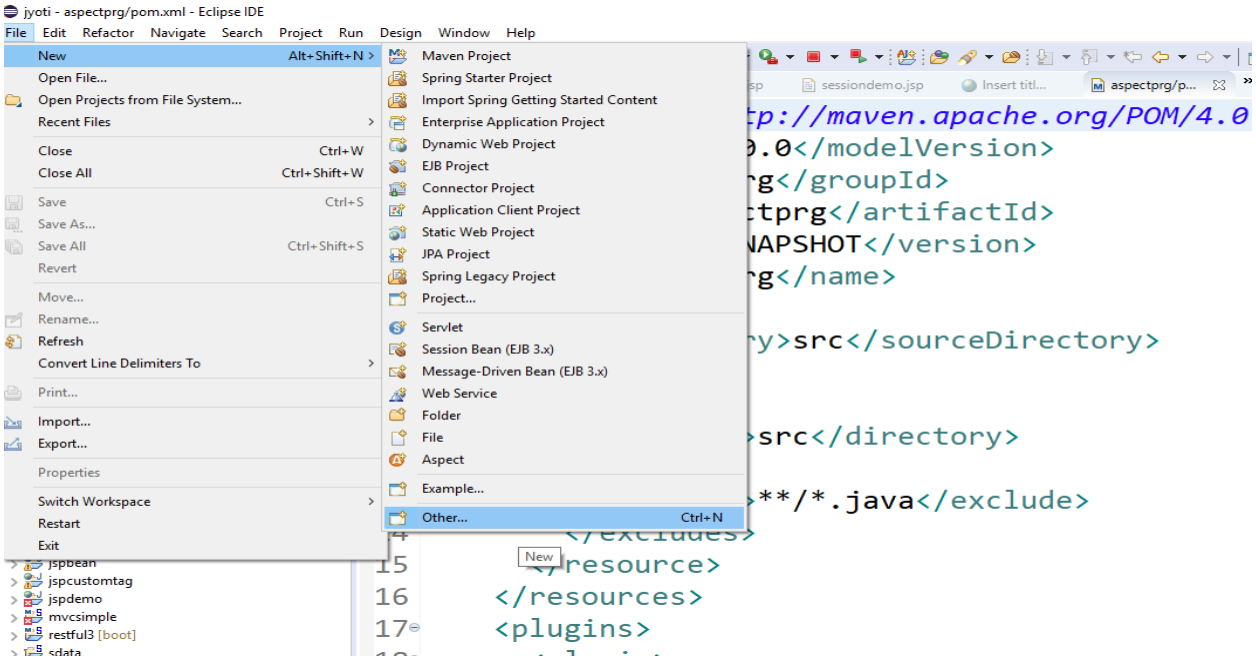
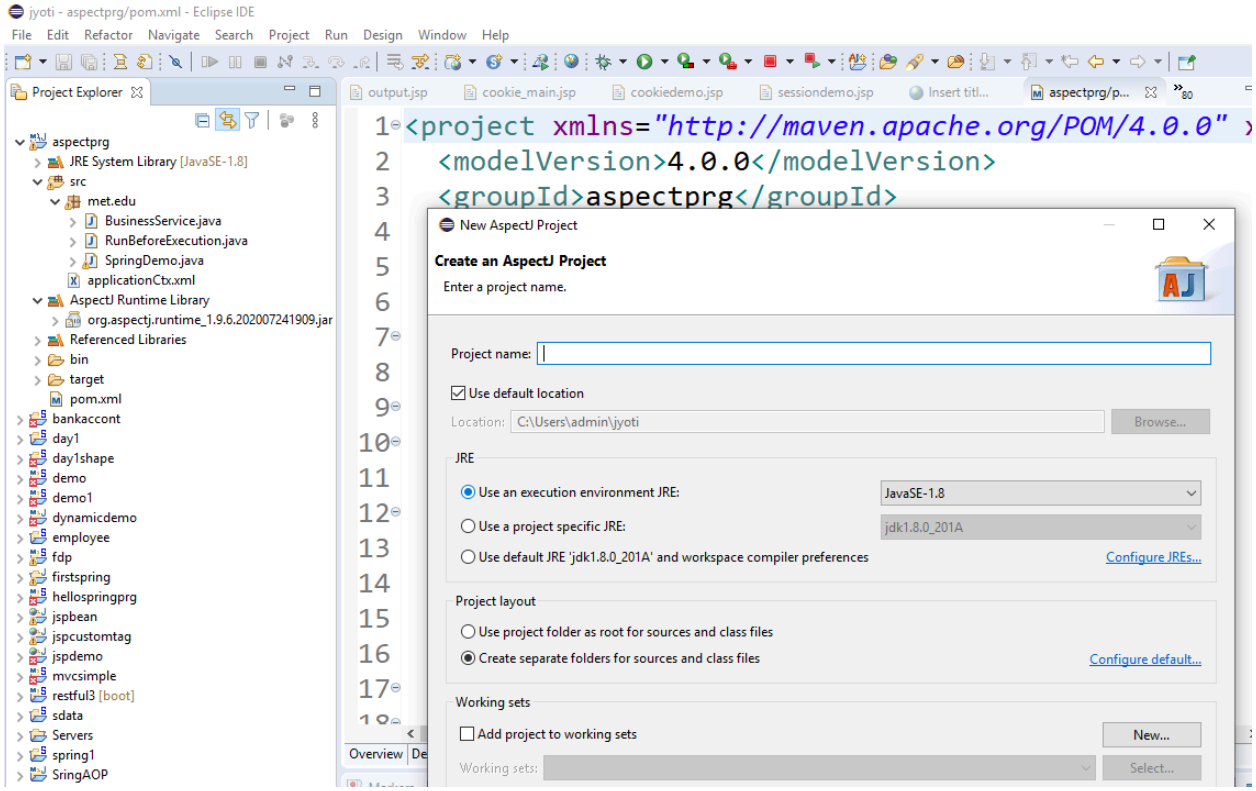
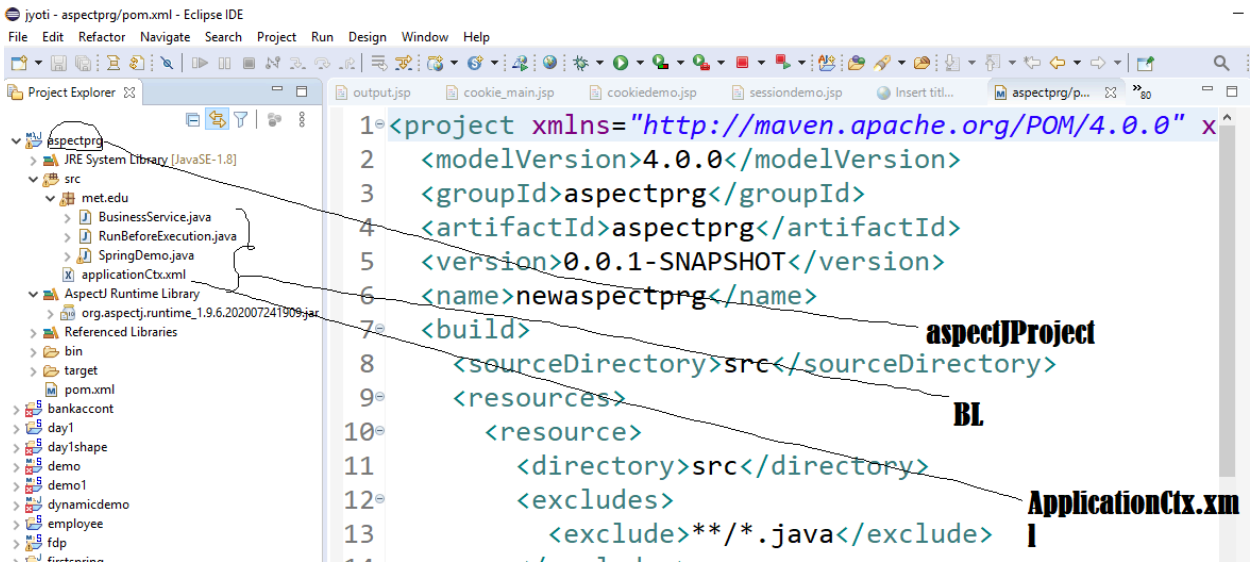
Spring and AOP : Aspect Oriented Programming with Spring

