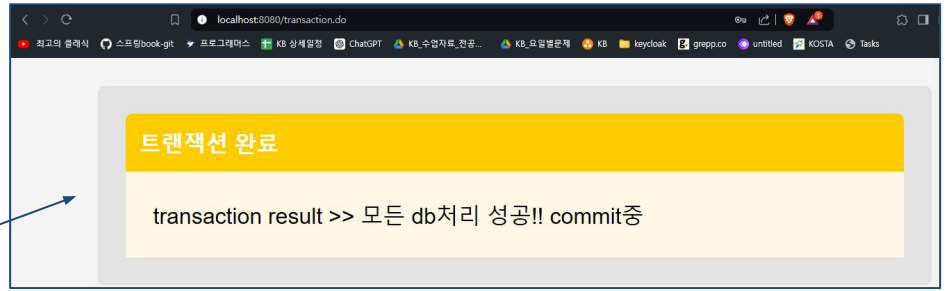


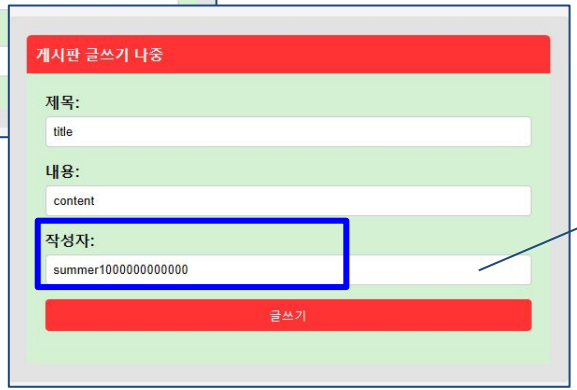

```
use shop2;

CREATE TABLE `member` (
  `id` varchar(45) NOT NULL,
  `pw` varchar(45) NOT NULL,
  `name` varchar(45) DEFAULT NULL,
  `tel` varchar(45) DEFAULT NULL,
  PRIMARY KEY (`id`)
);

CREATE TABLE `board` (
  `no` int NOT NULL AUTO_INCREMENT,
  `title` varchar(255) DEFAULT NULL,
  `content` varchar(255) DEFAULT NULL,
  `writer` varchar(255) DEFAULT NULL,
  PRIMARY KEY (`no`),
  KEY `writer` (`writer`),
  CONSTRAINT `board_ibfk_1` FOREIGN KEY (`writer`)
REFERENCES `member` (`id`)
);
```

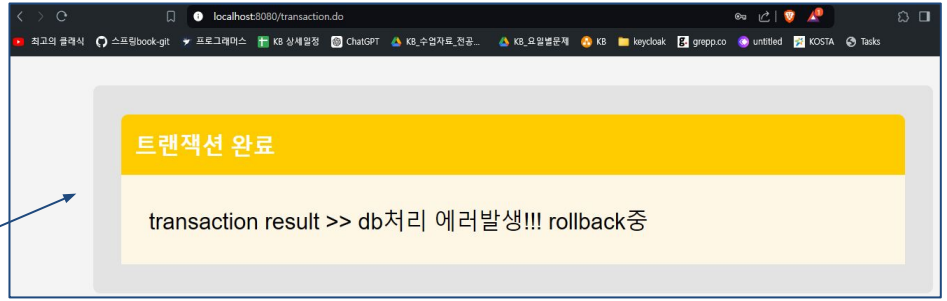
AOP


게시판 글쓰기 나중
제목:
title
내용:
content
작성자:
win55
글쓰기


회원가입 먼저
id:
win55
pw:
••••
name:
name
tel:
011


localhost:8080/transaction.do
트랜잭션 완료
transaction result >> 모든 db처리 성공!! commit중


게시판 글쓰기 나중
제목:
title
내용:
content
작성자:
summer100000000000
글쓰기


localhost:8080/transaction.do
트랜잭션 완료
transaction result >> db처리 에러발생!!! rollback중

AOP

```java
@Configuration
@MapperScan(basePackages = "com.multi.spring2.aop.mapper")
@EnableAspectJAutoProxy(proxyTargetClass = true)
public class AppConfig {

    //private DataSource dataSource;

    public AppConfig(){
        System.out.println("AppConfig created");
    }

    @Bean
    public DataSource dataSource() {
        BasicDataSource dataSource = new BasicDataSource();
        dataSource.setDriverClassName("com.mysql.cj.jdbc.Driver");

dataSource.setUrl("jdbc:mysql://localhost:3306/shop2?useSSL=false&allo
wPublicKeyRetrieval=true&serverTimezone=UTC&characterEncoding=UTF-8&us
eUnicode=true");
        dataSource.setUsername("root");
        dataSource.setPassword("1234");
        dataSource.setInitialSize(5); // 초기 커넥션 수
        dataSource.setMaxTotal(10); // 최대 커넥션 수
        //this.dataSource = dataSource;
        return dataSource;
    }
```

```java
@Bean
    public SqlSessionFactory sqlSessionFactory(DataSource dataSource)
throws Exception {
        SqlSessionFactoryBean sessionFactory = new
SqlSessionFactoryBean();
        sessionFactory.setDataSource(dataSource);
        sessionFactory.setConfigLocation(new
ClassPathResource("mybatis-config.xml"));
        sessionFactory.setMapperLocations(new
PathMatchingResourcePatternResolver().getResources("classpath:mapper/**/*
.xml"));
        return sessionFactory.getObject();
    }

    @Bean
    public SqlSessionTemplate sqlSessionTemplate(SqlSessionFactory
sqlSessionFactory) {
        return new SqlSessionTemplate(sqlSessionFactory);
    }

    @Bean
    public PlatformTransactionManager
transactionManager(DataSource dataSource) {
        System.out.println("transactionManager
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>-------");
        return new DataSourceTransactionManager(dataSource);
    }
}
```