1. Select New-> other->aspectJProject



Give name to the project as aspectprg





Right click on src -> new package as met.edu

File : BusinessService.java

```
package met.edu;

public class BusinessService {

    public void runMyBusinessLogic(){
        System.out.println("************************************");
        System.out.println("Running business logic...");
        System.out.println("************************************");
    }

    public void testThrowException() {
        throw new NullPointerException();
    }
}
```

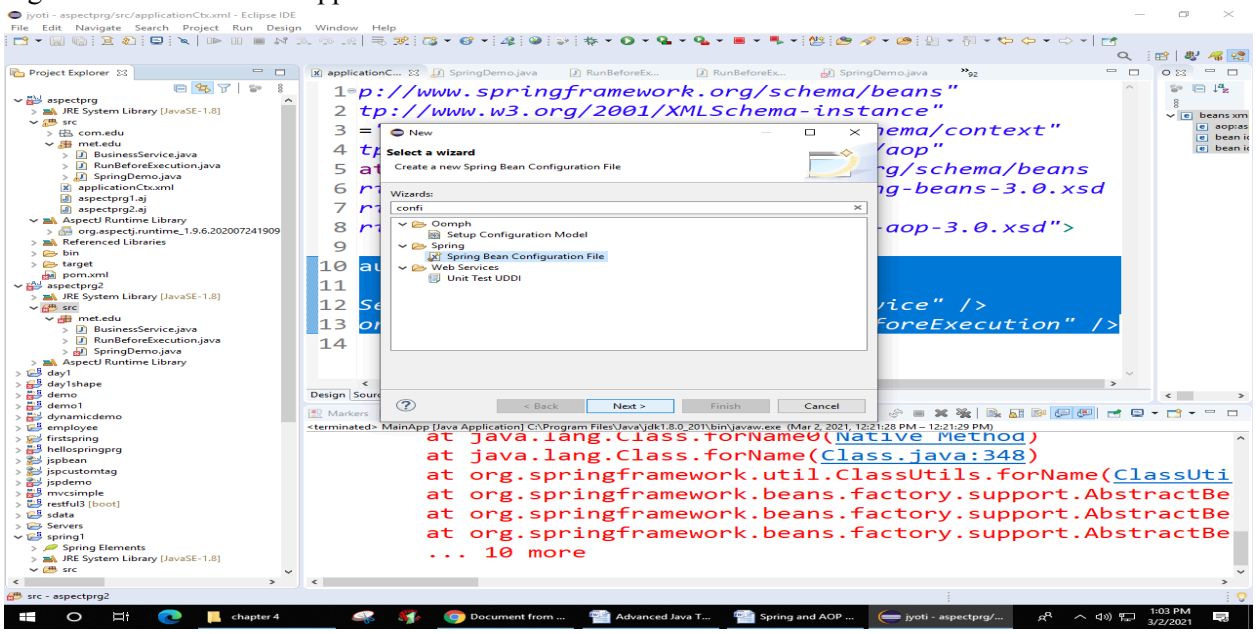
File:RunBeforeExecution.java

```
package met.edu;


import org.aspectj.lang.JoinPoint;
import org.aspectj.lang.annotation.Aspect;
import org.aspectj.lang.annotation.Before;

@Aspect
public class RunBeforeExecution {

   @Before("execution(* met.edu.BusinessService.runMyBusinessLogic(..))")
   public void before(JoinPoint joinPoint) throws Throwable {
      System.out.println("Inside RunBeforeExecution.before() method...");
      System.out.println("inserted before : " + joinPoint.getSignature().getName());
   }
}
```

File: SpringDemo.java

```
package met.edu;
import java.util.*;
import org.springframework.context.ConfigurableApplicationContext;
import org.springframework.context.support.ClassPathXmlApplicationContext;
public class SpringDemo {
          static ConfigurableApplicationContext context;
          public static void main(String[] args) {
                    String confFile = "applicationCtx.xml";

                    context = new ClassPathXmlApplicationContext(confFile);
      BusinessService busServ = (BusinessService) context.getBean("busService");
      busServ.runMyBusinessLogic();
      System.out.println("Press 'Enter' to terminate");
      new Scanner(System.in).nextLine();
      System.out.println("Exiting");
      System.exit(1);
          }

}
```

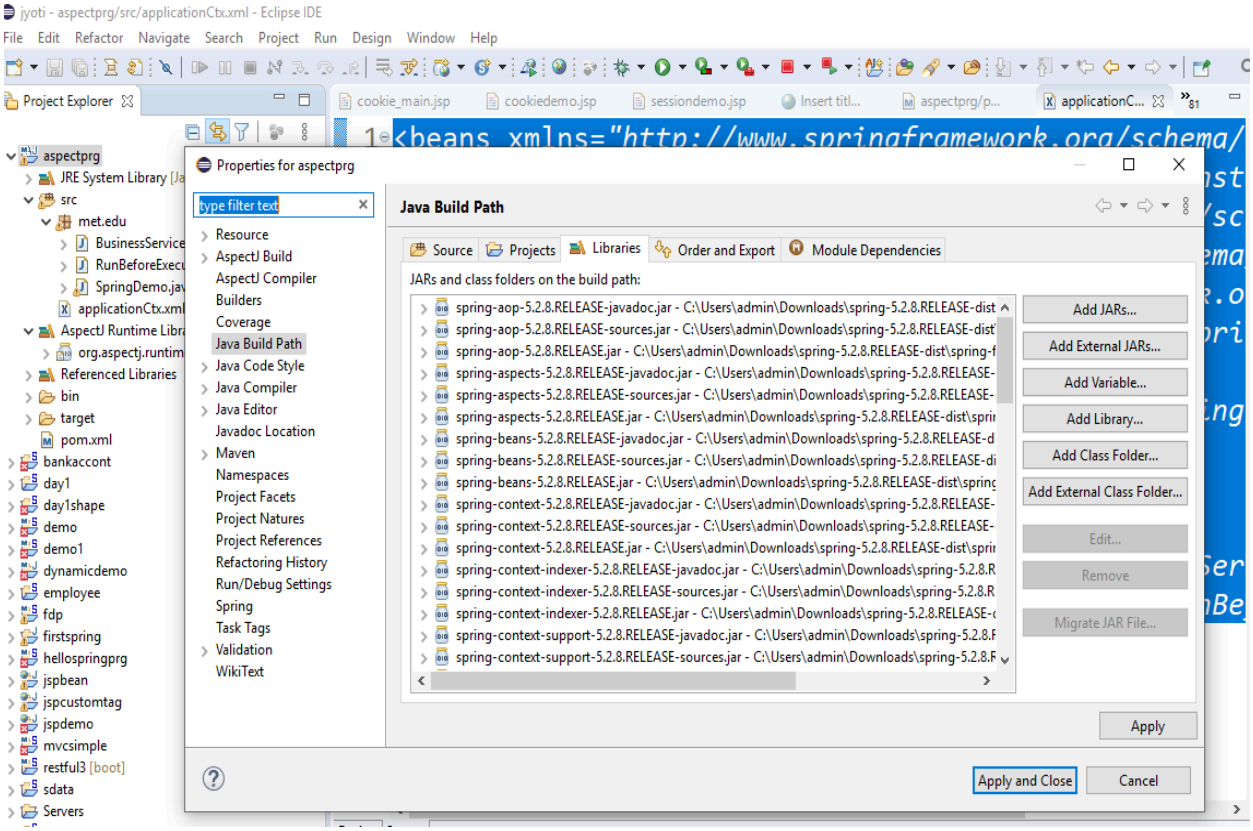
Right click on src -> new applicationCtx.xml



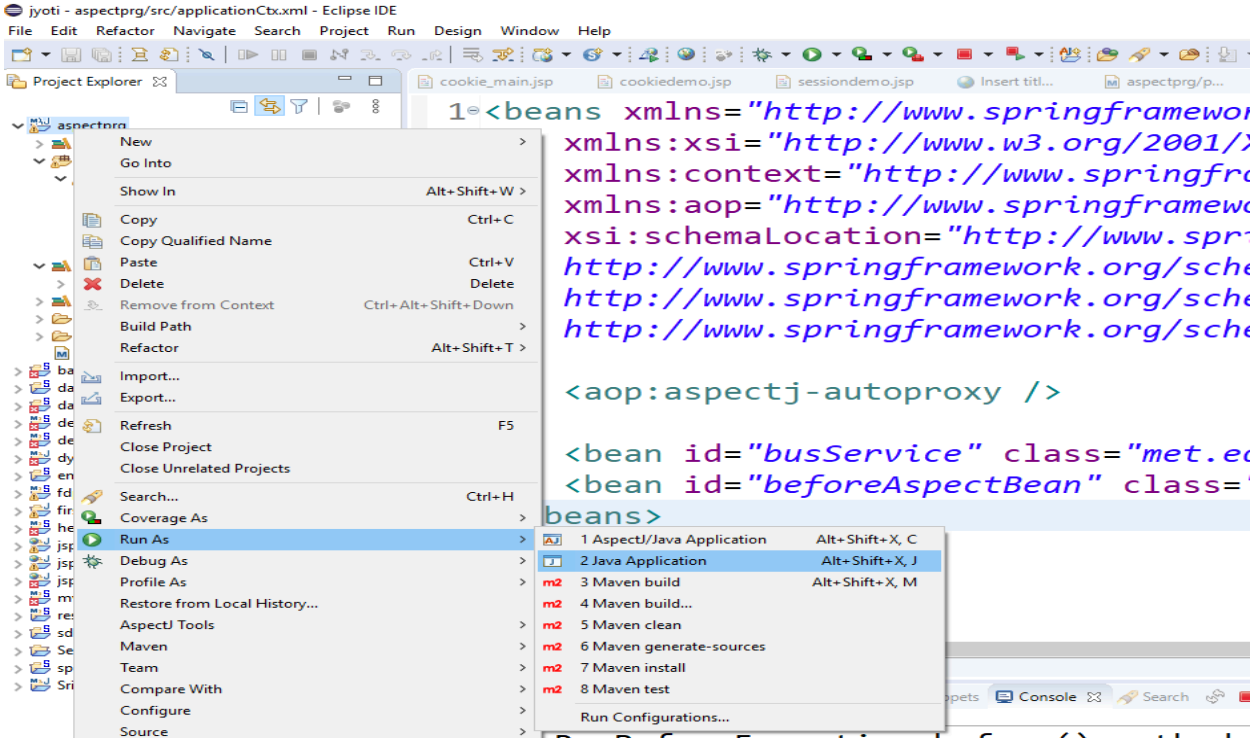
File: applicationCtx.xml

```
<beans xmlns="http://www.springframework.org/schema/beans"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xmlns:context="http://www.springframework.org/schema/context"
   xmlns:aop="http://www.springframework.org/schema/aop"
   xsi:schemaLocation="http://www.springframework.org/schema/beans
   http://www.springframework.org/schema/beans/spring-beans-3.0.xsd
   http://www.springframework.org/schema/aop
   http://www.springframework.org/schema/aop/spring-aop-3.0.xsd">

   <aop:aspectj-autoproxy />

   <bean id="busService" class="met.edu.BusinessService" />
   <bean id="beforeAspectBean" class="met.edu.RunBeforeExecution" />
</beans>
```

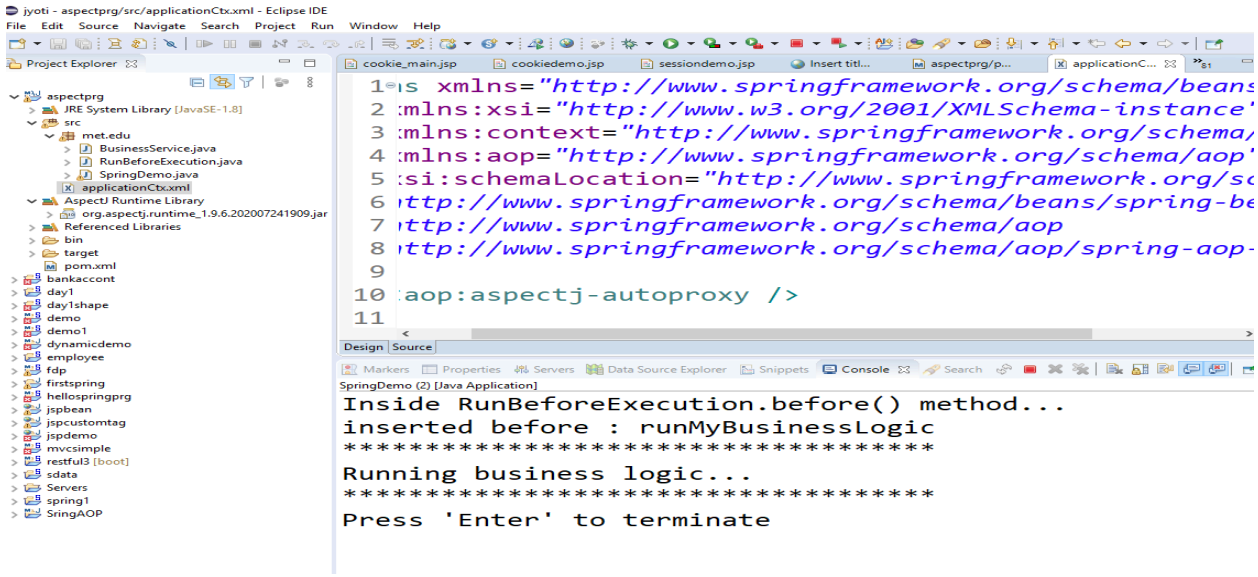
Right click on aspectprg-> buildpath->configurebuildpath
Select Libraries and add external jar files and click apply