AOP

```java
public interface TransactionInterface {

   public int tran(BoardVO boardVO, MemberVO memberVO)
throws Exception;
}
```

```java
@Mapper
public interface AOPMapper {
 int insertMember(MemberVO memberVO);

 int insertBoard(BoardVO boardVO);
}
```

```xml
<configuration>
   <typeAliases>
      <package
name="com.multi.spring2.aop.domain"/>
   </typeAliases>

</configuration>
```

```java
@Service
@Slf4j
public class TransactionService implements TransactionInterface {

   AOPDAO aopDAO;

   @Autowired
   public TransactionService(AOPDAO aopDAO) {
      this.aopDAO = aopDAO;
   }

   @Override
   @Transactional
   public int tran(BoardVO boardVO, MemberVO memberVO){

      int result = 1;

      // 1. 회원가입 처리
      int memberResult = aopDAO.insertMember(memberVO);


      // 2. 게시글 작성 처리
      int boardResult = aopDAO.insertBoard(boardVO);

      if (memberResult != 1 || boardResult != 1) {
         throw new RuntimeException("error..rolling back.....");
      }
      return result;
   }
}
```

AOP

```java
@Repository
@Slf4j
public class AOPDAO {

   private final SqlSessionTemplate
sqlSessionTemplate;

   @Autowired
   public AOPDAO(SqlSessionTemplate
sqlSessionTemplate) {
      this.sqlSessionTemplate = sqlSessionTemplate;
   }

   public int insertMember(MemberVO memberVO) {
      int rows =
sqlSessionTemplate.getMapper(AOPMapper.class).insertMe
mber(memberVO);
      return rows;
   }

   public int insertBoard(BoardVO boardVO) {
      int rows =
sqlSessionTemplate.getMapper(AOPMapper.class).insertBo
ard(boardVO);
      return rows;
   }
}
```

```java
@Controller
public class AOPController {

   ASiteInterface aSiteService;
   TransactionInterface aopService;


   @Autowired
   public AOPController(ASiteInterface aSiteService, TransactionService
aopService) {
      this.aSiteService = aSiteService;
      this.aopService = aopService;
   }

   @RequestMapping ("a.do")
   public void aop1() {
      aSiteService.tour();
   }

   @RequestMapping ("transaction.do")
   public String transaction(BoardVO bbsVO2,
                             MemberVO memberVO,
                             Model model) {
      int result = 0;
      try {
         result = aopService.tran(bbsVO2, memberVO);
         model.addAttribute( "result", "모든 db처리 성공!! commit중");
      } catch (Exception e) {
         model.addAttribute( "result", "db처리 에러발생!!! rollback중");
         e.printStackTrace();
      }

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

      return "/aop/aop_result";
   }

}
```

AOP

```java
@Data
@AllArgsConstructor
@NoArgsConstructor
public class BoardVO {
	private int no;			// 게시글의 고유 ID
	private String title;	// 게시글 제목
	private String content;	// 게시글 내용
	private String writer;		// 게시글 작성자
(member 테이블의 id를 참조)
}

@Data
@AllArgsConstructor
@NoArgsConstructor
public class MemberVO {
	private String id;
	private String pw;
	private String name;
	private String tel;
}
```

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<!DOCTYPE mapper
	PUBLIC "-//mybatis.org//DTD Mapper 3.0//EN"
	"http://mybatis.org/dtd/mybatis-3-mapper.dtd">

<mapper
namespace="com.multi.spring2.aop.mapper.AOPMapper">

<insert id="insertMember" parameterType="MemberVO">
   insert into member
   values
	(#{id}, #{pw}, #{name}, #{tel})
</insert>
   <insert id="insertBoard" parameterType="BoardVO">
	insert into board
	values
	    (null, #{title}, #{content}, #{writer})
   </insert>

</mapper>
```

핵심 요약

1. **AOP**
2. **Advice**
    a. Before
    b. After
    c. After Running
    d. Around
    e. After Throwing
3. 핵심 기능, 부가 기능
4. **Transaction**