Right click on aspectprg and click on run java application



Output



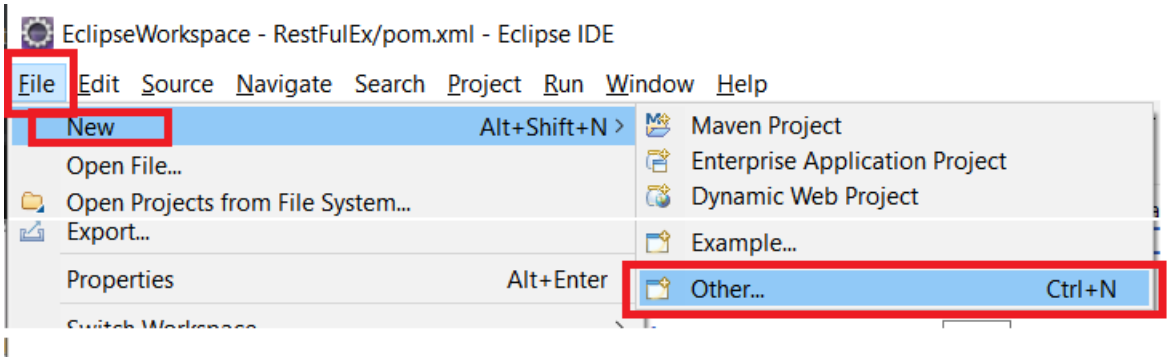
Aspect Oriented Programming

1. Write a program to demonstrate Spring AOP – before advice.
2. Write a program to demonstrate Spring AOP – after advice.
3. Write a program to demonstrate Spring AOP – around advice.
4. Write a program to demonstrate Spring AOP – after returning advice.
5. Write a program to demonstrate Spring AOP – after throwing advice.
6. Write a program to demonstrate Spring AOP – pointcuts.

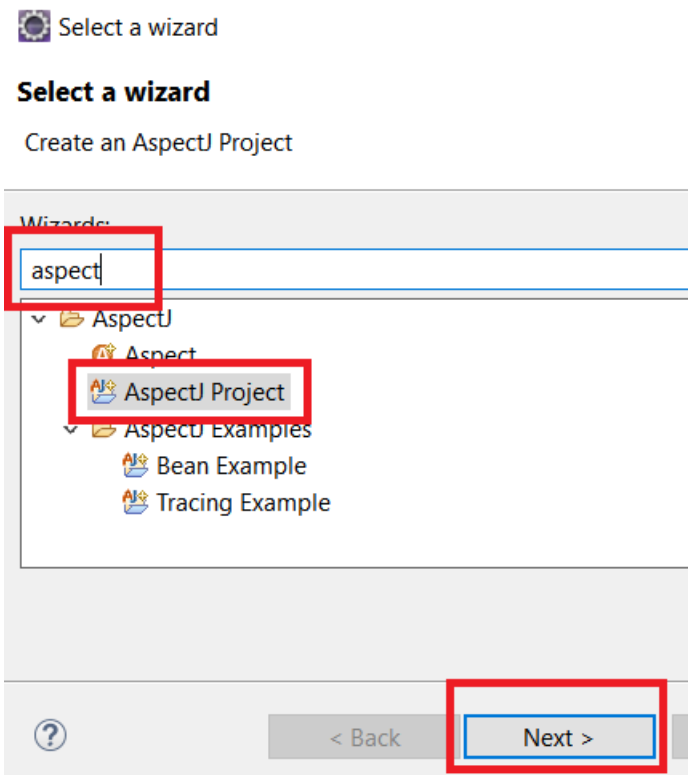
Steps to Create an AOP Project

Step 1 : Creating AspectJ Project.

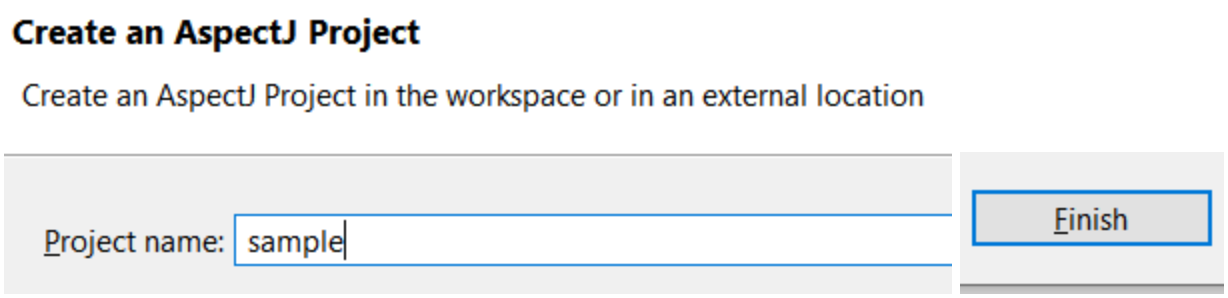
1.1 : Open Eclipse. Go To File > New > Other.



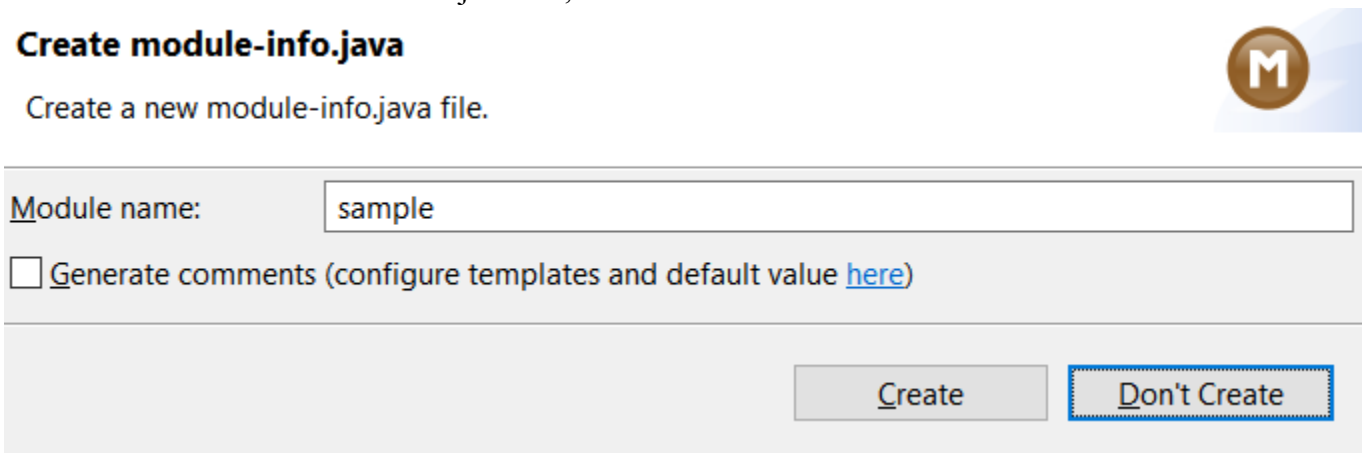
1.2 : Search for 'aspect' and Select 'AspectJ Project'. Then Click on Next.



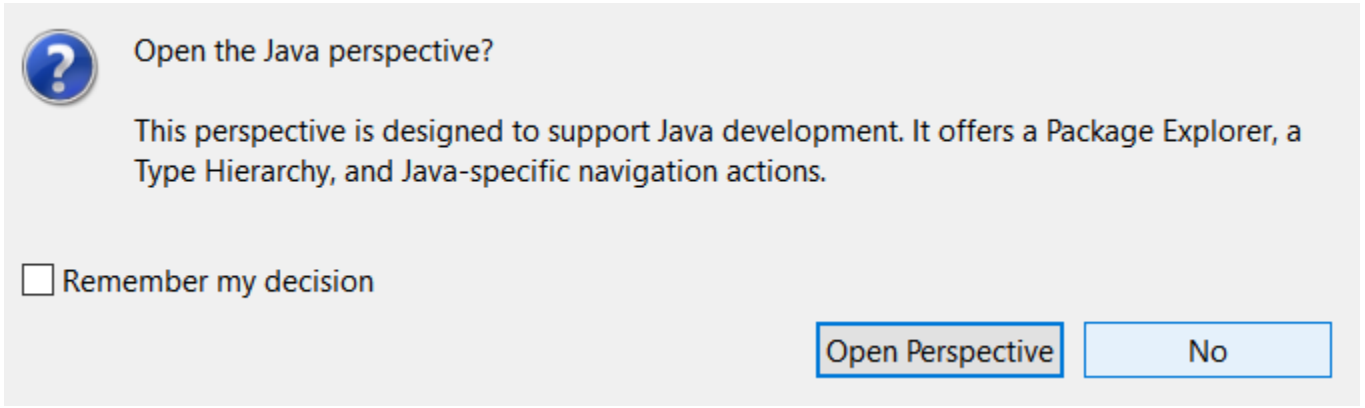
1.3 : Enter Project Name of your wish, and click on Finish.



1.4 : If asked to create module-info.java file, select 'Don't Create'.



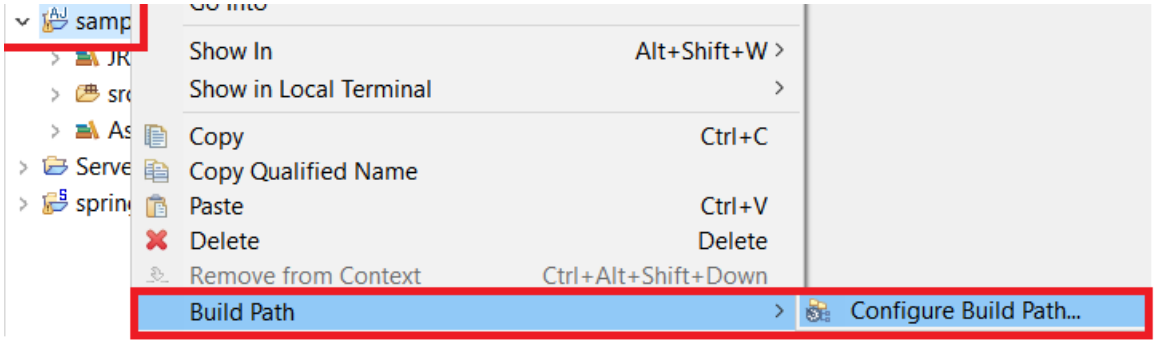
1.5 : Finally if you are asked to Open Java Perspective, just choose **NO.**



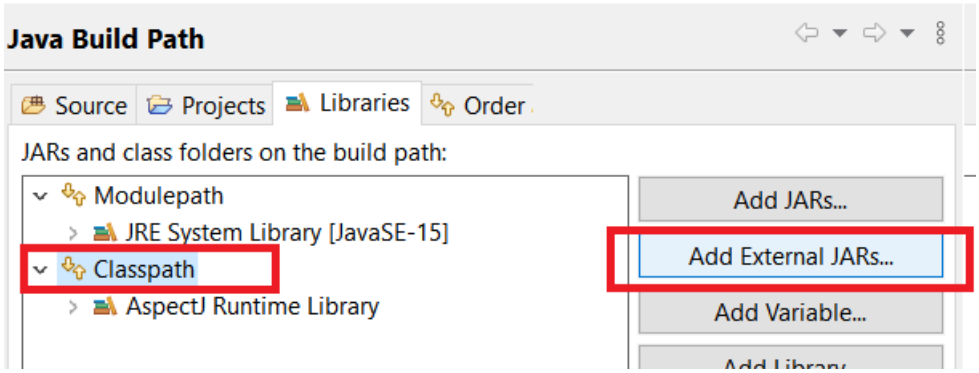
This creates your AspectJ project.

Step 2 : Adding the Spring Libraries.

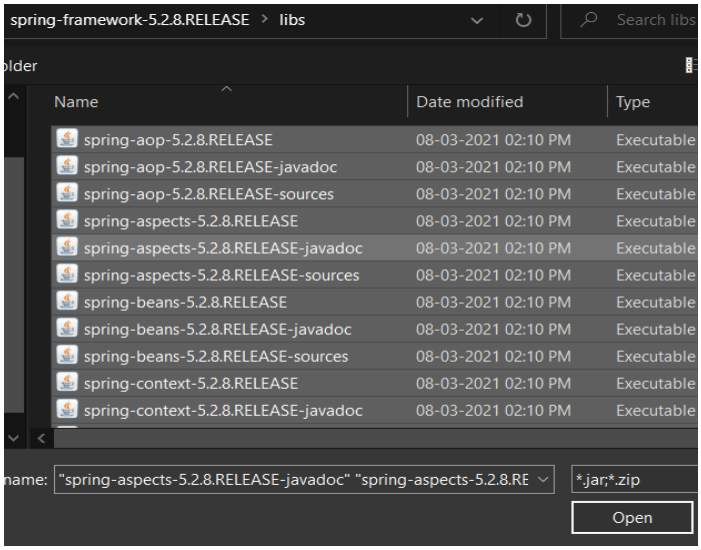
2.1 : Right click on your Newly created AspectJ project, Choose Build Path > Configure Build Path.

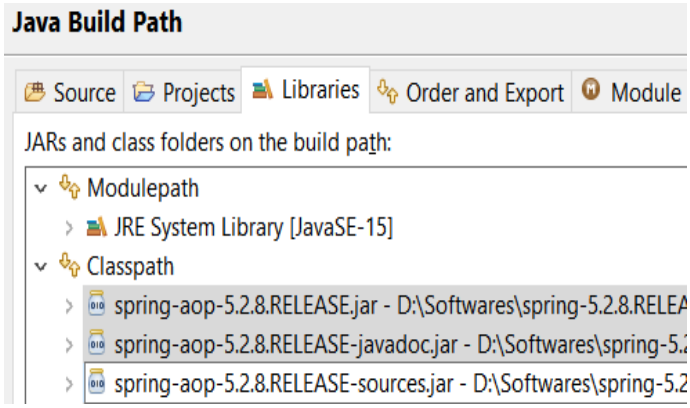


2.2 On Java Build Path wizard, Choose **Classpath**and then select **Add External JARs.**

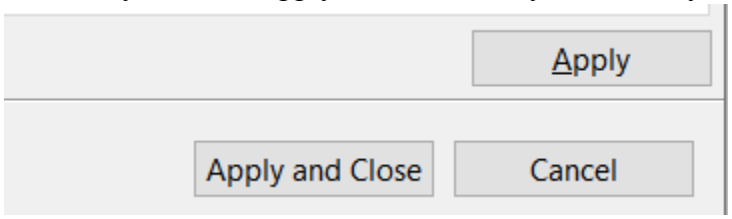


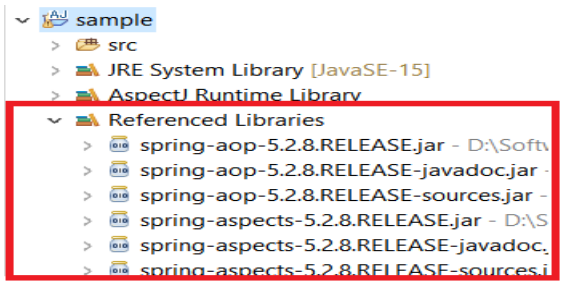
2.3 : Choose all the Spring Libraries you've downloaded, and click on OPEN. This will add all libraries to Classpath.





2.4 Finally click on Apply & Close, now you are ready to work with Aspects in Spring.





Problem Statement 1 : Write a program to demonstrate Spring AOP – before advice.
Solution :
beforeaop.java

```
package bvimit.edu;

import org.aspectj.lang.JoinPoint;
import org.aspectj.lang.annotation.Aspect;
import org.aspectj.lang.annotation.Before;
import org.aspectj.lang.annotation.Pointcut;

@Aspect
public class beforeaop {

	@Pointcut("execution(int beforeoperation.*(..))")
	public void p(){}

	@Before("p()")
	public void myadvice(JoinPoint jp)
	{
		System.out.println("before advice");
	}
}
```

beforeoperation.java

```
package bvimit.edu;

public class beforeoperation {
public void msg() {System.out.println("method 1");}
public int m(){System.out.println("method 2 with return");return 2;}
public int k(){System.out.println("method 3 with return");return 3;}
    }
```

aopctx1.xml

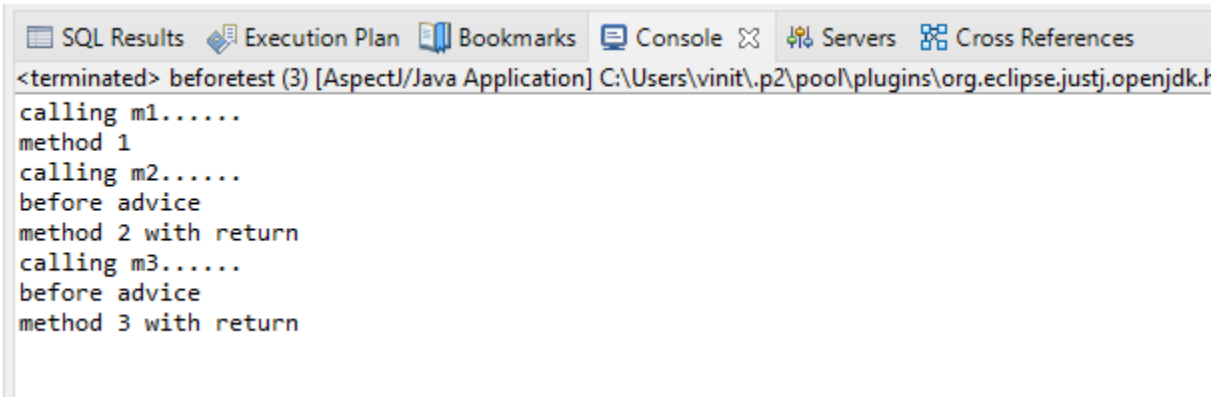
```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
	xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
	xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd">

<bean id="opBean" class="bvimit.edu.beforeoperation"></bean>

<bean id="trackMyBean" class="bvimit.edu.beforeaop"></bean>
```

```
<bean
class="org.springframework.aop.aspectj.annotation.AnnotationAwareAspectJAutoProxyCreator"
></bean>

</beans>
```

beforetest.java

```
package bvimit.edu;

import org.springframework.context.ApplicationContext;
import org.springframework.context.support.ClassPathXmlApplicationContext;

public class beforetest {

	public static void main(String[] args) {
		ApplicationContext context = new
ClassPathXmlApplicationContext("aopctx1.xml");
		beforeoperation e = (beforeoperation) context.getBean("opBean");
		System.out.println("calling m1......");
		e.msg();
		System.out.println("calling m2......");
		e.m();
		System.out.println("calling m3......");
		e.k();


	}

}
```

Output :



Problem Statement 2 : Write a program to demonstrate Spring AOP – after advice.
Solution :
Afteraopdata.java

```
package bvimit.edu;

import org.aspectj.lang.JoinPoint;
import org.aspectj.lang.annotation.After;
import org.aspectj.lang.annotation.Aspect;
import org.aspectj.lang.annotation.Pointcut;

@Aspect
public class afteraopdata {

	@Pointcut("execution(int afteroperation.*(..))")
	public void p(){}

	@After("p()")
	public void myadvice(JoinPoint jp)
	{
		System.out.println("after advice");
	}
}
```

afteroperation.java

```
package bvimit.edu;

publicclass afteroperation {
publicvoid msg() {System.out.println("method 1");}
publicint m(){System.out.println("method 2 with return");return 2;}
publicint k(){System.out.println("method 3 with return");return 3;}
    }
```

aopctx.xml

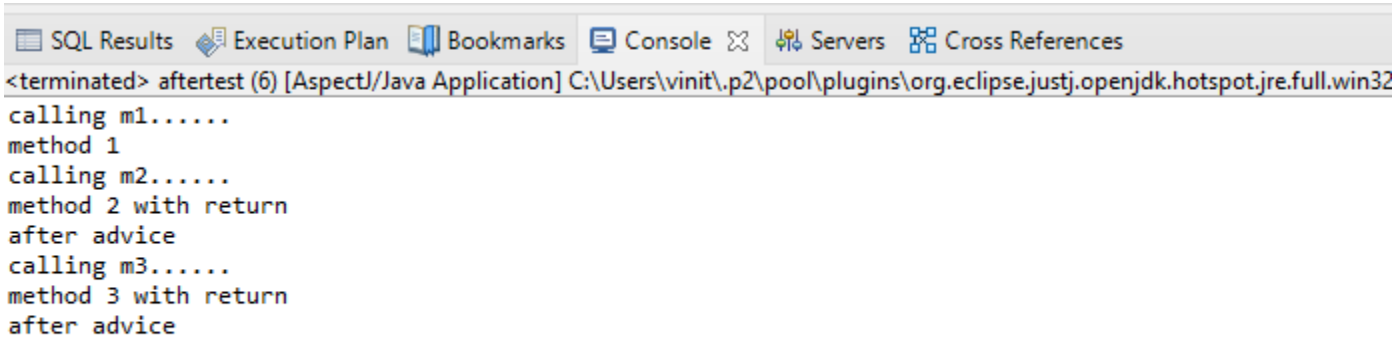
```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
	xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
	xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd">

<bean id="opBean" class="bvimit.edu.afteroperation"></bean>

<bean id="trackMyBean" class="bvimit.edu.afteraopdata"></bean>
```

```
<bean
class="org.springframework.aop.aspectj.annotation.AnnotationAwareAspectJAutoProxyCreator"
></bean>
</beans>
```

aftertest.java

```
package bvimit.edu;

import org.springframework.context.ApplicationContext;
import org.springframework.context.support.ClassPathXmlApplicationContext;

public class aftertest {

	public static void main(String[] args) {
		ApplicationContext context = new
ClassPathXmlApplicationContext("aopctx.xml");
		afteroperation e = (afteroperation) context.getBean("opBean");
		System.out.println("calling m1.....");
		e.msg();
		System.out.println("calling m2.....");
		e.m();
		System.out.println("calling m3.....");
		e.k();


	}

}
```

Output :



Problem Statement 3 : Write a program to demonstrate Spring AOP – around advice.
Solution :
Bankaopdata.java

```
package bvimit.edu;

import org.aspectj.lang.ProceedingJoinPoint;
import org.aspectj.lang.annotation.Around;
import org.aspectj.lang.annotation.Aspect;
import org.aspectj.lang.annotation.Pointcut;

@Aspect
public class Bankaopdata {

	@Pointcut("execution(* Bank.*(..))")
	public void a() {}

	@Around("a()")
	public Object myadvice(ProceedingJoinPoint p)throws Throwable
	{
		System.out.println("Around concern Before calling actual method");
		Object obj=p.proceed();
		System.out.println("Around Concern After calling actual method");
		return obj;
	}
}
```

Bank.java

```
package bvimit.edu;

publicclass Bank {
	publicvoid welcome() {System.out.println("welcome to bank");}
	publicint icici() {System.out.println("icici bank interest rate");return 7;}
	publicint pnb() {System.out.println("pnb bank interest rate");return 6;}

}
```

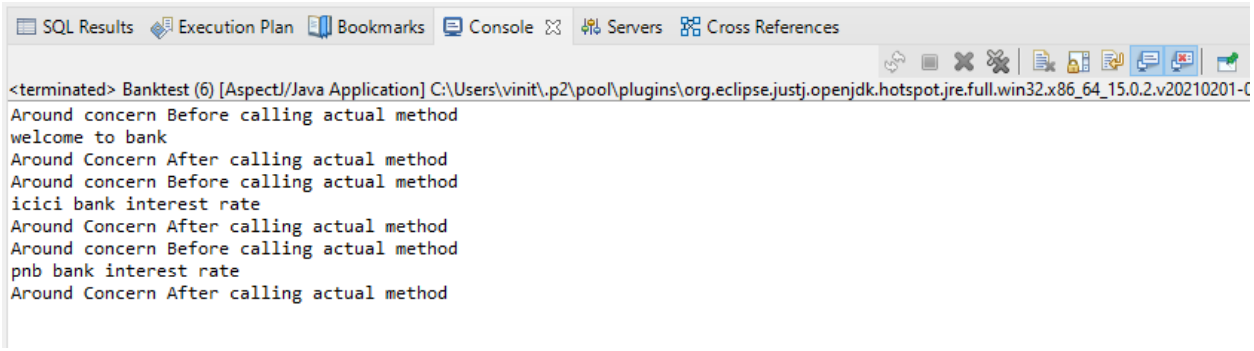
Bankaopdata.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
	xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
	xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd">

<bean id="opBean" class="bvimit.edu.Bank"></bean>
<bean id="trackMyBean" class="bvimit.edu.Bankaopdata"></bean>

<bean
class="org.springframework.aop.aspectj.annotation.AnnotationAwareAspectJAutoProxyCreator"
></bean>
</beans>
```

Banktest.java

```
package bvimit.edu;

import org.springframework.context.ApplicationContext;
import org.springframework.context.support.ClassPathXmlApplicationContext;

publicclass Banktest {

	privatestatic ApplicationContext context;

	publicstaticvoid main(String[] args) {
		context = new ClassPathXmlApplicationContext("Bankaopdata.xml");

		Bank e =(Bank) context.getBean("opBean");
		System.out.println("Calling welcome method...");
		e.welcome();
		System.out.println("Calling icici method...");
		e.icici();
		System.out.println("Calling pnb method...");
		e.pnb();
	}

}
```

Output :


SQL Results
Execution Plan
Bookmarks
Console
Servers
Cross References
<terminated> Banktest (6) [AspectJ/Java Application] C:\Users\vinit\.p2\pool\plugins\org.eclipse.justj.openjdk.hotspot.jre.full.win32.x86_64_15.0.2.v20210201-0
Around concern Before calling actual method
welcome to bank
Around Concern After calling actual method
Around concern Before calling actual method
icici bank interest rate
Around Concern After calling actual method
Around concern Before calling actual method
pnb bank interest rate
Around Concern After calling actual method

Problem Statement 4 : Write a program to demonstrate Spring AOP – after returning advice.
Solution :
Bankaopdata.java

```
package bvimit.edu;

import org.aspectj.lang.JoinPoint;
importorg.aspectj.lang.ProceedingJoinPoint;
import org.aspectj.lang.annotation.AfterReturning;
importorg.aspectj.lang.annotation.Around;
import org.aspectj.lang.annotation.Aspect;
importorg.aspectj.lang.annotation.Pointcut;

@Aspect
publicclass Bankaopdata {

	@AfterReturning(
				pointcut ="execution(* Bank.*(..))",
				returning="result")
publicvoid myadvice(JoinPoint jp,Object result)
{
	System.out.println("AfterReturning concern");
	System.out.println("Result in advice" +result);
	}
}
```

Bank.java

```
package bvimit.edu;

publicclass Bank {
	publicvoid welcome() {System.out.println("welcome to bank");}
	publicint icici() {System.out.println("icici bank interest rate");return 7;}
	publicint pnb() {System.out.println("pnb bank interest rate");return 6;}

}
```

Bankaopdata.xml

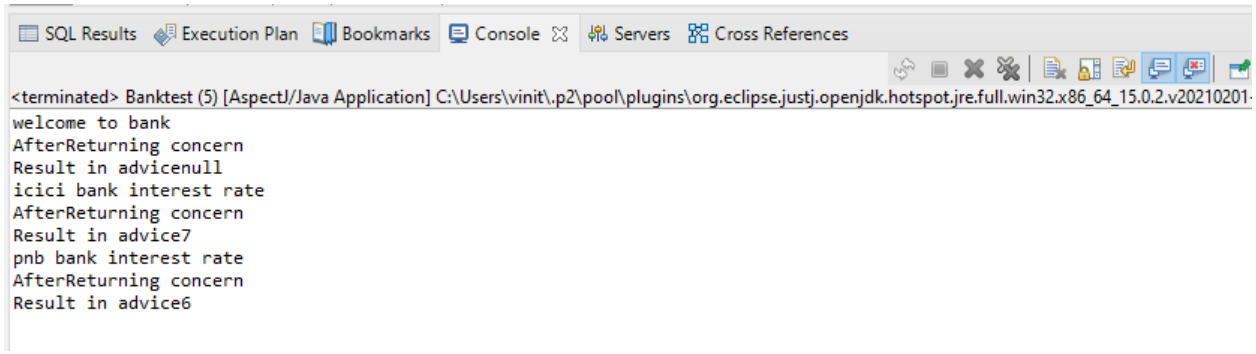
```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
	xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
	xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd">

<bean id="opBean" class="bvimit.edu.Bank"></bean>
<bean id="trackMyBean" class="bvimit.edu.Bankaopdata"></bean>
```

```
<bean
class="org.springframework.aop.aspectj.annotation.AnnotationAwareAspectJAutoProxyCreator"
></bean>
</beans>
```

Banktest.java

```
package bvimit.edu;

import org.springframework.context.ApplicationContext;
import org.springframework.context.support.ClassPathXmlApplicationContext;

publicclass Banktest {

	privatestatic ApplicationContext context;

	publicstaticvoid main(String[] args) {
		context = new ClassPathXmlApplicationContext("Bankaopdata.xml");

		Bank e =(Bank) context.getBean("opBean");
		//System.out.println("Calling welcome method...");
		e.welcome();
		//System.out.println("Calling icici method...");
		e.icici();
		//System.out.println("Calling pnb method...");
		e.pnb();
	}

}
```

Output :



Problem Statement 5 : Write a program to demonstrate Spring AOP – after throwing advice.
Solution :

Operationaop_at.java

```
package bvimit.edu;
import org.aspectj.lang.JoinPoint;
import org.aspectj.lang.annotation.AfterThrowing;
import org.aspectj.lang.annotation.Aspect;

@Aspect
publicclass Operationaop_at {
@AfterThrowing(
                        pointcut = "execution(* Operation_at.*(..))", throwing = "error")
        publicvoid myadvice(JoinPoint jp, Throwable error)
        {
                System.out.println("AfterThrowing concern");
                System.out.println("Exception is: "+error);
                System.out.println("end of after throwing advice....");
        }
        }
```

Operation_at.java

```
package bvimit.edu;
publicclass Operation_at {

        publicvoid validate(int att)throws Exception{
                if(att<75) {
                        thrownew ArithmeticException("Not eligible for exam");
                }
                else {
                        System.out.println("Eligible for exam");
                }
        }
}
```

validctx.xml

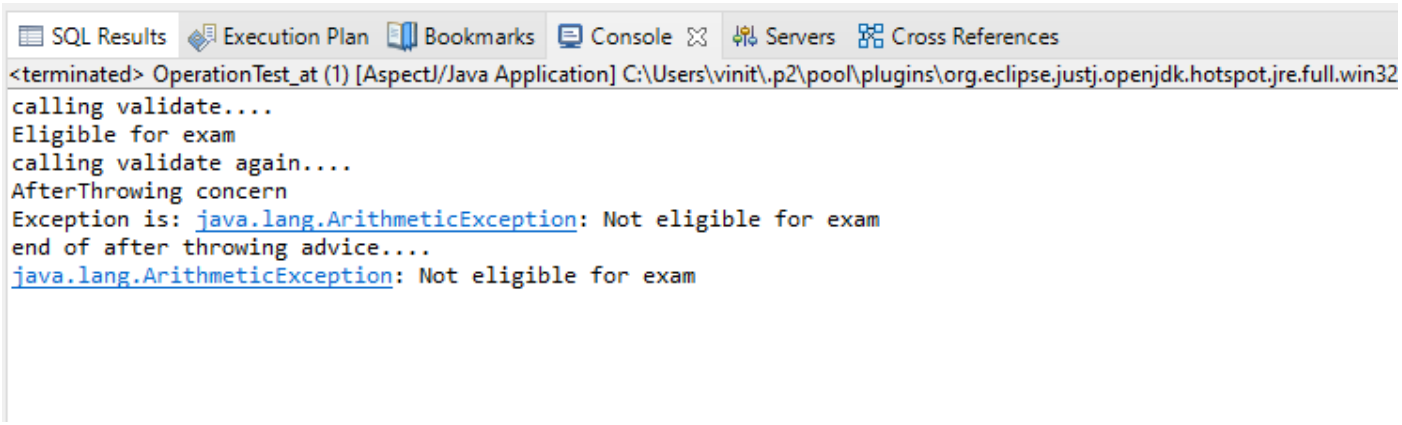
```
<?xml version="1.0" encoding="UTF-8"?>
```

```
<beans xmlns="http://www.springframework.org/schema/beans"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd">


<bean id="opBean" class="bvimit.edu.Operation_at"></bean>

<bean id="trackMyBean" class="bvimit.edu.Operationaop_at"></bean>

<bean
class="org.springframework.aop.aspectj.annotation.AnnotationAwareAspectJAutoProxyCreator"
></bean></beans>
```

TestValidation.java

```
package bvimit.edu;
import org.springframework.context.ApplicationContext;
import org.springframework.context.support.ClassPathXmlApplicationContext;

public class OperationTest_at {
private static ApplicationContext context;
                public static void main(String[] args) {
ApplicationContext context = new ClassPathXmlApplicationContext("validctx.xml");
                        Operation_at op = (Operation_at) context.getBean("opBean");
                        System.out.println("calling validate....");
                        try {
                                op.validate(85);
                        }catch(Exception e){System.out.println(e);}

                        System.out.println("calling validate again....");

                        try {
                                op.validate(25);
                        }catch(Exception e){System.out.println(e);}
                        }
                        }
```

Output :



Problem Statements 6: Write a program to demonstrate Spring AOP –pointcuts.

Solution:

Operation_pc.java

```
package bvimit.edu;
publicclass Operation_pc {

        publicvoid msg() {System.out.println("method 1");}
        publicint m() {System.out.println("method 2 with return");return 2;}
        publicint k() {System.out.println("method 3 with return");return 3;}
        }
```

Aopdata_pc.java

```
package bvimit.edu;
import org.aspectj.lang.JoinPoint;
import org.aspectj.lang.annotation.After;
import org.aspectj.lang.annotation.Pointcut;
import org.aspectj.lang.annotation.Aspect;
import org.aspectj.lang.annotation.Before;
@Aspect
public class Aopdata_pc {

	@Pointcut("execution(int Operation.*(..))")
	public void p(){}

	@After("p()")
	public void myadvice(JoinPoint jp)
	{
		System.out.println("After advice");
	}
	@Pointcut("execution(* Operation.*(..))")
	public void i(){}

	@Before("i()")
	public void myadvice1(JoinPoint jp)
	{
		System.out.println("Before advice");
}
}
```

Test_pc.java

```
package bvimit.edu;
import org.springframework.context.ApplicationContext;
import org.springframework.context.support.ClassPathXmlApplicationContext;

public class Test_pc {
public static void main(String[] args) {

ApplicationContext context = new ClassPathXmlApplicationContext("aopctx_pc.xml");
		Operation_pc e=(Operation_pc)context.getBean("opBean");
		System.out.println("calling m1...");
		e.msg();
		System.out.println("calling m2...");
		e.m();
```

```
                System.out.println("calling m3...");
                e.k();
                }
}
```

aopctx_pc.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd">

<bean id="opBean" class="bvimit.edu.Operation_pc"></bean>

<bean id="trackMyBean" class="bvimit.edu.Aopdata_pc"></bean>

<bean
class="org.springframework.aop.aspectj.annotation.AnnotationAwareAspectJAutoProxyCreator"
></bean>

</beans>
```

Output: