Tutorial #03: How to develop a conversational web application that handles exceptions?

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Module: INT316D

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Purpose

The purpose of this tutorial is to demonstrate to the student how to develop a conversational web application that handles exceptions (fail-safe). In this application, we will implement the following concepts:

- HTML
- JSP
- Servlets
- EJBs (Stateless Session Beans)
- Exception handling
- Deployment Descriptor file (web.xml)

Our tutorial is having five parts, namely part A, B, C, D, and E. In part A we introduce the problem statement, in B we solve the problem, in C we test the application, in D we provide homework, and in E we conclude.

PART A

Problem statement

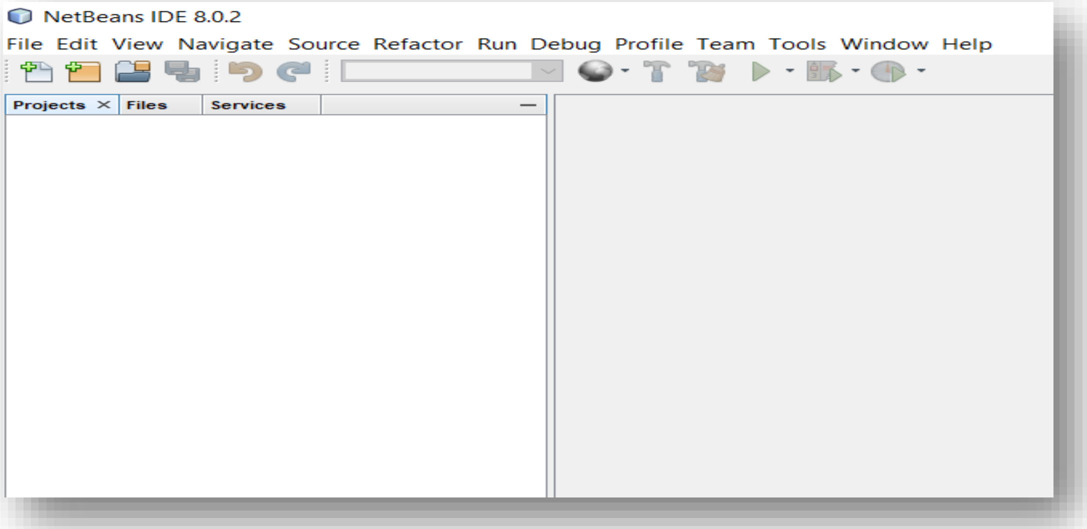
Create a web application that will allow a user to practice their mathematical skills on addition and multiplication. The application must give a student a question based on the operation the operation they want to perform. When the user decides to end the program, the application must provide a summary report on the performance of the student.

PART B

Create Solution

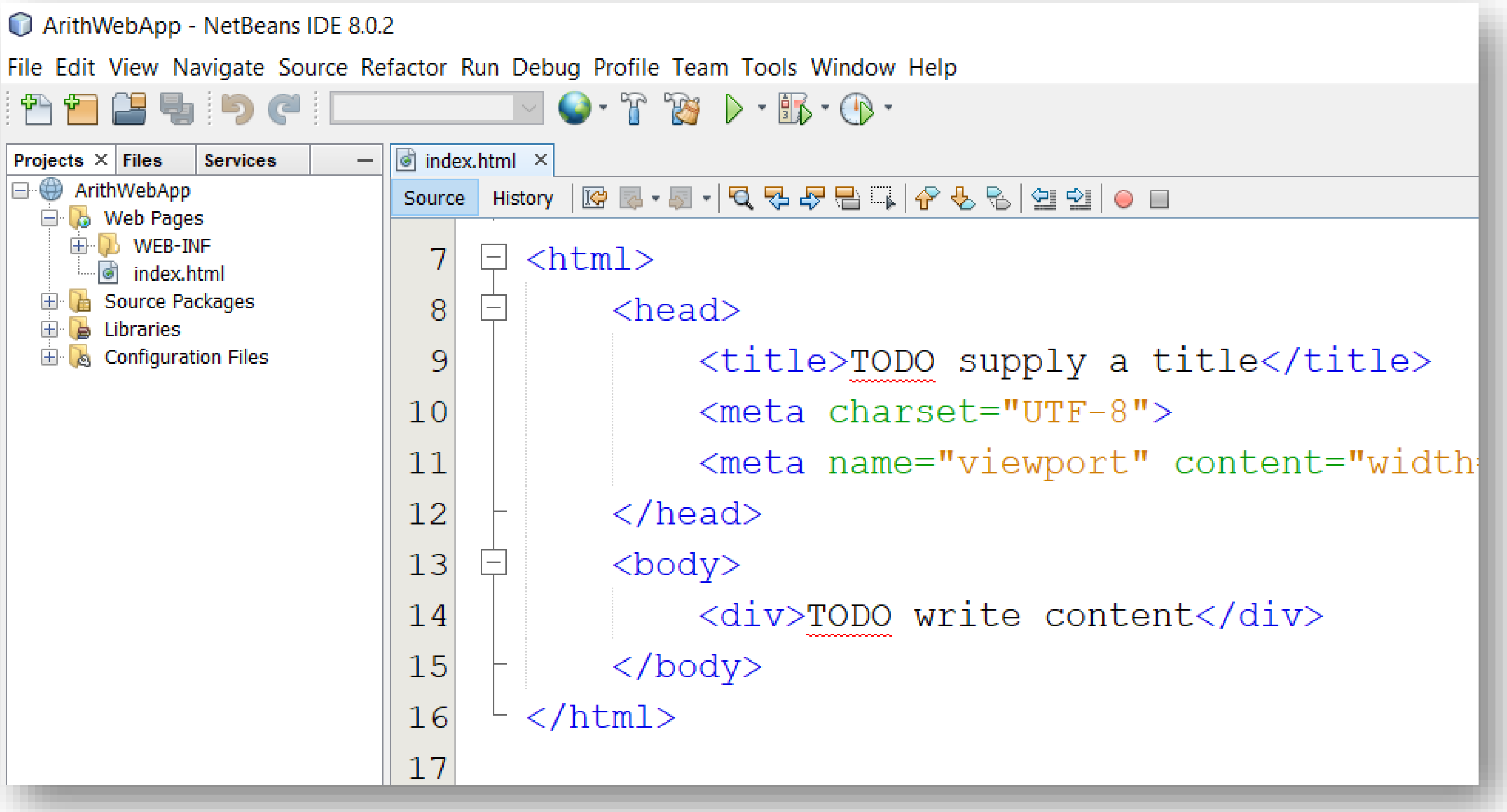
Step 1

Launch **NetBeans**.


NetBeans IDE 8.0.2
File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help
Projects
Files
Services

Step 2

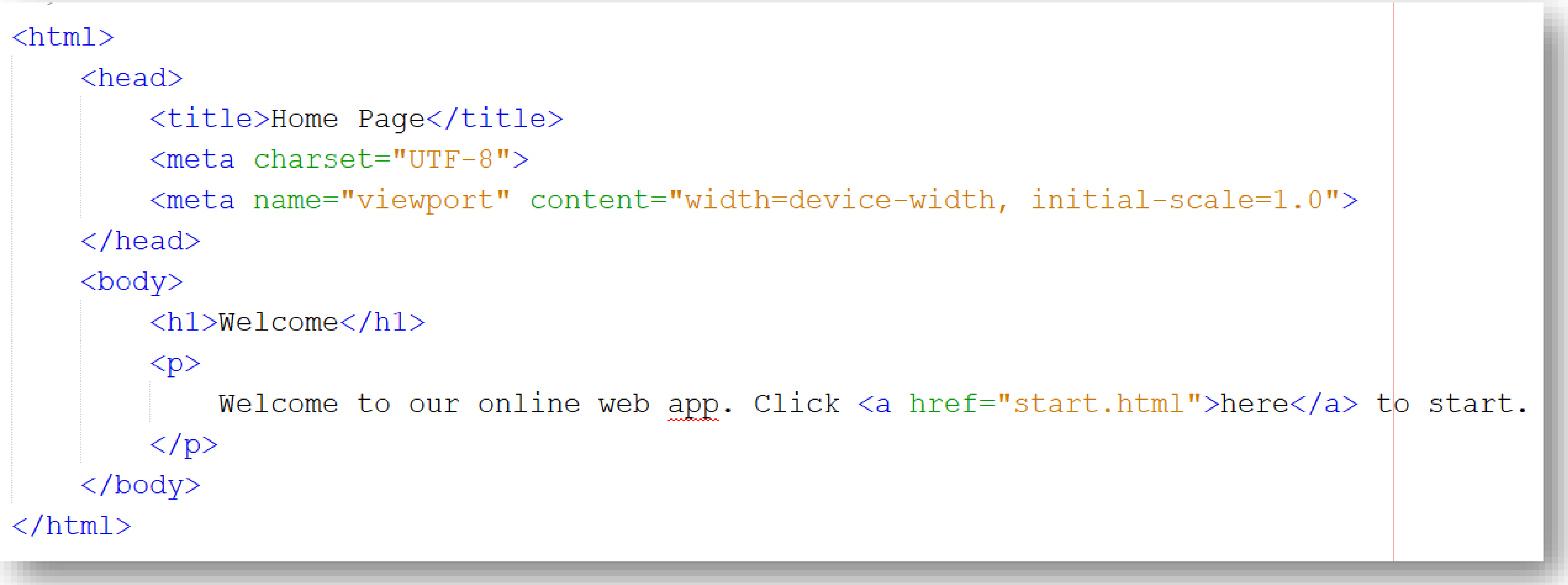
Create a web application called **ArithWebApp**.



```
<html>
    <head>
        <title>TODO supply a title</title>
        <meta charset="UTF-8">
        <meta name="viewport" content="width
    </head>
    <body>
        <div>TODO write content</div>
    </body>
</html>
```

Step 3

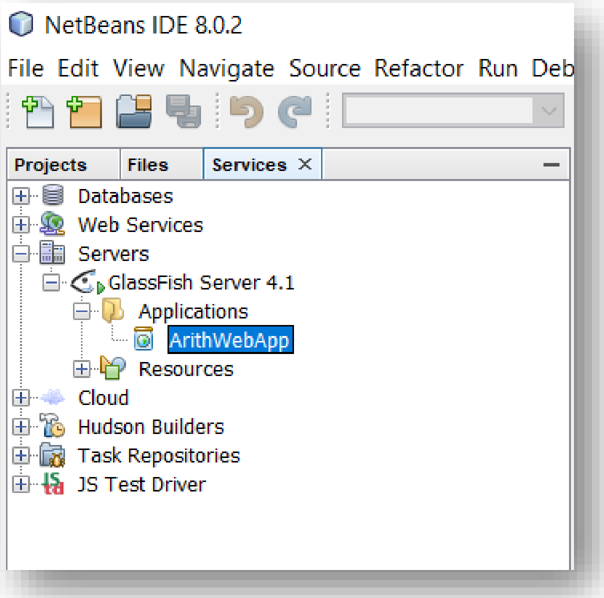
Update the index.html page.



```
<html>
    <head>
        <title>Home Page</title>
        <meta charset="UTF-8">
        <meta name="viewport" content="width=device-width, initial-scale=1.0">
    </head>
    <body>
        <h1>Welcome</h1>
        <p>
            Welcome to our online web app. Click <a href="start.html">here</a> to start.
        </p>
    </body>
</html>
```

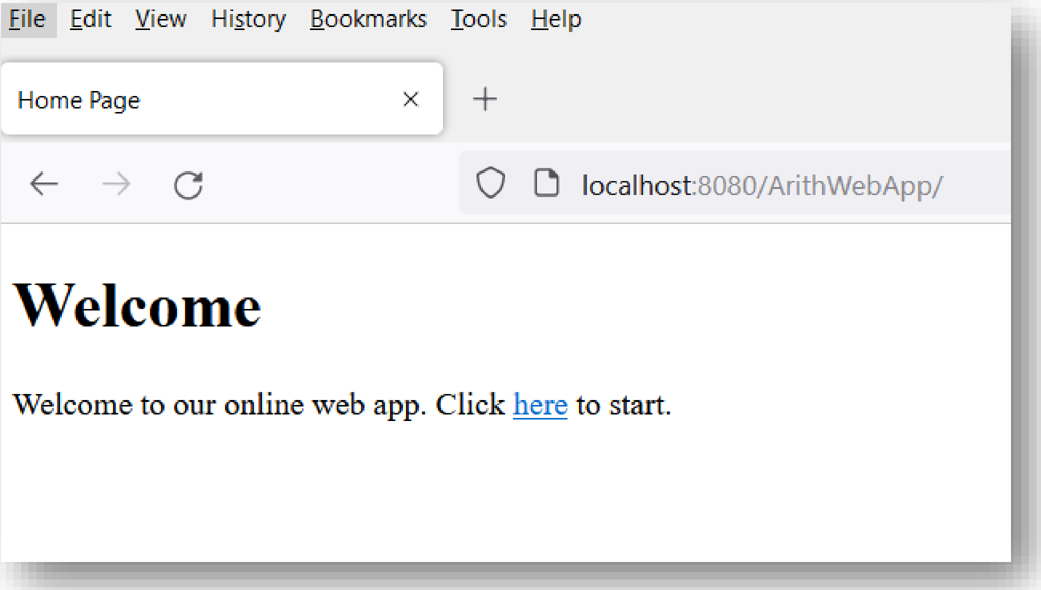
Step 4

Clean, Build, Start server, Deploy, and Run the war file.



Step 5

Run the web application.

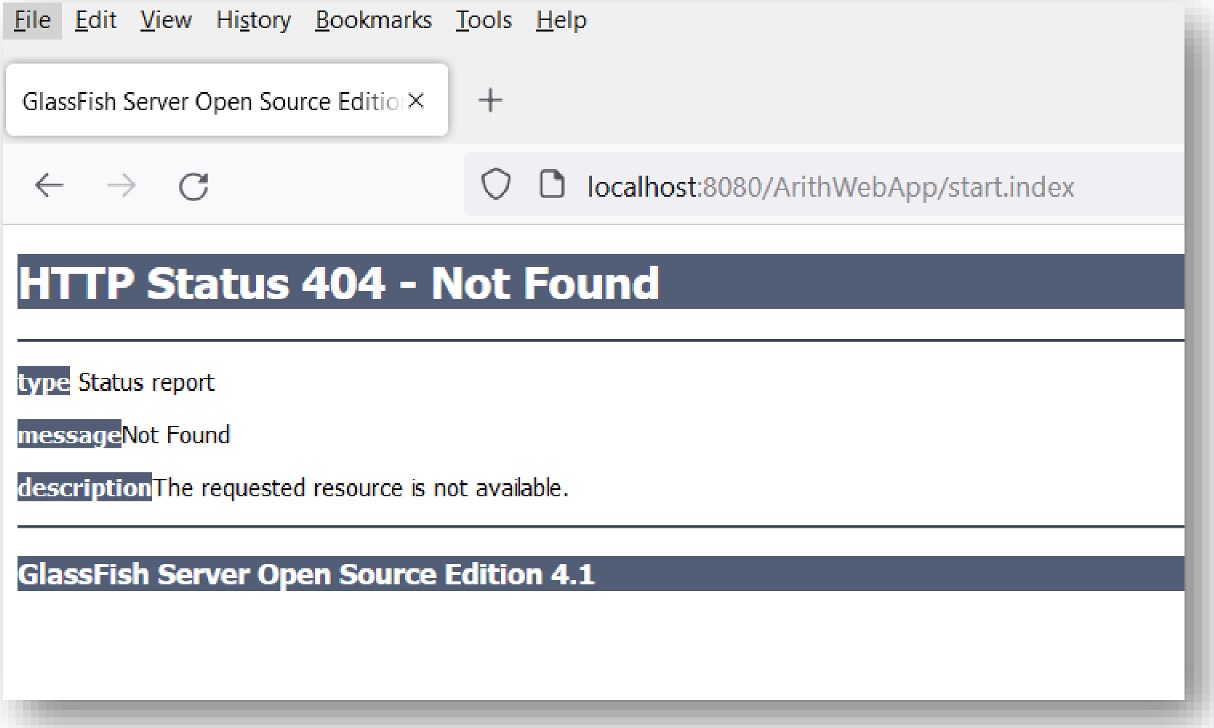

File Edit View History Bookmarks Tools Help
Home Page
localhost:8080/ArithWebApp/

Welcome

Welcome to our online web app. Click here to start.

Step 6

Click on the link.


File Edit View History Bookmarks Tools Help
GlassFish Server Open Source Editio
localhost:8080/ArithWebApp/start.index

HTTP Status 404 - Not Found

type Status report

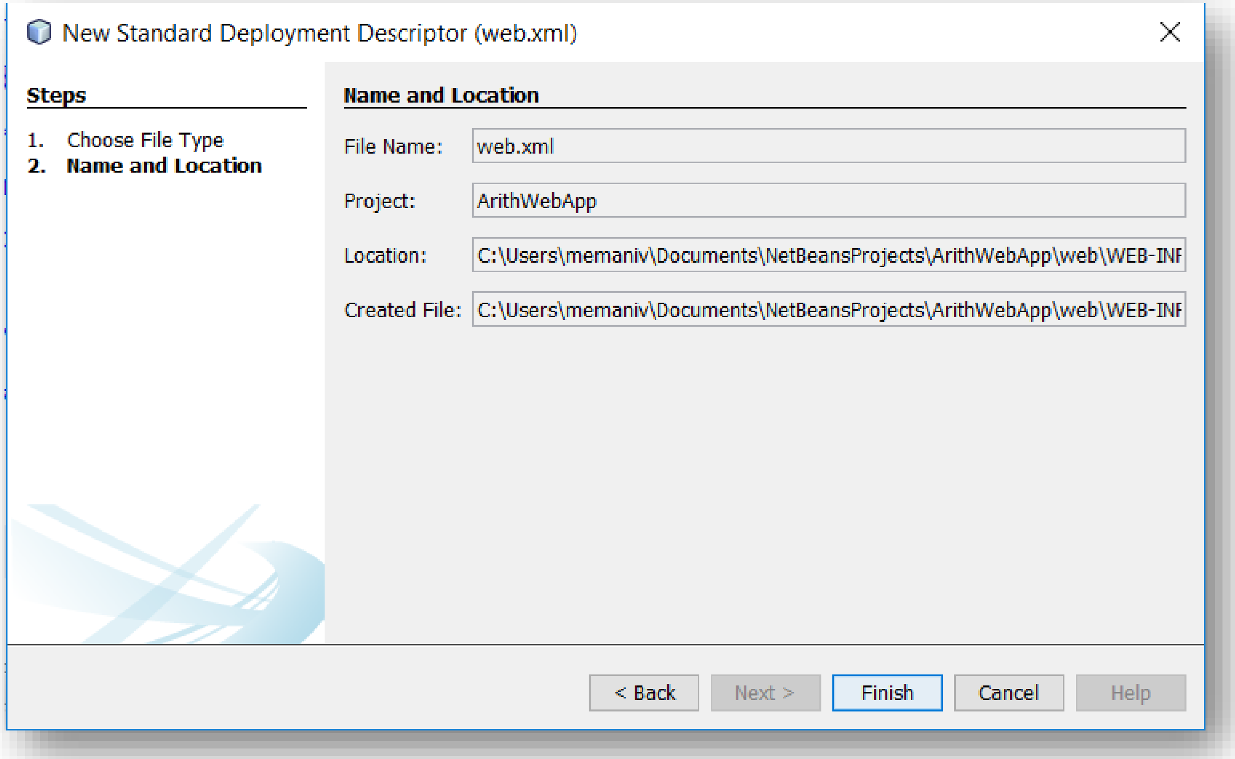
message Not Found

description The requested resource is not available.

GlassFish Server Open Source Edition 4.1

The requested resource, **start.html**, was not found, hence the **404** status code. Let us handle this exception through a file called **fileNotFound.jsp**

Right-click on the project, then **New | Standard Deployment Descriptor (web.xml)**



New Standard Deployment Descriptor (web.xml)

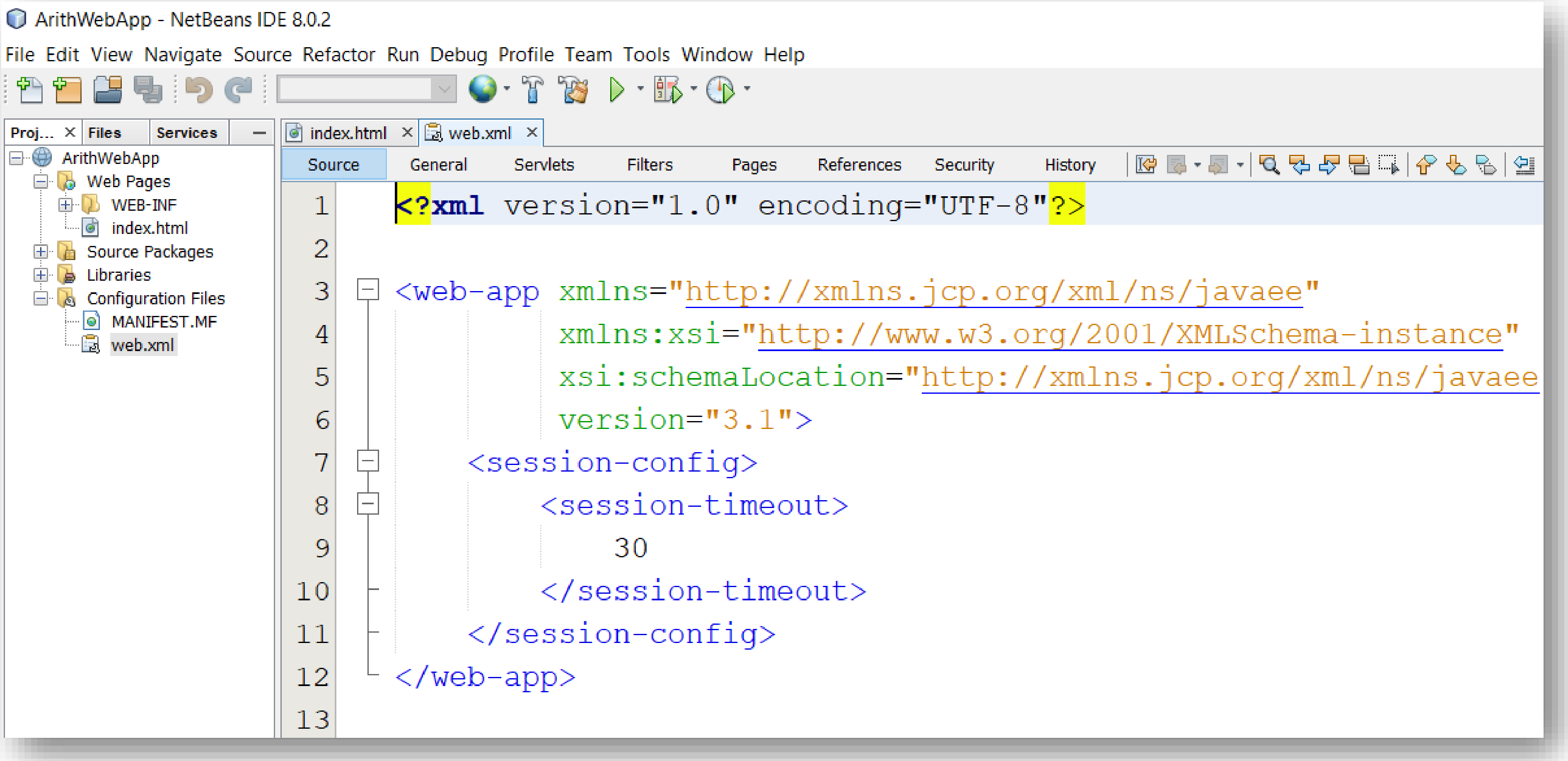
File Name: web.xml

Project: ArithWebApp

Location: C:\Users\memaniv\Documents\NetBeansProjects\ArithWebApp\web\WEB-INF

Created File: C:\Users\memaniv\Documents\NetBeansProjects\ArithWebApp\web\WEB-INF

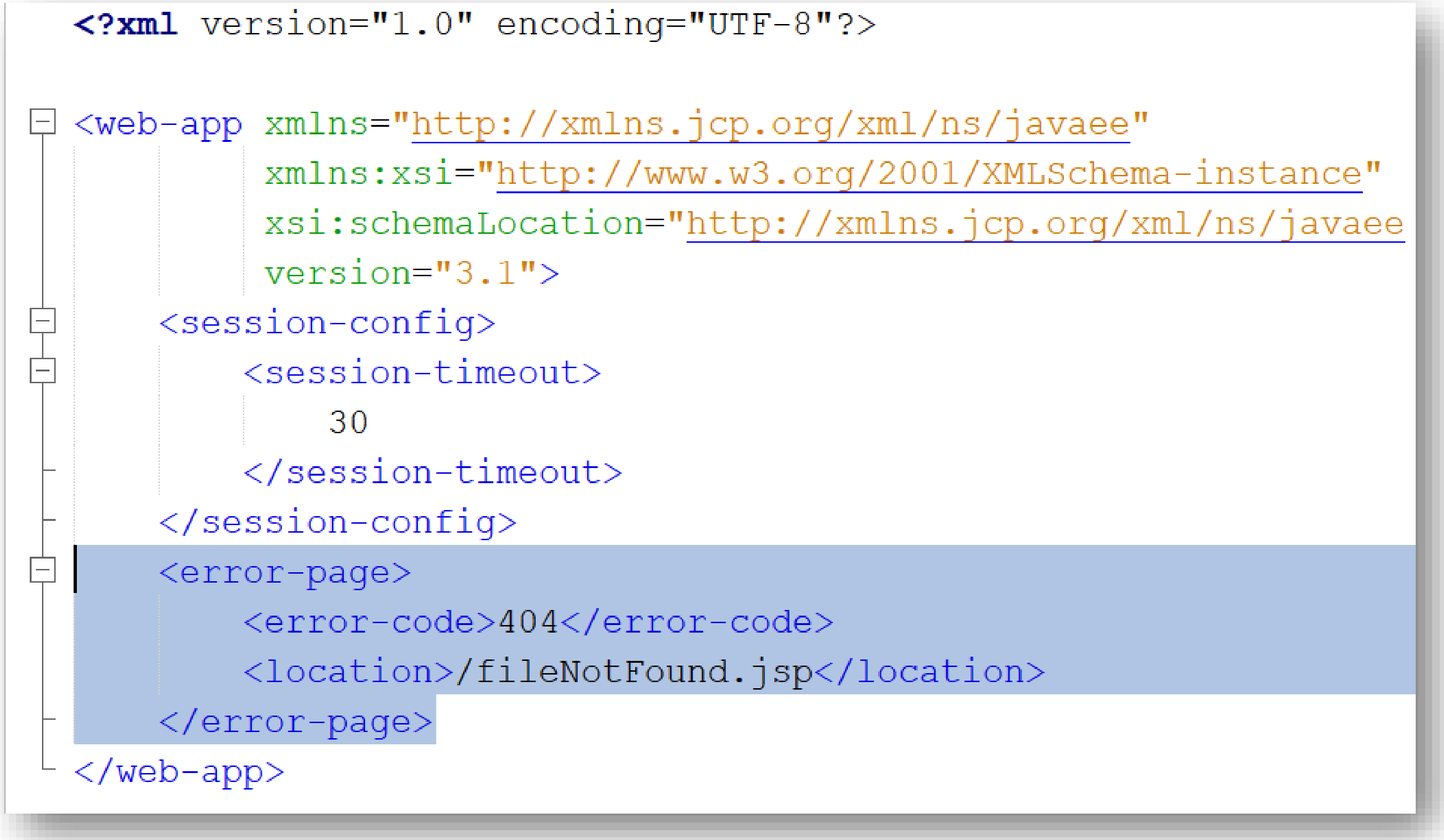
Click on **Finish.**



ArithWebApp - NetBeans IDE 8.0.2
File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help
Proj... Files Services
ArithWebApp
Web Pages
WEB-INF
index.html
Source Packages
Libraries
Configuration Files
MANIFEST.MF
web.xml
index.html
web.xml
Source General Servlets Filters Pages References Security History

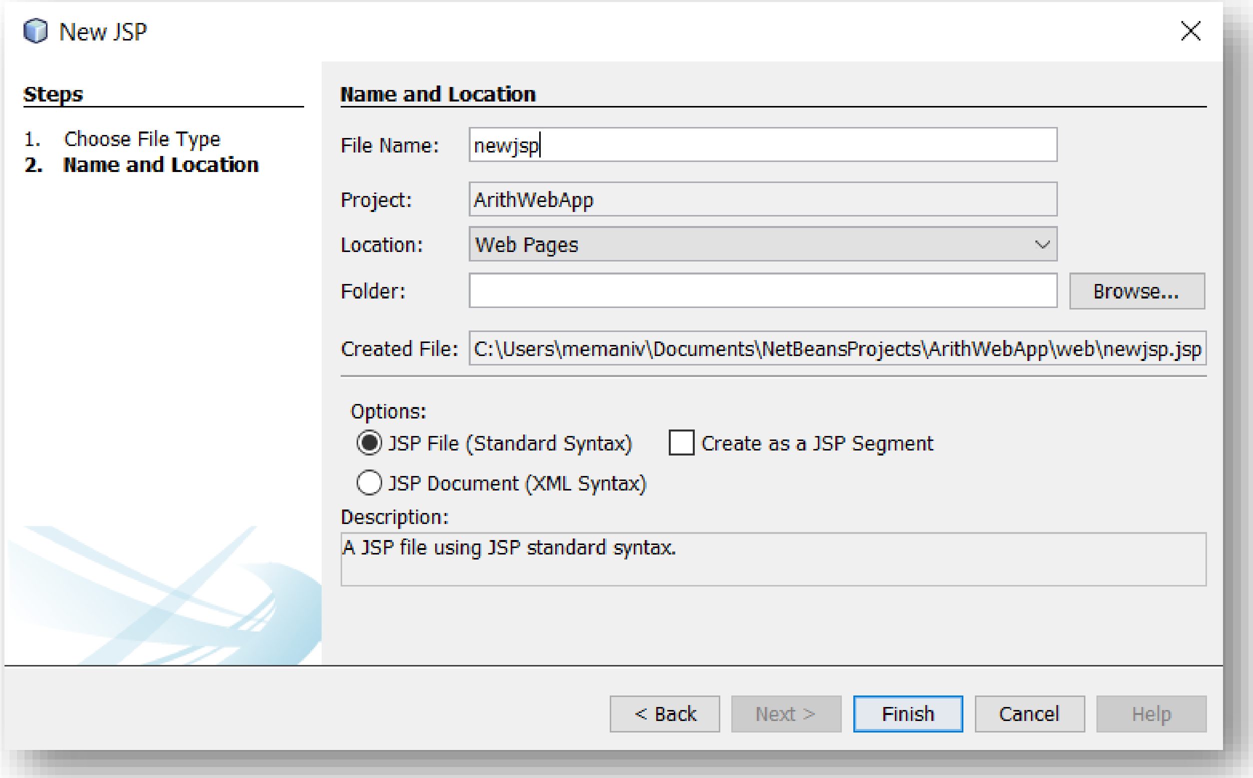
```xml
<?xml version="1.0" encoding="UTF-8"?>

<web-app xmlns="http://xmlns.jcp.org/xml/ns/javaee"
         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xsi:schemaLocation="http://xmlns.jcp.org/xml/ns/javaee
         version="3.1">
    <session-config>
        <session-timeout>
            30
        </session-timeout>
    </session-config>
</web-app>

```

Add an error page element that will be used to handle the 404 error when it occurs. The error will be handled through a page, **fileNotFound.jsp**, which will display a user-friendly page.



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

<web-app xmlns="http://xmlns.jcp.org/xml/ns/javaee"
         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xsi:schemaLocation="http://xmlns.jcp.org/xml/ns/javaee
         version="3.1">
    <session-config>
        <session-timeout>
            30
        </session-timeout>
    </session-config>
    <error-page>
        <error-code>404</error-code>
        <location>/fileNotFound.jsp</location>
    </error-page>
</web-app>
```

Create the actual page. Right-click on the **Web-Pages** folder and select **New | JSP**



New JSP

Steps

1. Choose File Type
2. **Name and Location**

Name and Location

File Name: newjsp

Project: ArithWebApp

Location: Web Pages

Folder:

Created File: C:\Users\memaniv\Documents\NetBeansProjects\ArithWebApp\web\newjsp.jsp

Options:

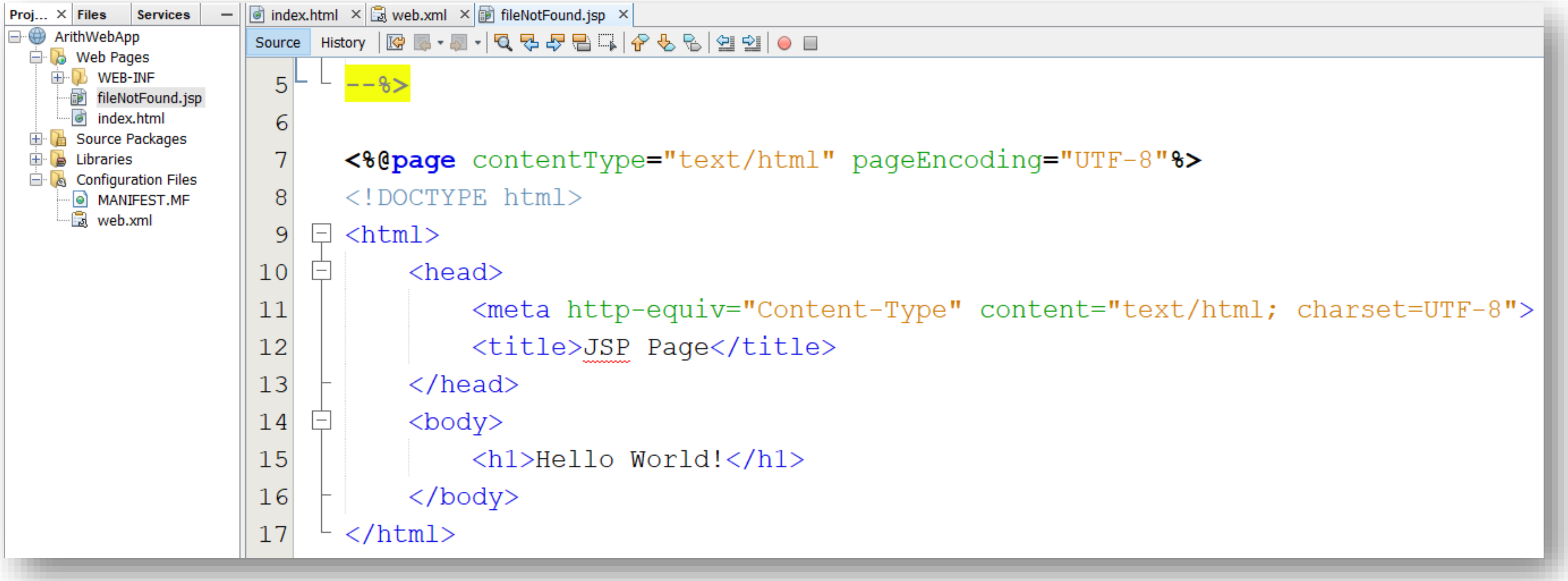
● JSP File (Standard Syntax) □ Create as a JSP Segment

○ JSP Document (XML Syntax)

Description:

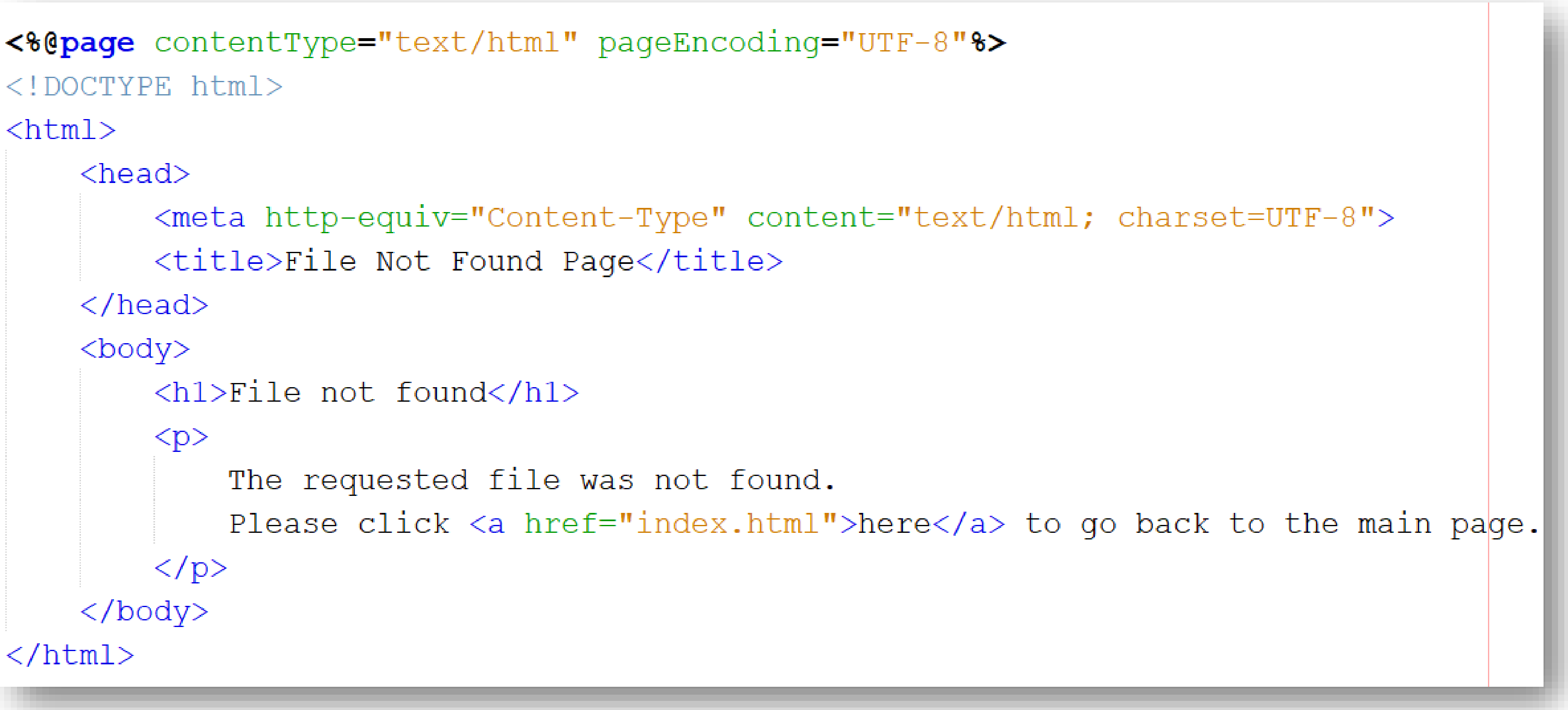
A JSP file using JSP standard syntax.

Name the file as **fileNotFound.jsp**, and click **Finish**.



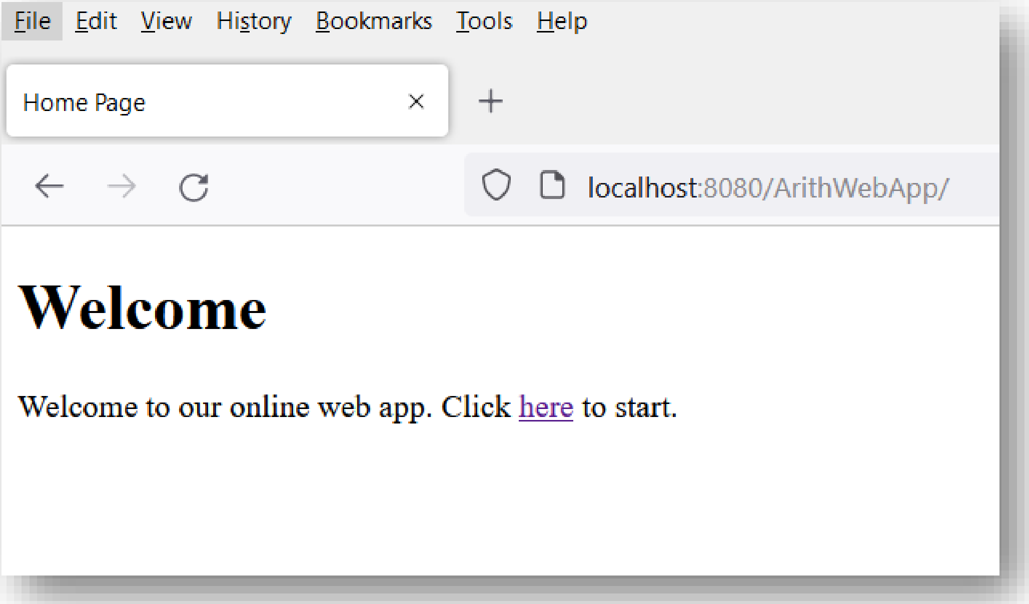
```
--%>

<%@page contentType="text/html" pageEncoding="UTF-8"%>
<!DOCTYPE html>
<html>
    <head>
        <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
        <title>JSP Page</title>
    </head>
    <body>
        <h1>Hello World!</h1>
    </body>
</html>
```

Edit the file.



```
<%@page contentType="text/html" pageEncoding="UTF-8"%>
<!DOCTYPE html>
<html>
    <head>
        <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
        <title>File Not Found Page</title>
    </head>
    <body>
        <h1>File not found</h1>
        <p>
            The requested file was not found.
            Please click <a href="index.html">here</a> to go back to the main page.
        </p>
    </body>
</html>
```

Clean, Build, Deploy, and Run the war file.

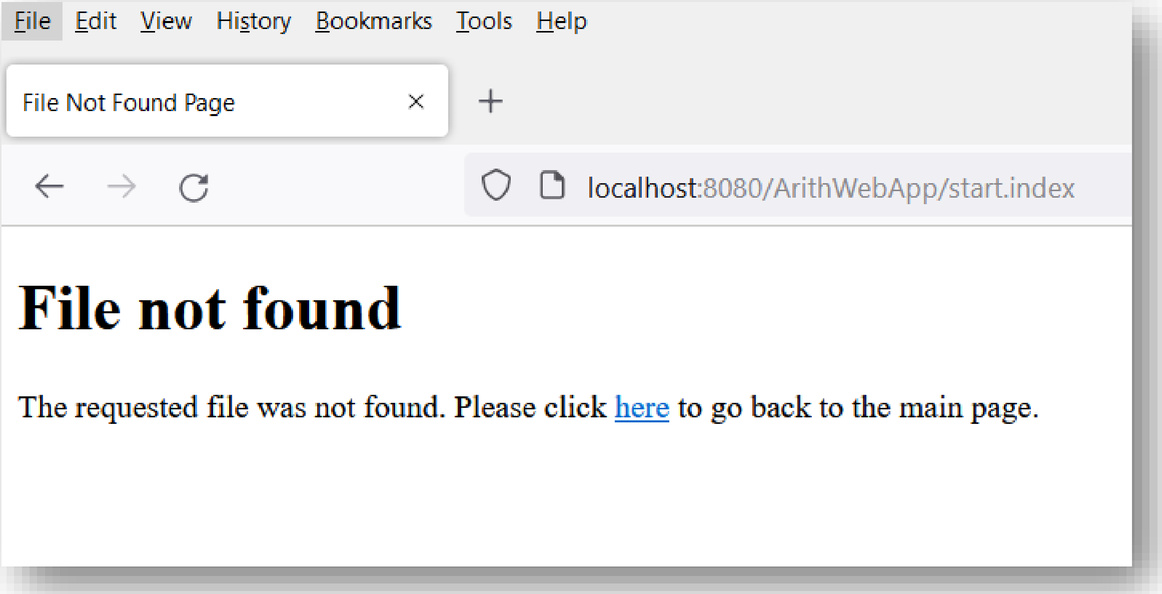


File Edit View History Bookmarks Tools Help
Home Page
localhost:8080/ArithWebApp/

Welcome

Welcome to our online web app. Click here to start.

Click on the link.

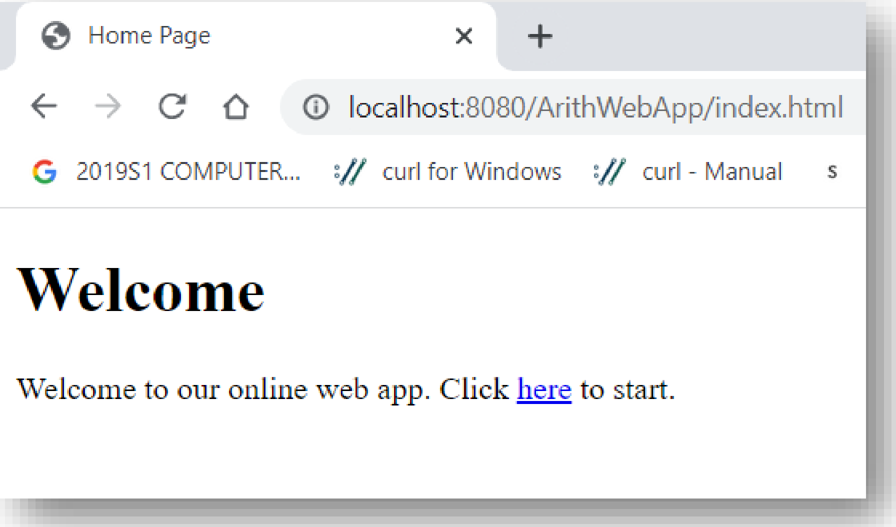


File not found

The requested file was not found. Please click here to go back to the main page.

The 404 exception has been handled.

Click on the link.

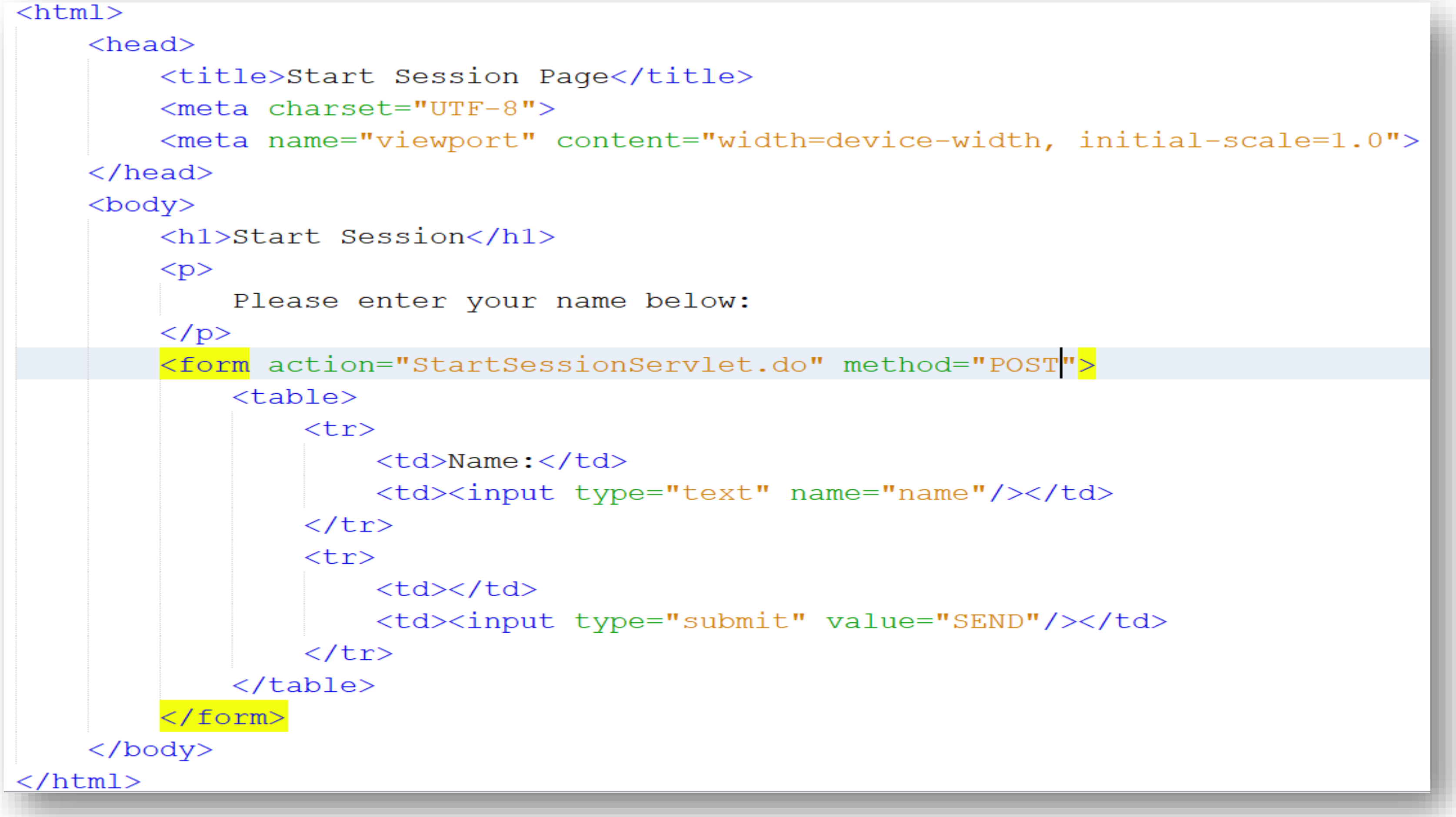


Welcome

Welcome to our online web app. Click here to start.

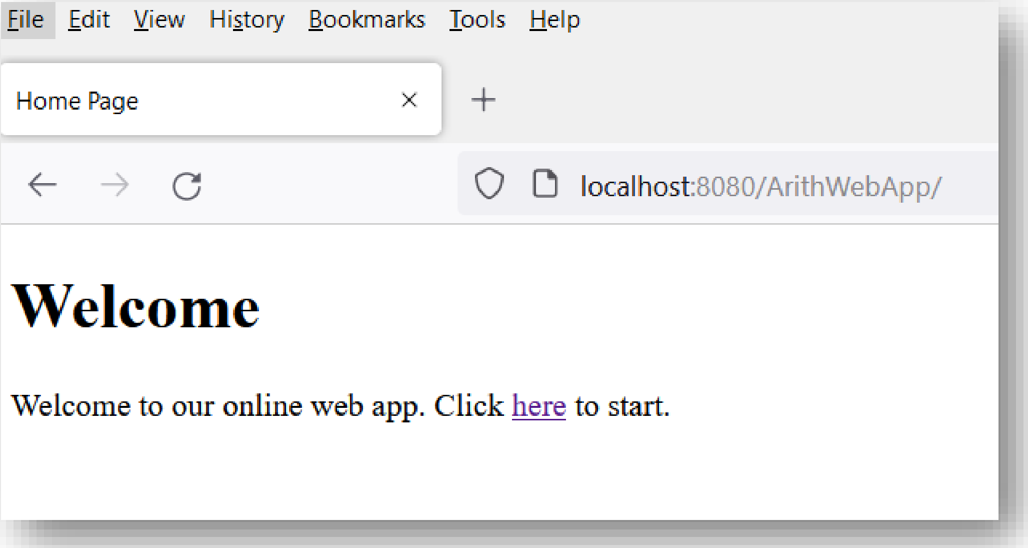
Step 7

Create the **start.html** file.



```
<html>
    <head>
        <title>Start Session Page</title>
        <meta charset="UTF-8">
        <meta name="viewport" content="width=device-width, initial-scale=1.0">
    </head>
    <body>
        <h1>Start Session</h1>
        <p>
            Please enter your name below:
        </p>
        <form action="StartSessionServlet.do" method="POST">
            <table>
                <tr>
                    <td>Name:</td>
                    <td><input type="text" name="name"/></td>
                </tr>
                <tr>
                    <td></td>
                    <td><input type="submit" value="SEND"/></td>
                </tr>
            </table>
        </form>
    </body>
</html>
```

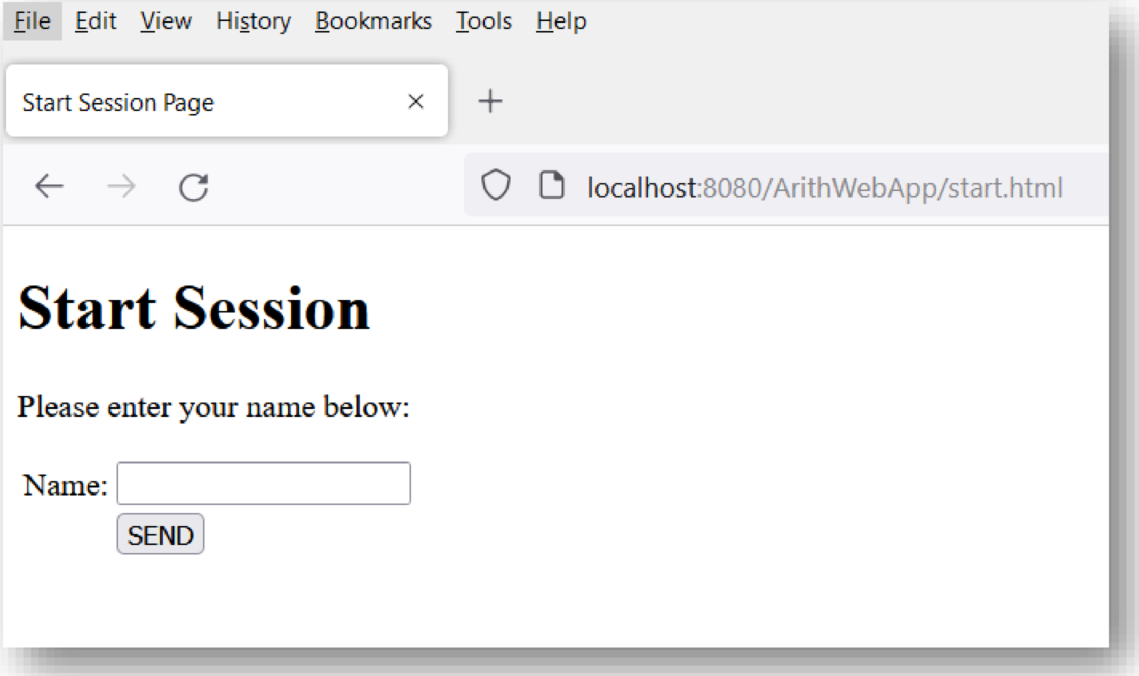
Clean, Build, Deploy and Run application.


File Edit View History Bookmarks Tools Help
Home Page
localhost:8080/ArithWebApp/

Welcome

Welcome to our online web app. Click here to start.

Click on the link.

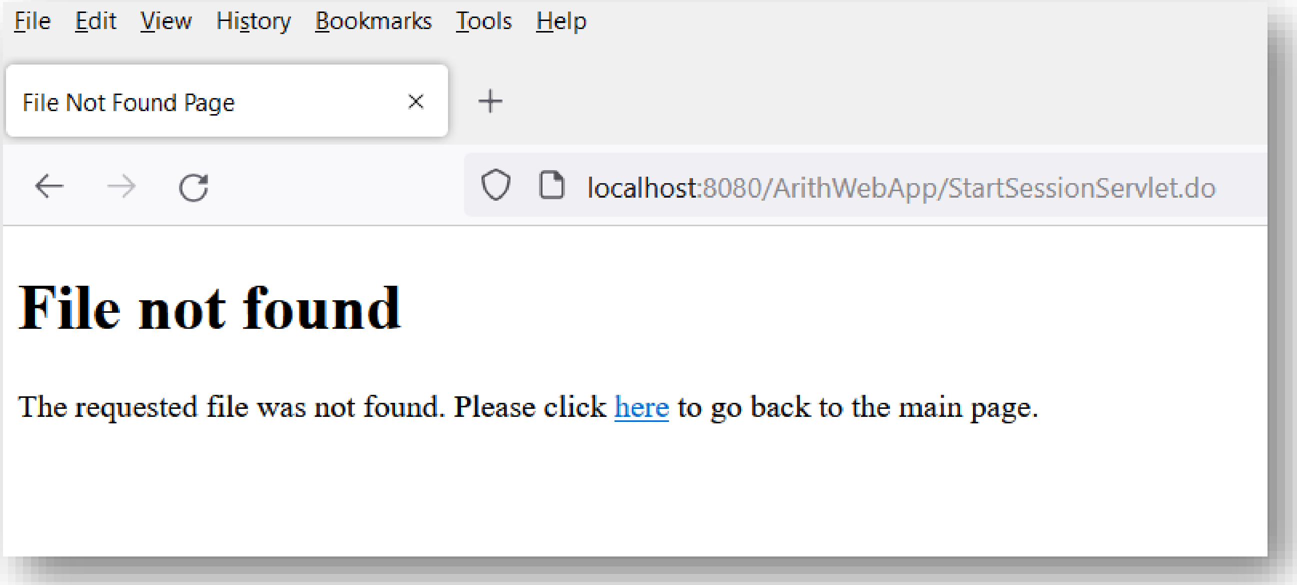

File Edit View History Bookmarks Tools Help
Start Session Page
localhost:8080/ArithWebApp/start.html

Start Session

Please enter your name below:

Name:

Provide a name and click the **SEND** button.

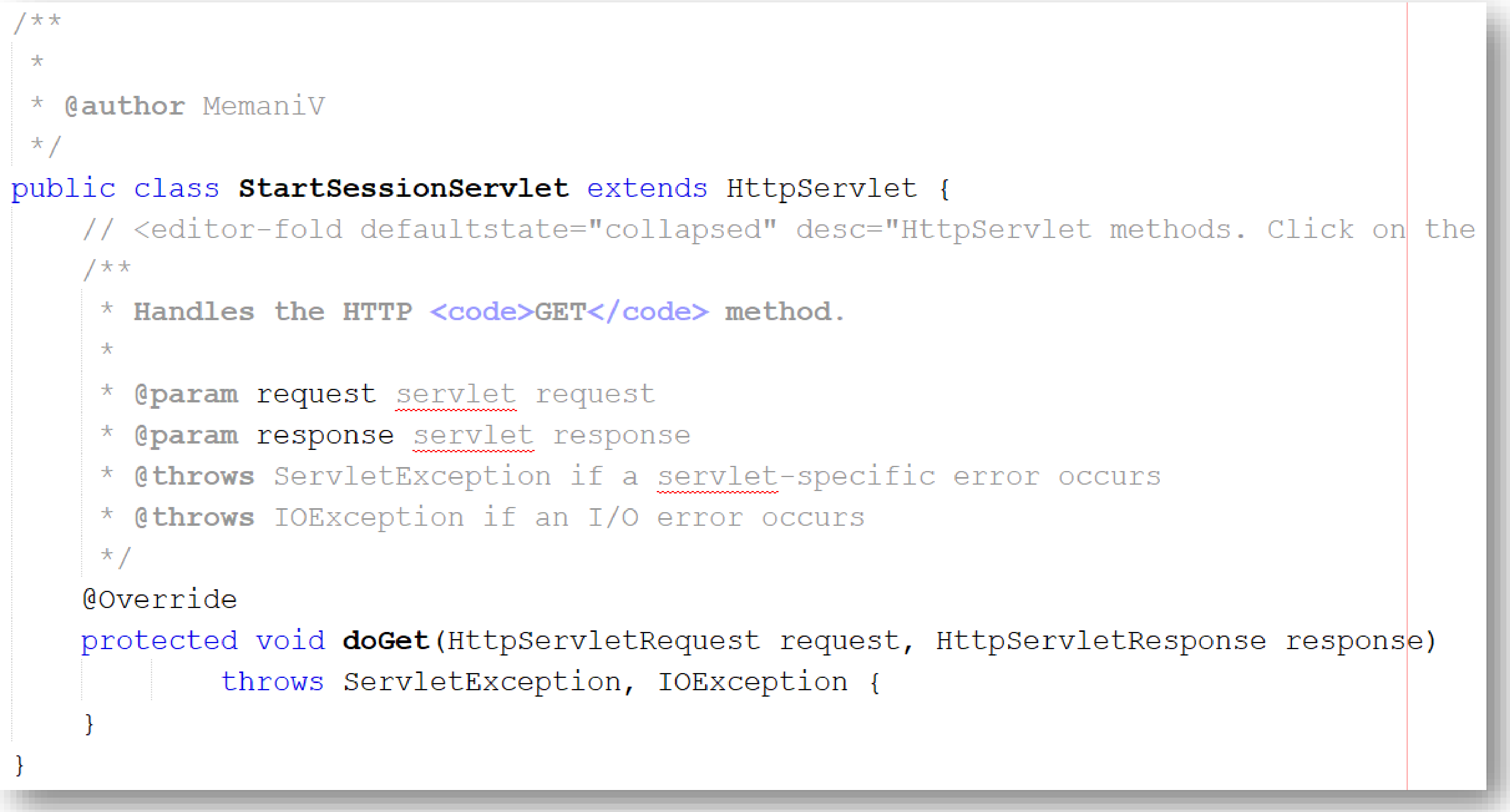

File Edit View History Bookmarks Tools Help
File Not Found Page
localhost:8080/ArithWebApp/StartSessionServlet.do

File not found

The requested file was not found. Please click here to go back to the main page.

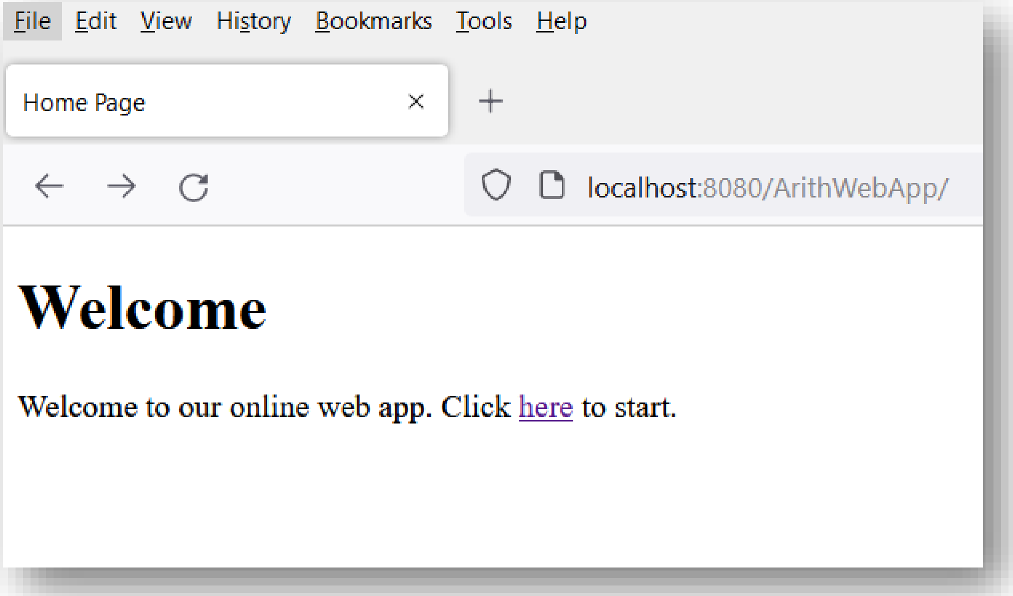
The requested servlet was not found. Let us create it.

Create a servlet called **StartSessionServlet**.



```
/**
 *
 * @author MemaniV
 */
public class StartSessionServlet extends HttpServlet {
    // <editor-fold defaultstate="collapsed" desc="HttpServlet methods. Click on the
    /**
     * Handles the HTTP <code>GET</code> method.
     *
     * @param request servlet request
     * @param response servlet response
     * @throws ServletException if a servlet-specific error occurs
     * @throws IOException if an I/O error occurs
     */
    @Override
    protected void doGet(HttpServletRequest request, HttpServletResponse response)
            throws ServletException, IOException {
    }
}
```

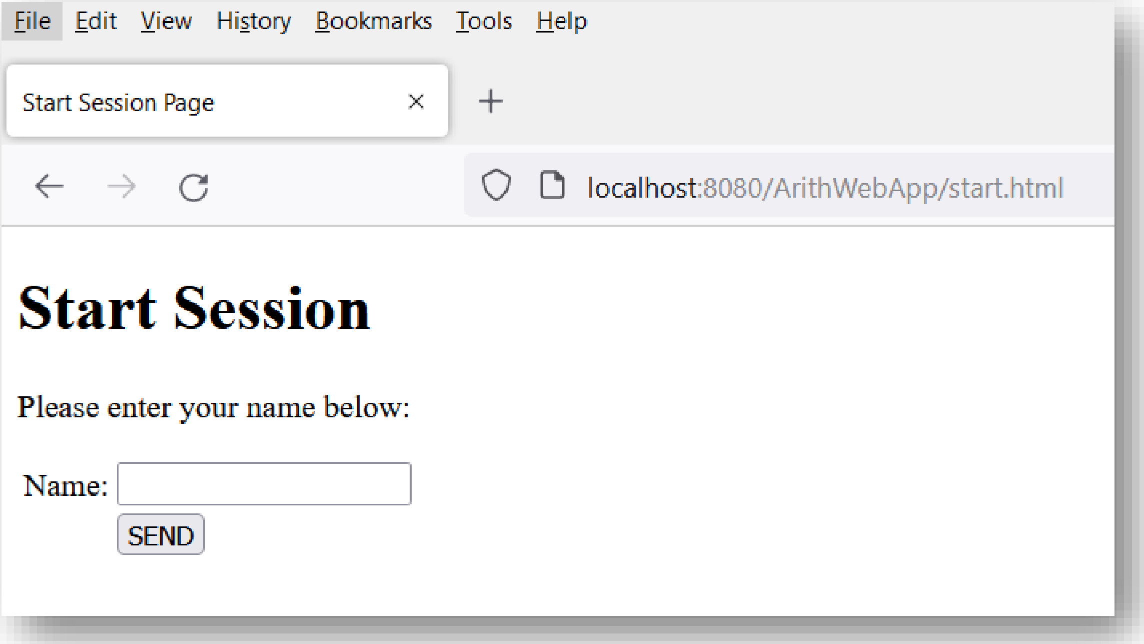
Clean, Build, Deploy and Run the war file.


File Edit View History Bookmarks Tools Help
Home Page
localhost:8080/ArithWebApp/

Welcome

Welcome to our online web app. Click here to start.

Click on the link.

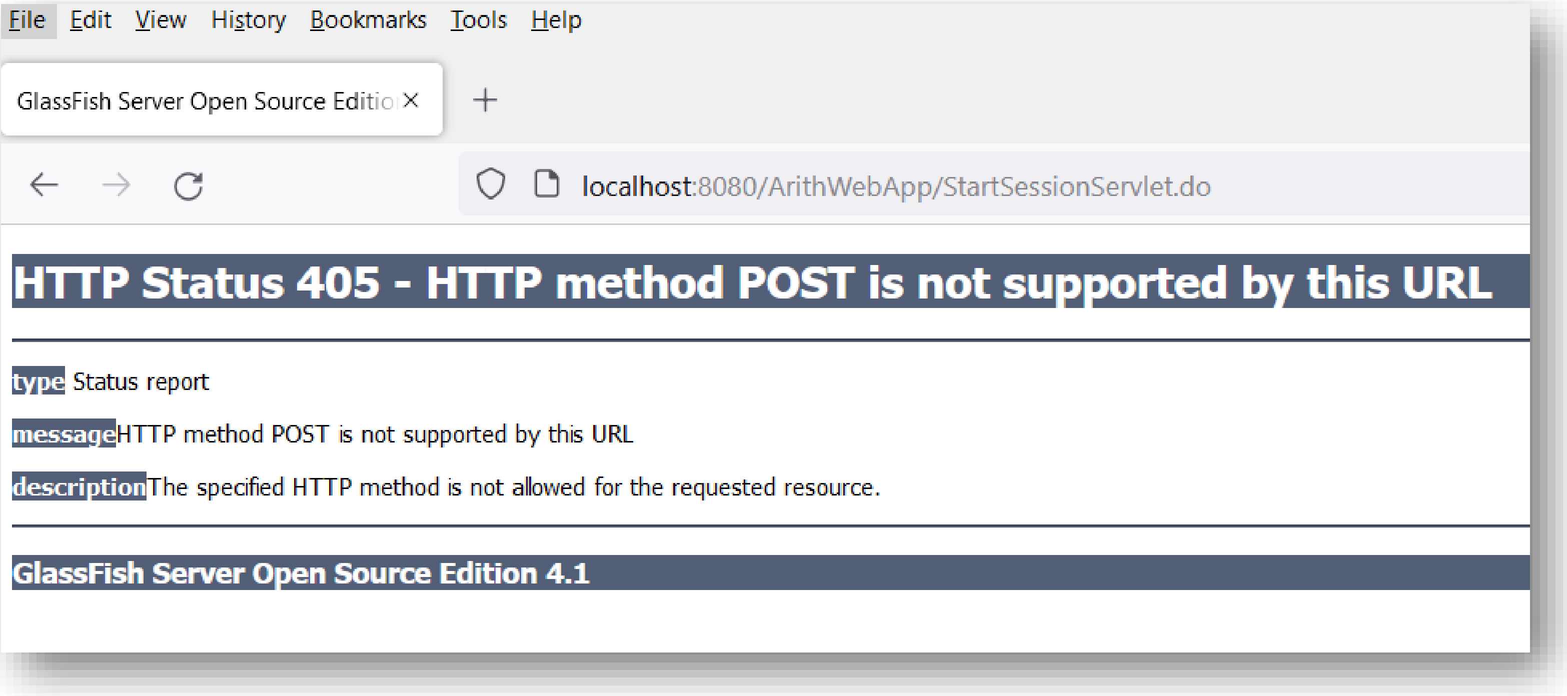


Start Session

Please enter your name below:

Name:

Enter name and click on the SEND button.


File Edit View History Bookmarks Tools Help
GlassFish Server Open Source Editio ×
localhost:8080/ArithWebApp/StartSessionServlet.do

HTTP Status 405 - HTTP method POST is not supported by this URL

type Status report

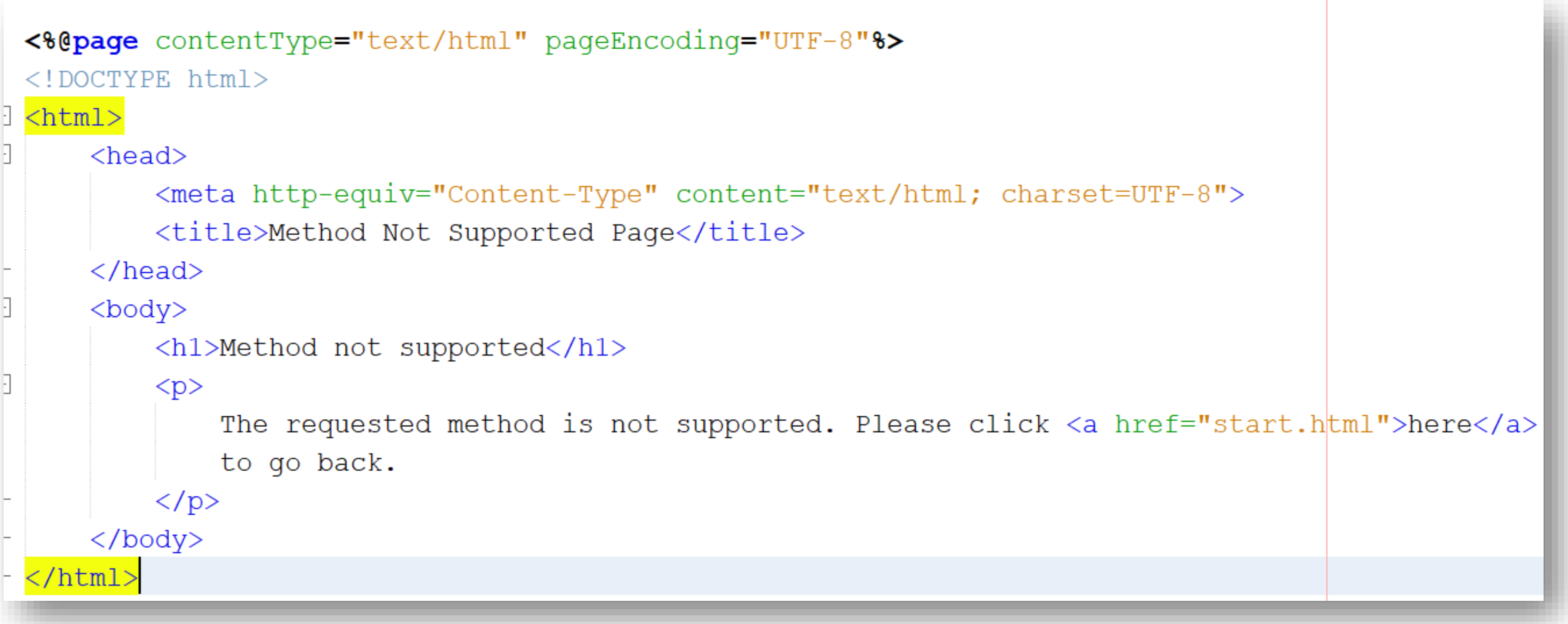
messageHTTP method POST is not supported by this URL

descriptionThe specified HTTP method is not allowed for the requested resource.

GlassFish Server Open Source Edition 4.1

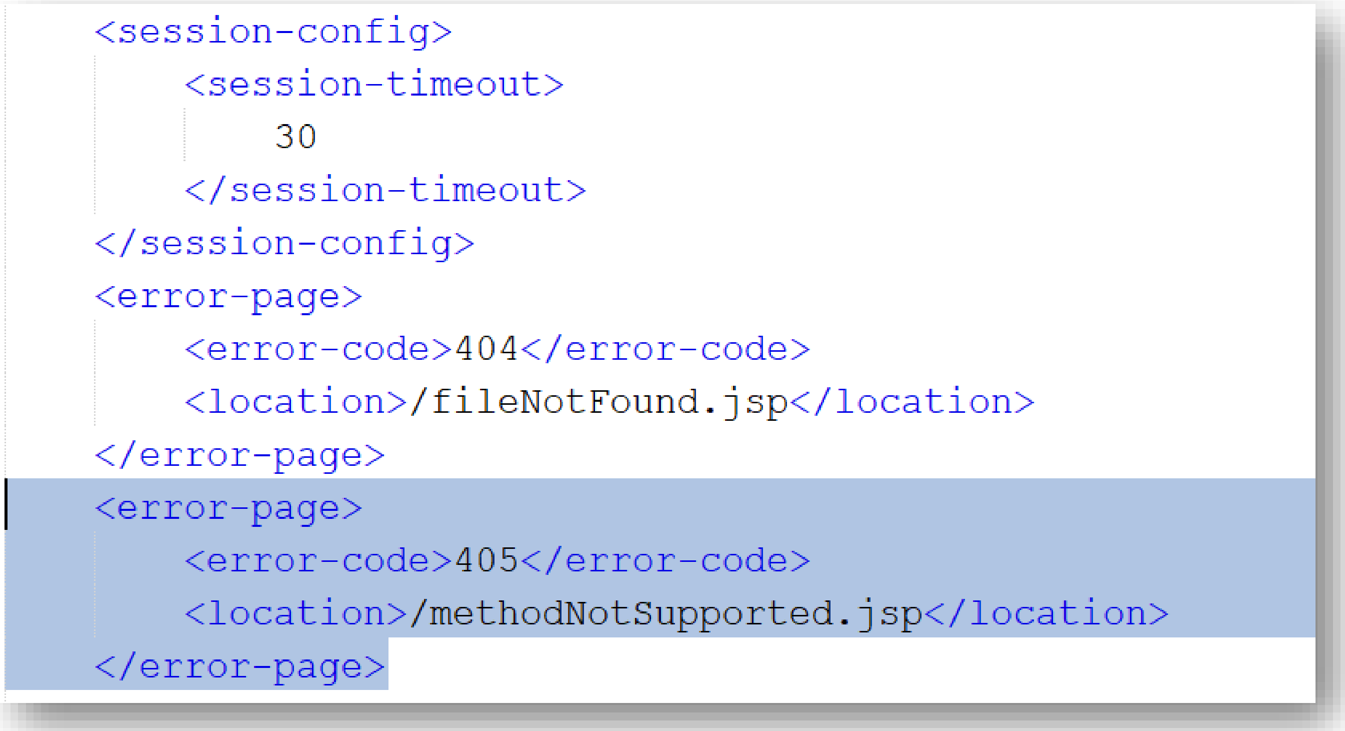
The POST method is not supported by the called servlet. Let us handle this exception.

Create a file to handle this exception, call it **methodNotSupportedError.jsp**



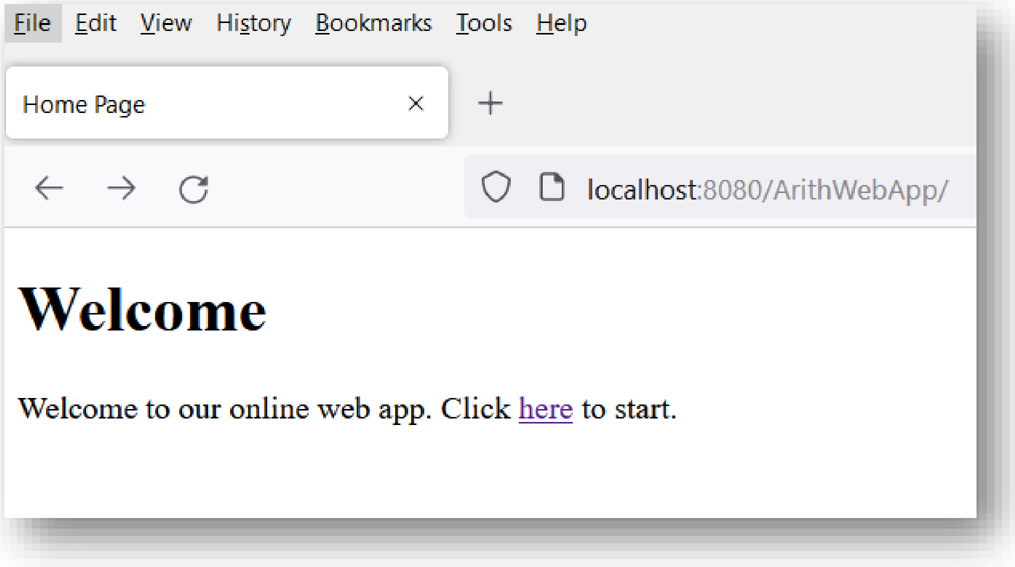
```
<%@page contentType="text/html" pageEncoding="UTF-8"%>
<!DOCTYPE html>
<html>
    <head>
        <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
        <title>Method Not Supported Page</title>
    </head>
    <body>
        <h1>Method not supported</h1>
        <p>
            The requested method is not supported. Please click <a href="start.html">here</a>
            to go back.
        </p>
    </body>
</html>
```

Include the page in the **DD** file.



```
    <session-config>
        <session-timeout>
            30
        </session-timeout>
    </session-config>
    <error-page>
        <error-code>404</error-code>
        <location>/fileNotFound.jsp</location>
    </error-page>
    <error-page>
        <error-code>405</error-code>
        <location>/methodNotSupported.jsp</location>
    </error-page>
```

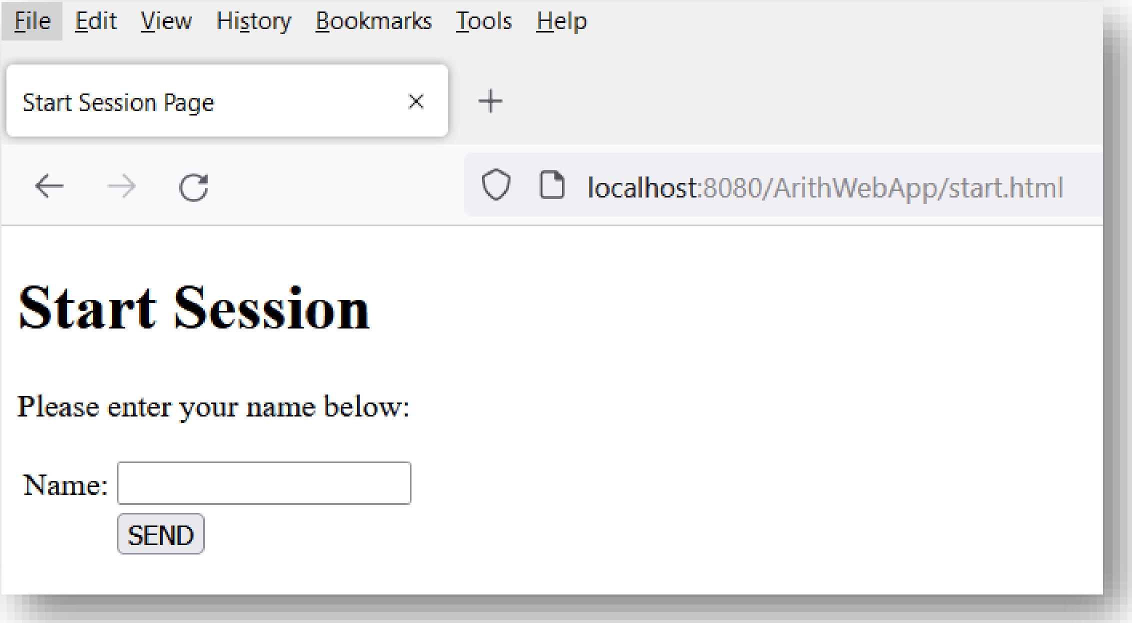
Clean, Build, Deploy, and Run.



Welcome

Welcome to our online web app. Click here to start.

Click on the link

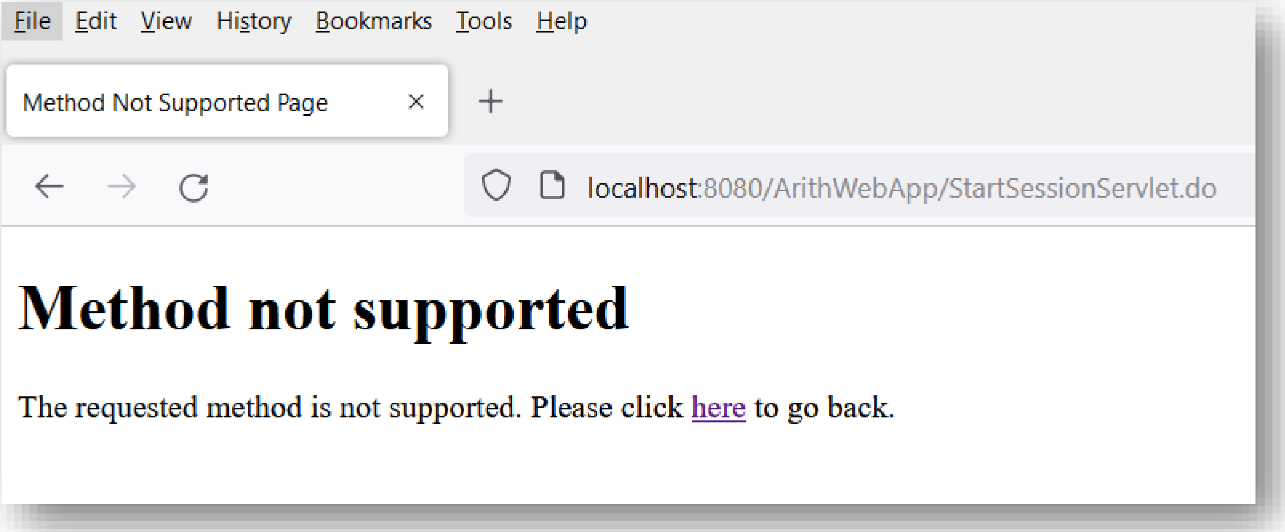


Start Session

Please enter your name below:

Name:

Enter name and click SEND

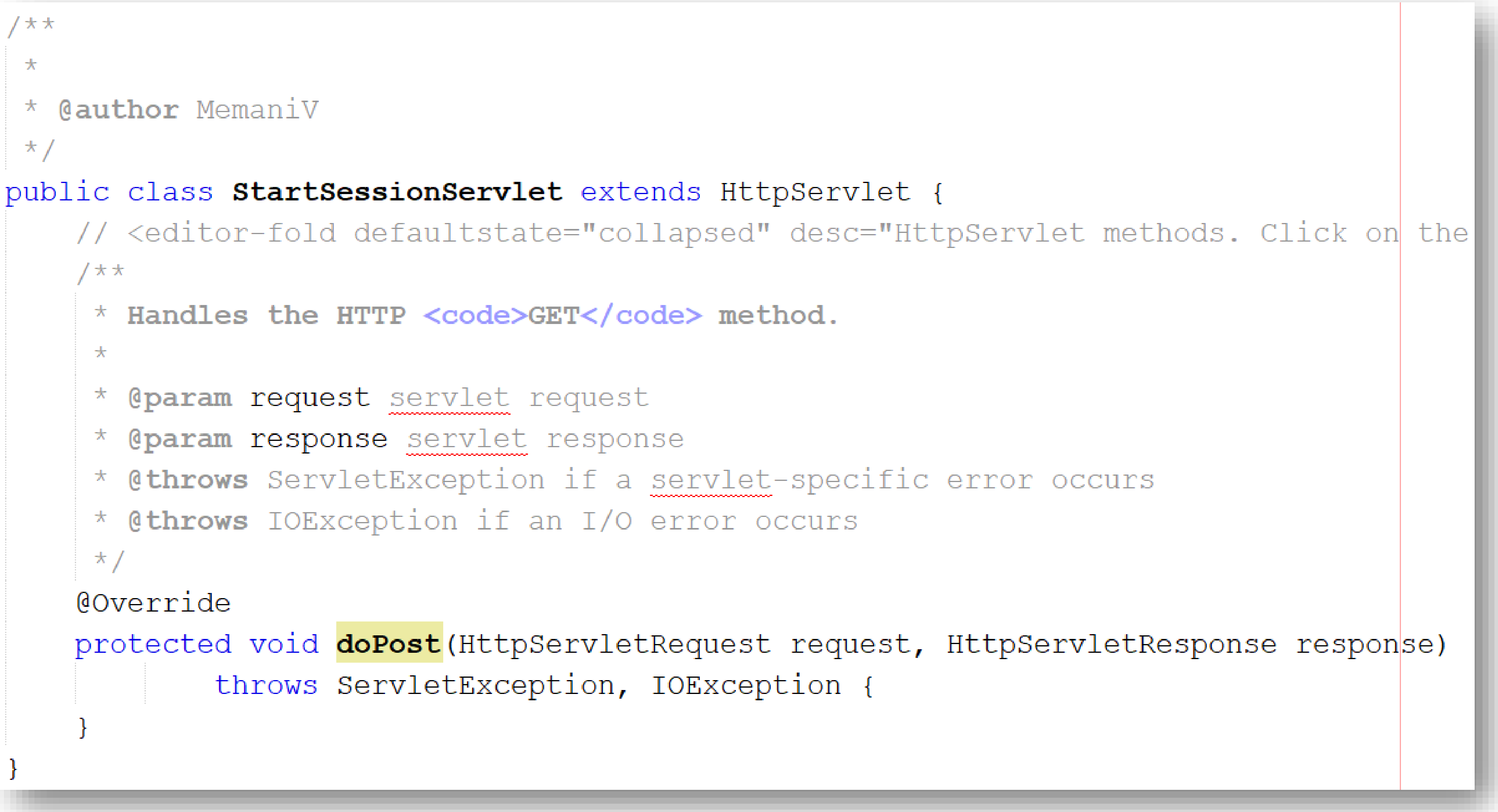

File
Edit
View
History
Bookmarks
Tools
Help
Method Not Supported Page
localhost:8080/ArithWebApp/StartSessionServlet.do

Method not supported

The requested method is not supported. Please click here to go back.

The 405 exception has been handled.

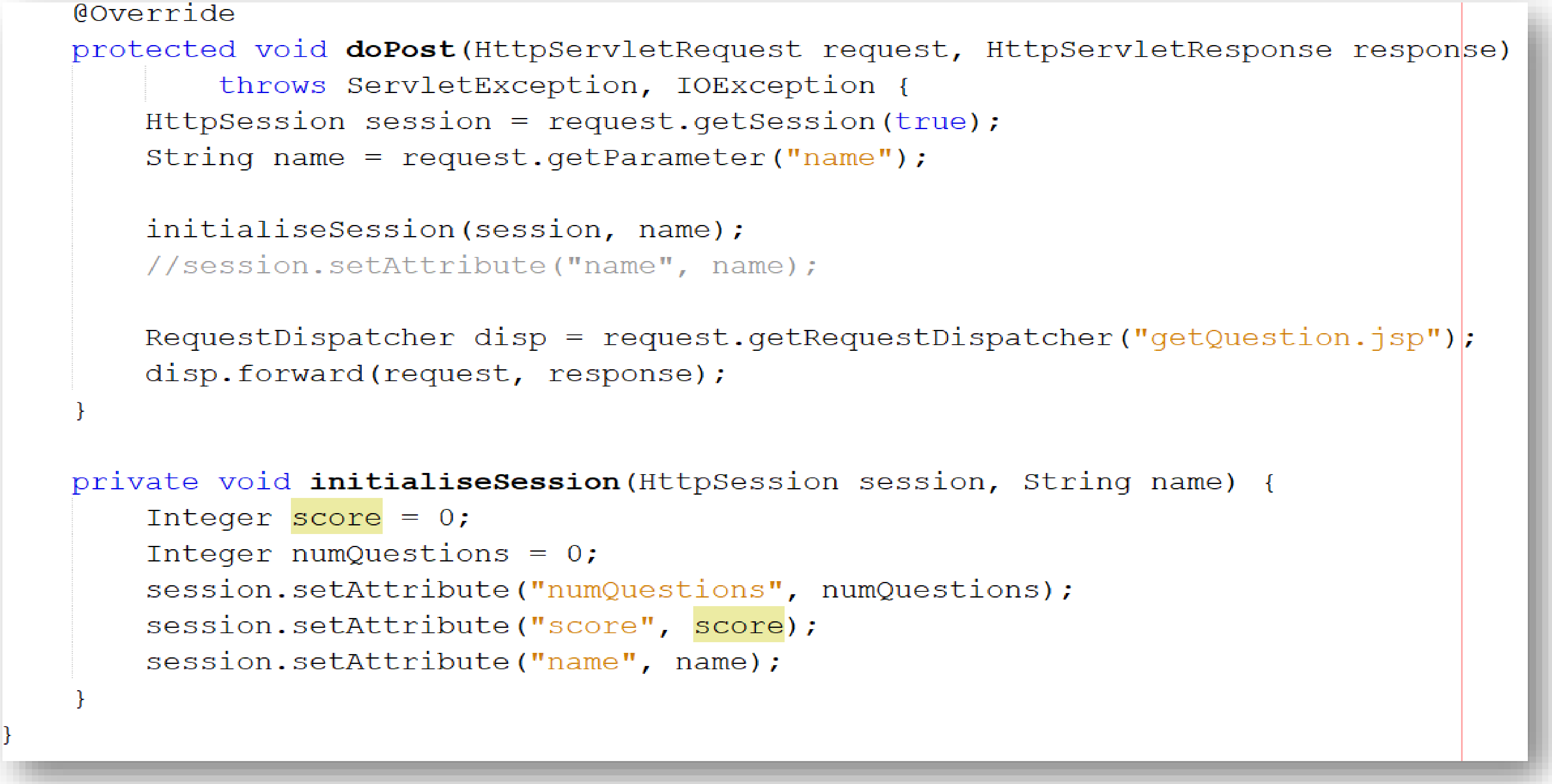
The POST method is not supported by the called servlet. Change doGet() to doPost() method in the servlet.



```
/**
 *
 * @author MemaniV
 */
public class StartSessionServlet extends HttpServlet {
    // <editor-fold defaultstate="collapsed" desc="HttpServlet methods. Click on the
    /**
     * Handles the HTTP <code>GET</code> method.
     *
     * @param request servlet request
     * @param response servlet response
     * @throws ServletException if a servlet-specific error occurs
     * @throws IOException if an I/O error occurs
     */
    @Override
    protected void doPost(HttpServletRequest request, HttpServletResponse response)
            throws ServletException, IOException {
    }
}
```

Step 8

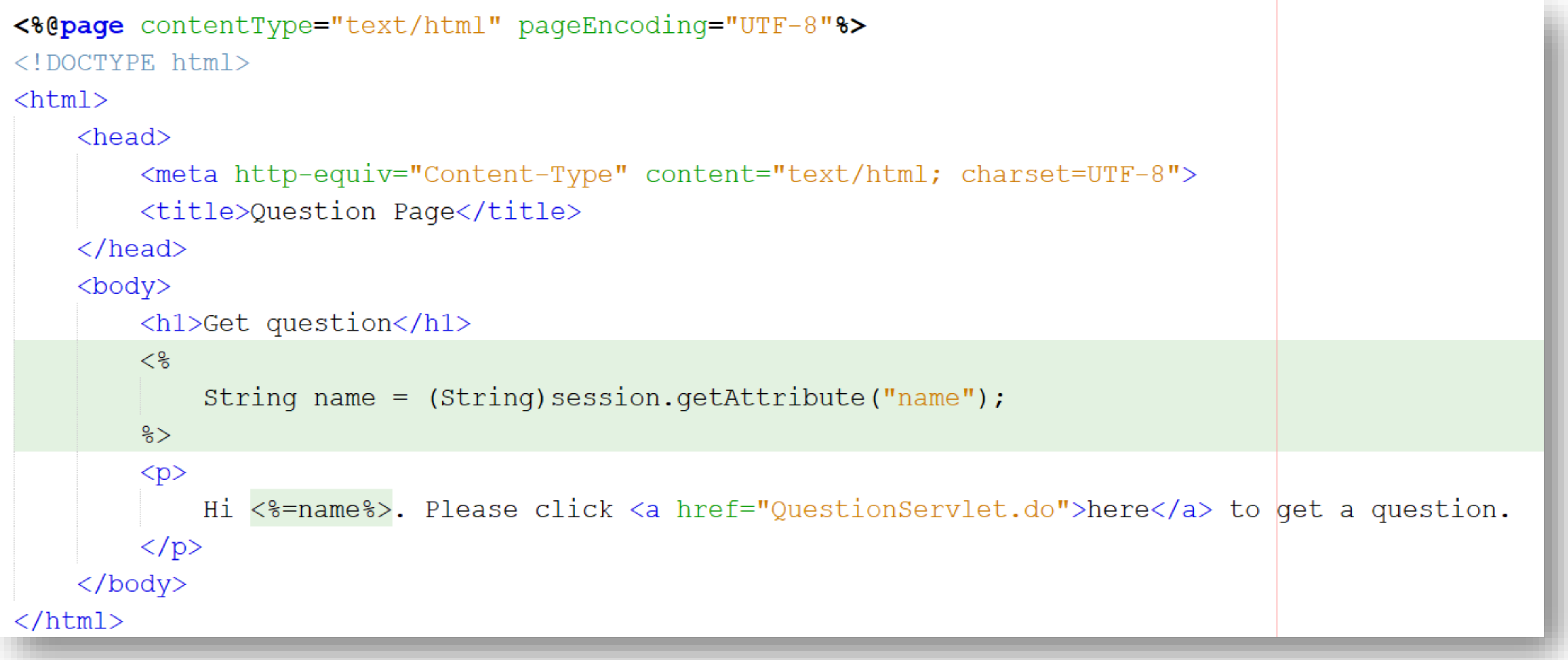
Start a session.



```
    @Override
    protected void doPost(HttpServletRequest request, HttpServletResponse response)
            throws ServletException, IOException {
        HttpSession session = request.getSession(true);
        String name = request.getParameter("name");

        initialiseSession(session, name);
        //session.setAttribute("name", name);

        RequestDispatcher disp = request.getRequestDispatcher("getQuestion.jsp");
        disp.forward(request, response);
    }

    private void initialiseSession(HttpSession session, String name) {
        Integer score = 0;
        Integer numQuestions = 0;
        session.setAttribute("numQuestions", numQuestions);
        session.setAttribute("score", score);
        session.setAttribute("name", name);
    }
}
```

Step 9

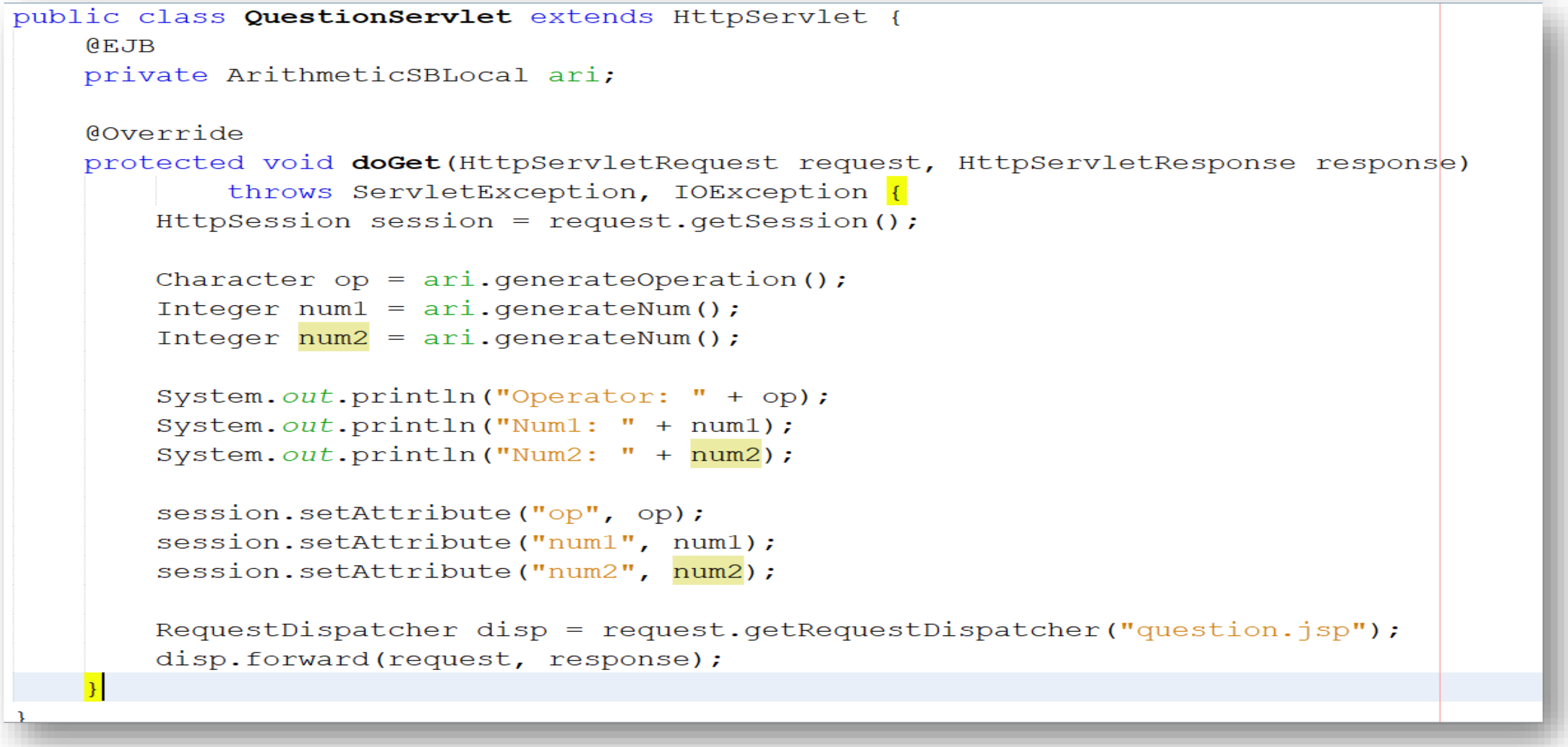
Create **getQuestion.jsp** file.



```
<%@page contentType="text/html" pageEncoding="UTF-8"%>
<!DOCTYPE html>
<html>
    <head>
        <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
        <title>Question Page</title>
    </head>
    <body>
        <h1>Get question</h1>
        <%
            String name = (String)session.getAttribute("name");
        %>
        <p>
            Hi <%=name%>. Please click <a href="QuestionServlet.do">here</a> to get a question.
        </p>
    </body>
</html>
```

Step 10

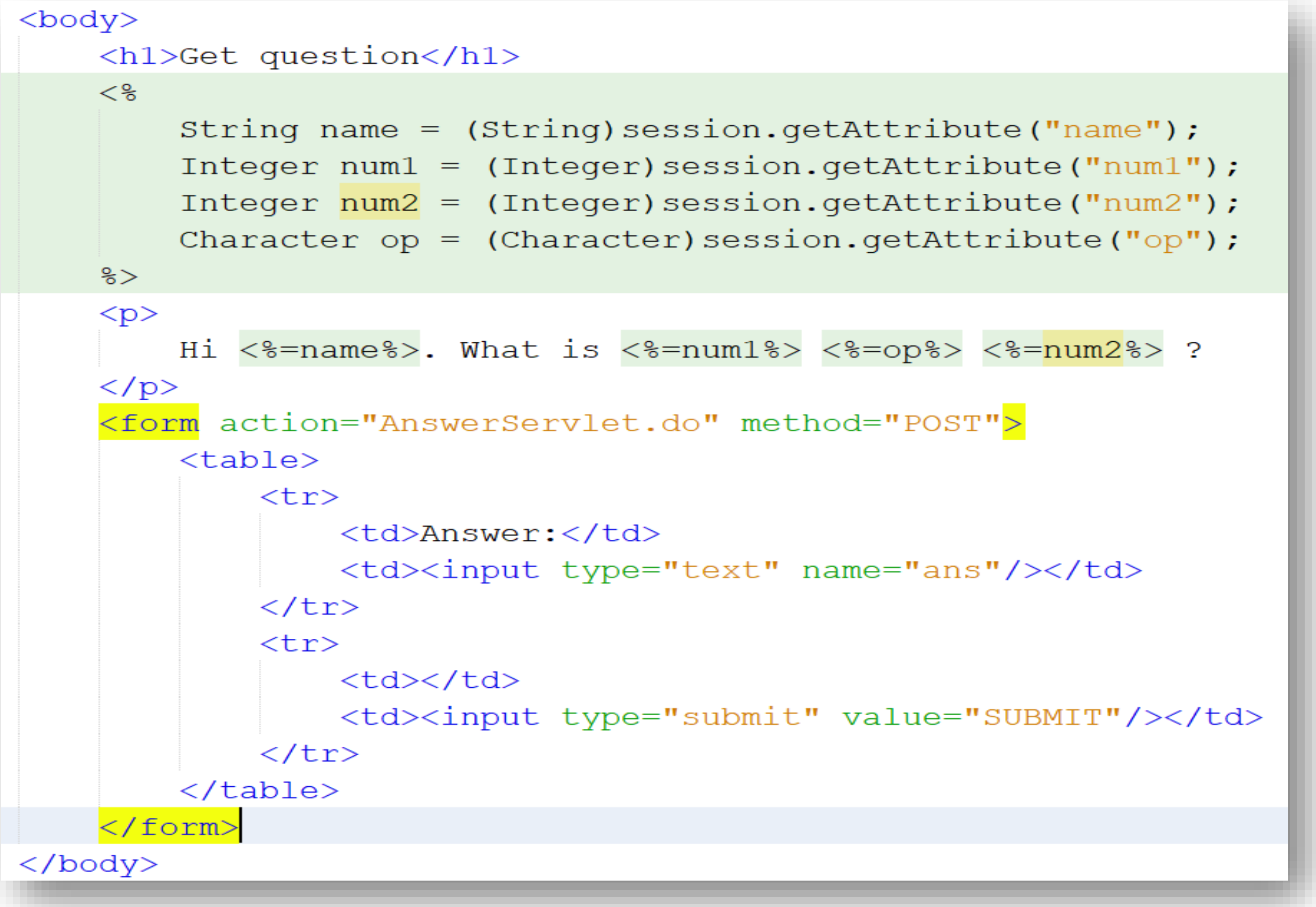
Create a **QuestionServlet** file.



```
public class QuestionServlet extends HttpServlet {
    @EJB
    private ArithmeticSBLocal ari;

    @Override
    protected void doGet(HttpServletRequest request, HttpServletResponse response)
            throws ServletException, IOException {
        HttpSession session = request.getSession();

        Character op = ari.generateOperation();
        Integer num1 = ari.generateNum();
        Integer num2 = ari.generateNum();

        System.out.println("Operator: " + op);
        System.out.println("Num1: " + num1);
        System.out.println("Num2: " + num2);

        session.setAttribute("op", op);
        session.setAttribute("num1", num1);
        session.setAttribute("num2", num2);

        RequestDispatcher disp = request.getRequestDispatcher("question.jsp");
        disp.forward(request, response);
    }
}
```

Step 11

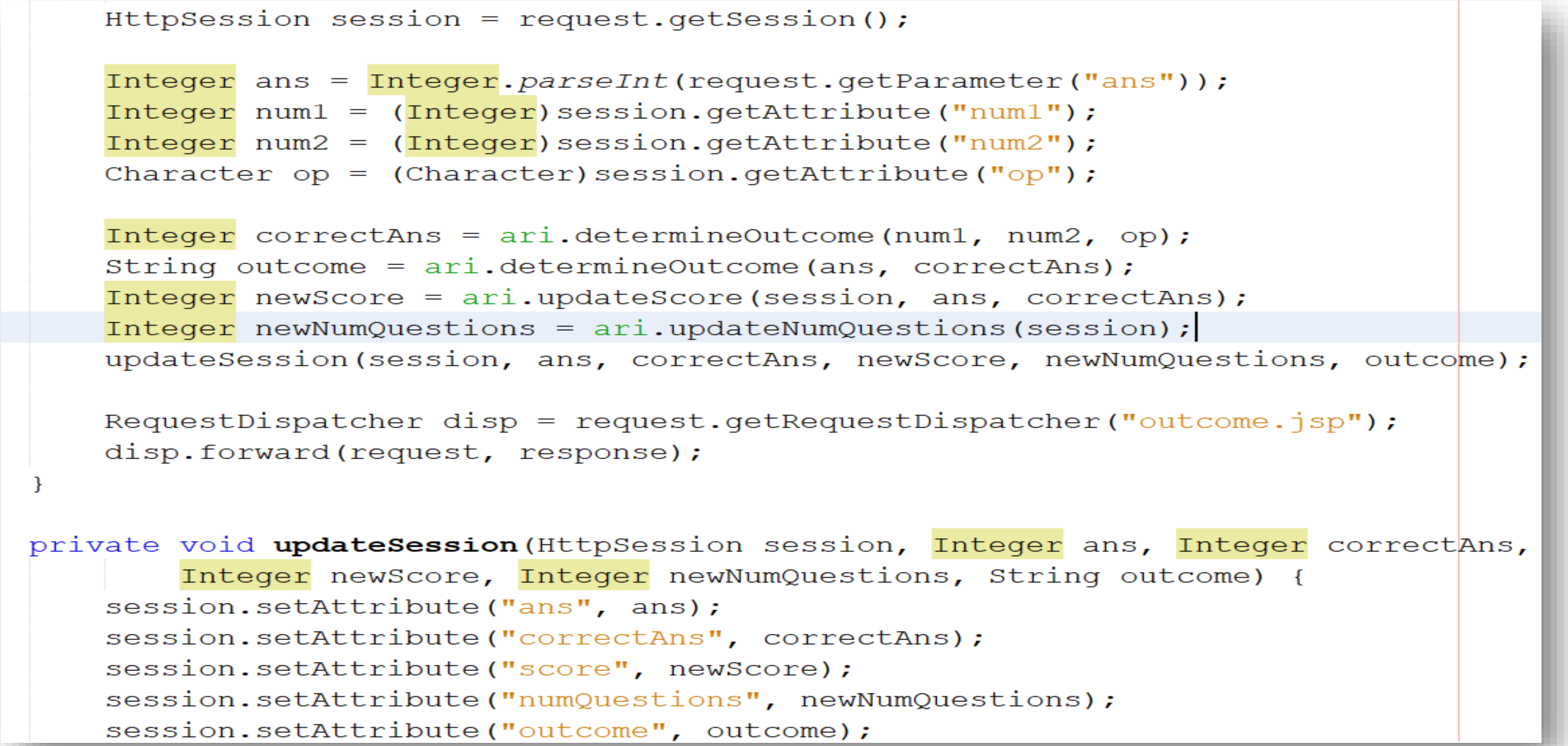
Create a **question.jsp** file.



```
<body>
    <h1>Get question</h1>
    <%
        String name = (String)session.getAttribute("name");
        Integer num1 = (Integer)session.getAttribute("num1");
        Integer num2 = (Integer)session.getAttribute("num2");
        Character op = (Character)session.getAttribute("op");
    %>
    <p>
        Hi <%=name%>. What is <%=num1%> <%=op%> <%=num2%> ?
    </p>
    <form action="AnswerServlet.do" method="POST">
        <table>
            <tr>
                <td>Answer:</td>
                <td><input type="text" name="ans"/></td>
            </tr>
            <tr>
                <td></td>
                <td><input type="submit" value="SUBMIT"/></td>
            </tr>
        </table>
    </form>
</body>
```

Step 12

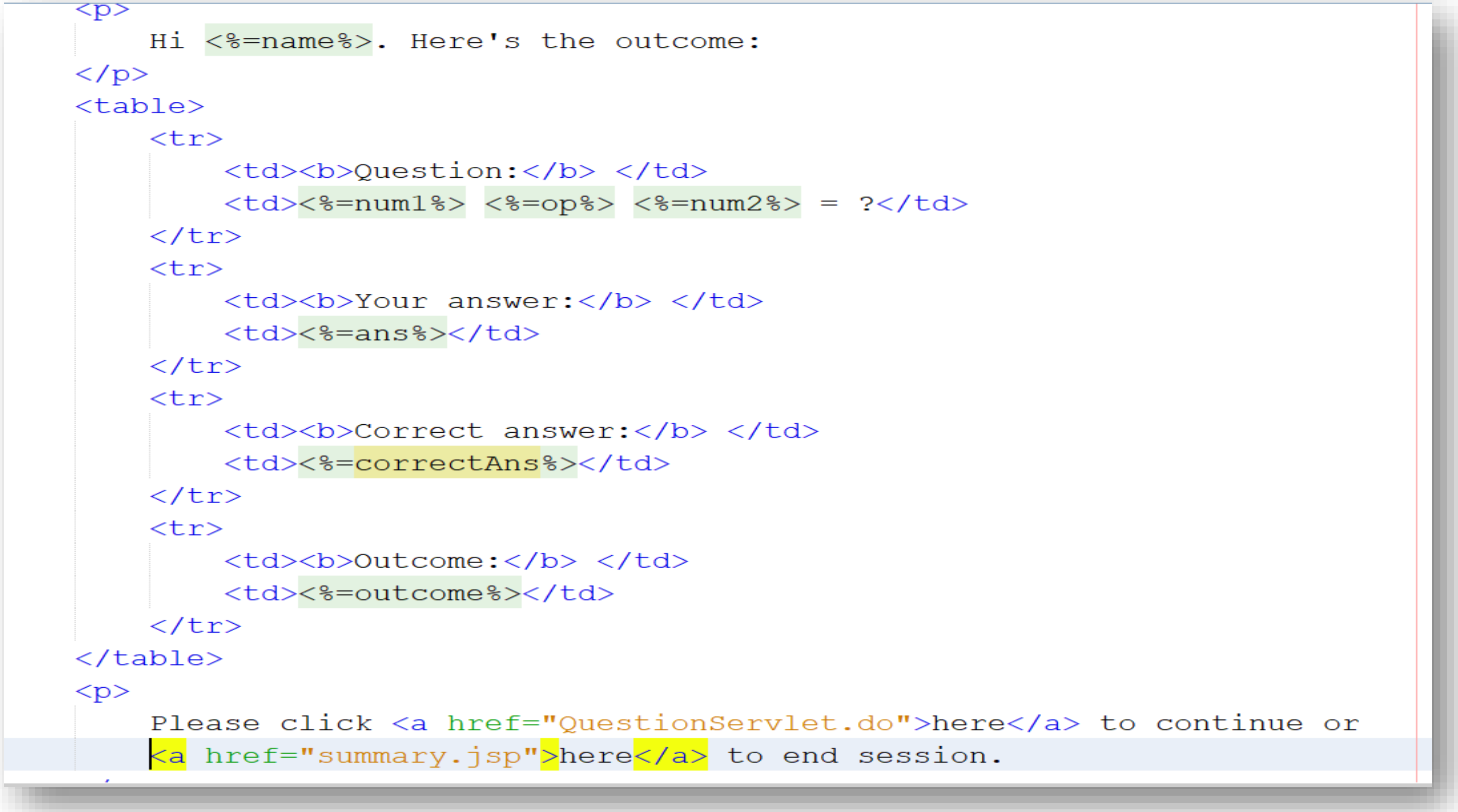
Create a **question.jsp** file.



```
    HttpSession session = request.getSession();

    Integer ans = Integer.parseInt(request.getParameter("ans"));
    Integer num1 = (Integer)session.getAttribute("num1");
    Integer num2 = (Integer)session.getAttribute("num2");
    Character op = (Character)session.getAttribute("op");

    Integer correctAns = ari.determineOutcome(num1, num2, op);
    String outcome = ari.determineOutcome(ans, correctAns);
    Integer newScore = ari.updateScore(session, ans, correctAns);
    Integer newNumQuestions = ari.updateNumQuestions(session);
    updateSession(session, ans, correctAns, newScore, newNumQuestions, outcome);

    RequestDispatcher disp = request.getRequestDispatcher("outcome.jsp");
    disp.forward(request, response);
}

private void updateSession(HttpSession session, Integer ans, Integer correctAns,
        Integer newScore, Integer newNumQuestions, String outcome) {
    session.setAttribute("ans", ans);
    session.setAttribute("correctAns", correctAns);
    session.setAttribute("score", newScore);
    session.setAttribute("numQuestions", newNumQuestions);
    session.setAttribute("outcome", outcome);
```

Step 13

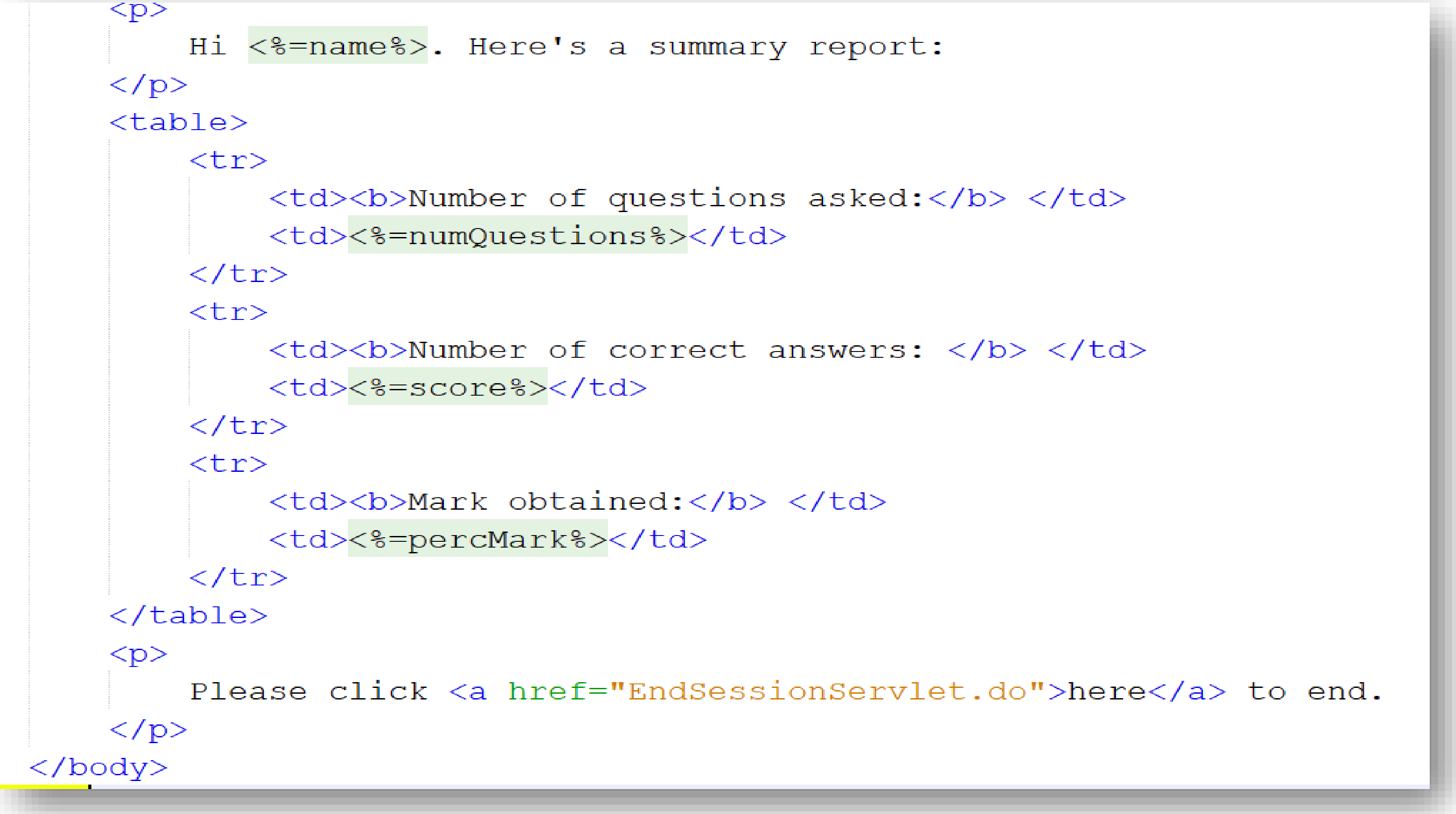
Create a **outcome.jsp** file.



```
<p>
    Hi <%=name%>. Here's the outcome:
</p>
<table>
    <tr>
        <td><b>Question:</b> </td>
        <td><%=num1%> <%=op%> <%=num2%> = ?</td>
    </tr>
    <tr>
        <td><b>Your answer:</b> </td>
        <td><%=ans%></td>
    </tr>
    <tr>
        <td><b>Correct answer:</b> </td>
        <td><%=correctAns%></td>
    </tr>
    <tr>
        <td><b>Outcome:</b> </td>
        <td><%=outcome%></td>
    </tr>
</table>
<p>
    Please click <a href="QuestionServlet.do">here</a> to continue or
    <a href="summary.jsp">here</a> to end session.
```

Step 14

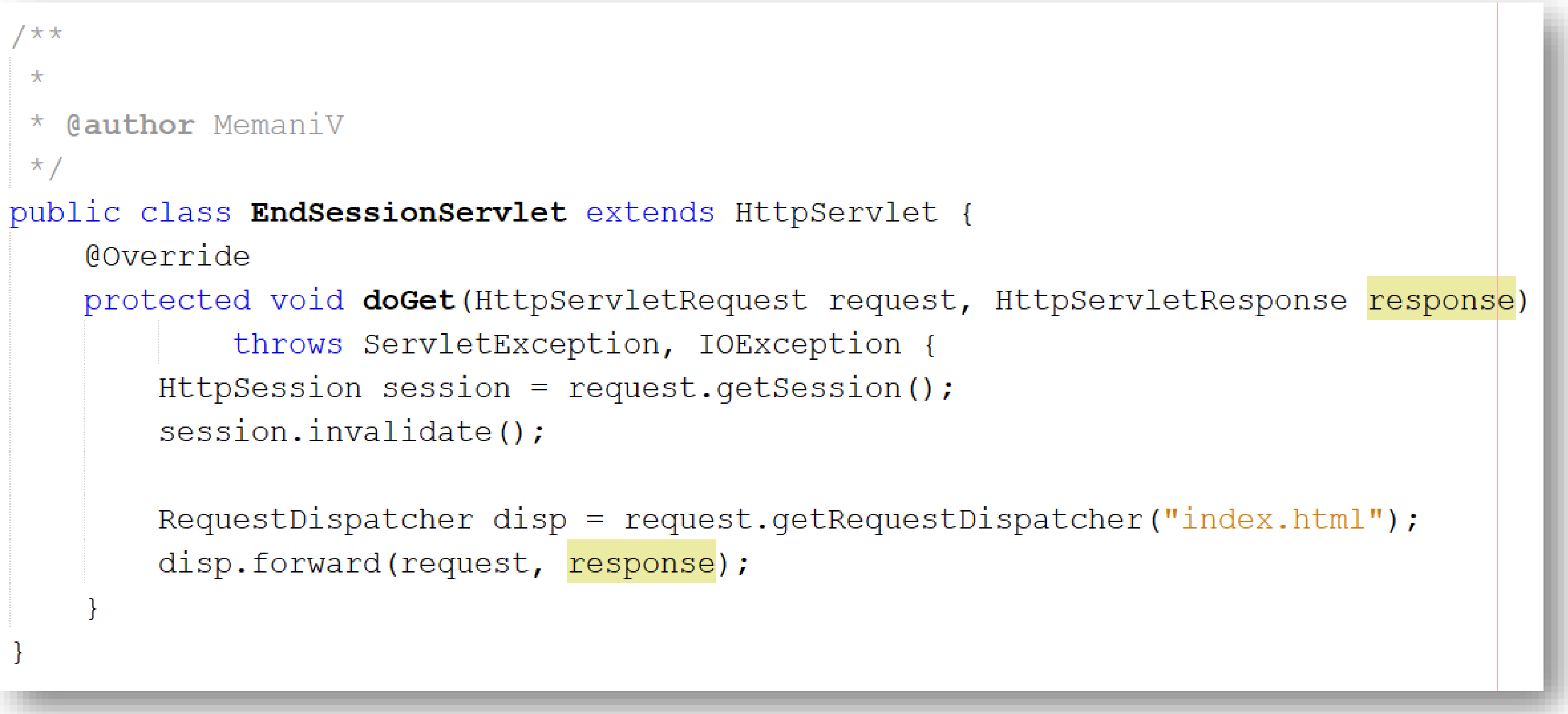
Create a **summary.jsp** file.



```
    <p>
        Hi <%=name%>. Here's a summary report:
    </p>
    <table>
        <tr>
            <td><b>Number of questions asked:</b> </td>
            <td><%=numQuestions%></td>
        </tr>
        <tr>
            <td><b>Number of correct answers: </b> </td>
            <td><%=score%></td>
        </tr>
        <tr>
            <td><b>Mark obtained:</b> </td>
            <td><%=percMark%></td>
        </tr>
    </table>
    <p>
        Please click <a href="EndSessionServlet.do">here</a> to end.
    </p>
</body>
```

Step 15

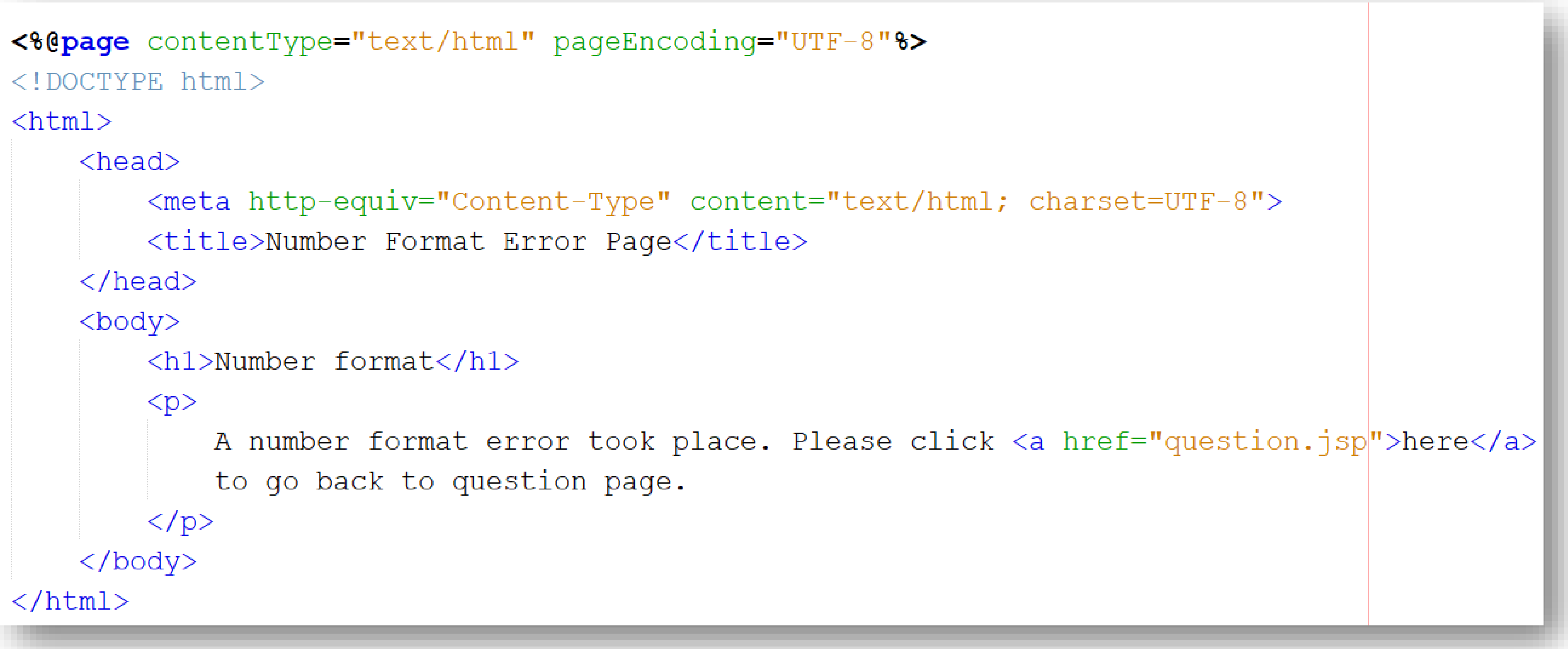
Create a **EndSessionServlet** file.



```
/**
 *
 * @author MemaniV
 */
public class EndSessionServlet extends HttpServlet {
    @Override
    protected void doGet(HttpServletRequest request, HttpServletResponse response)
            throws ServletException, IOException {
        HttpSession session = request.getSession();
        session.invalidate();

        RequestDispatcher disp = request.getRequestDispatcher("index.html");
        disp.forward(request, response);
    }
}
```

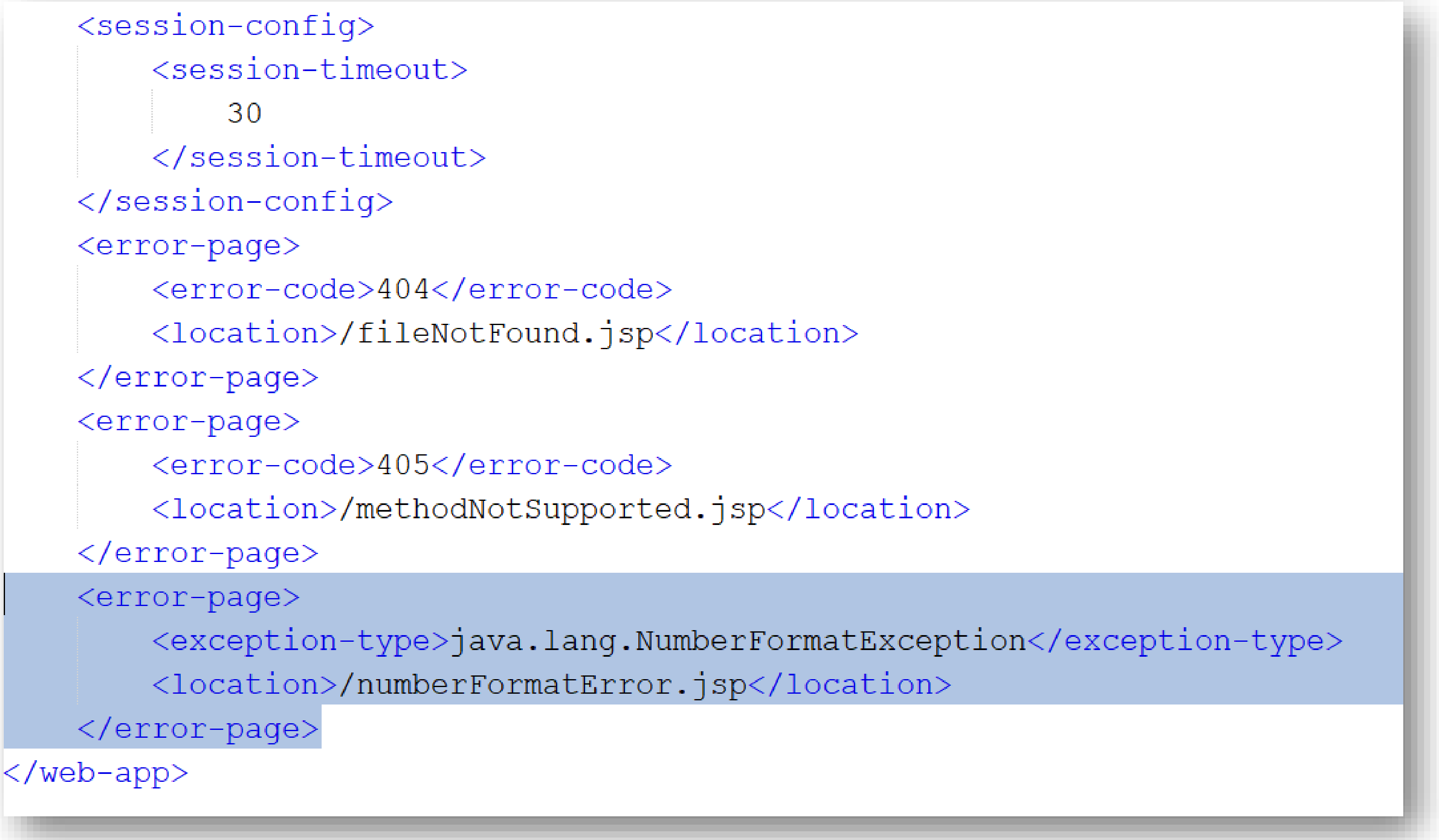
Step 16

Create a **page to handle a NumberFormat exception** file.



```
<%@page contentType="text/html" pageEncoding="UTF-8"%>
<!DOCTYPE html>
<html>
    <head>
        <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
        <title>Number Format Error Page</title>
    </head>
    <body>
        <h1>Number format</h1>
        <p>
            A number format error took place. Please click <a href="question.jsp">here</a>
            to go back to question page.
        </p>
    </body>
</html>
```

Include the page in the DD file



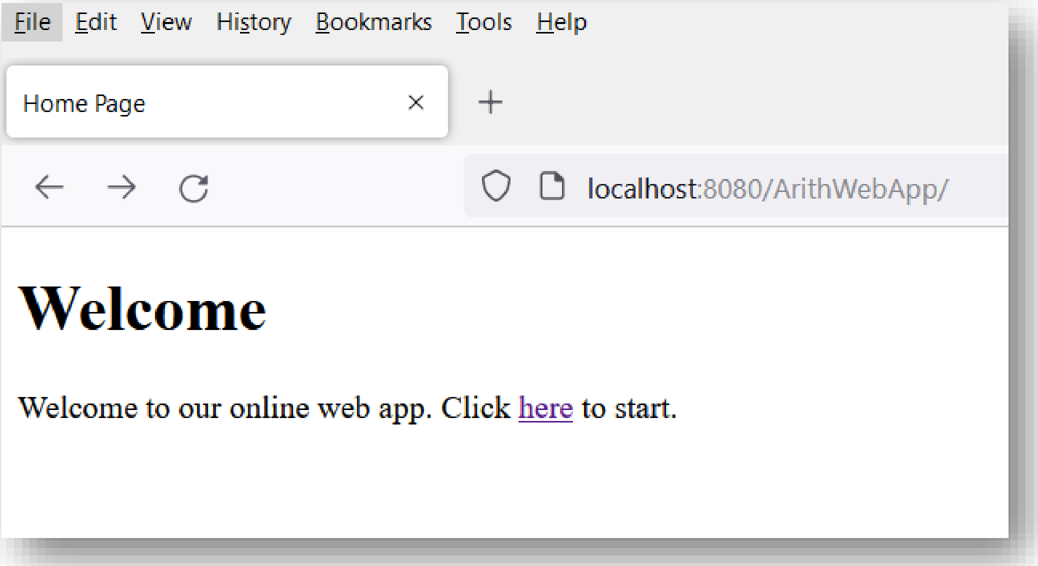
```
    <session-config>
        <session-timeout>
            30
        </session-timeout>
    </session-config>
    <error-page>
        <error-code>404</error-code>
        <location>/fileNotFound.jsp</location>
    </error-page>
    <error-page>
        <error-code>405</error-code>
        <location>/methodNotSupported.jsp</location>
    </error-page>
    <error-page>
        <exception-type>java.lang.NumberFormatException</exception-type>
        <location>/numberFormatError.jsp</location>
    </error-page>
</web-app>
```

PART C

Test Solution

Step 1

Clean, Build, Deploy, and Run.

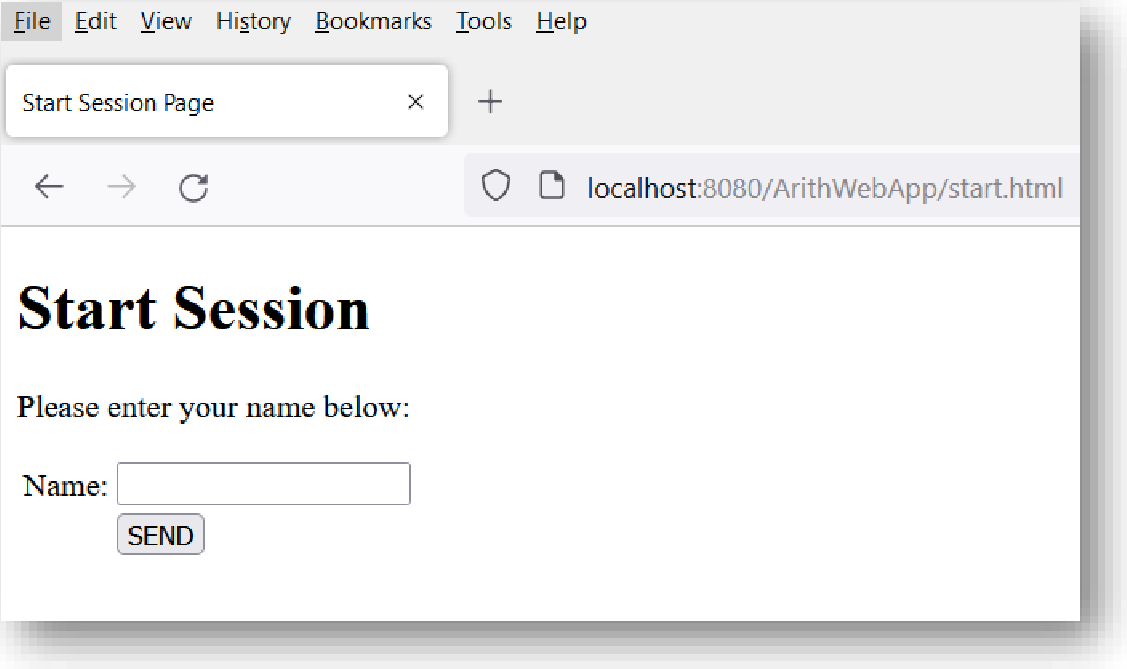


Welcome

Welcome to our online web app. Click here to start.

Step 2

Click on the link



Start Session

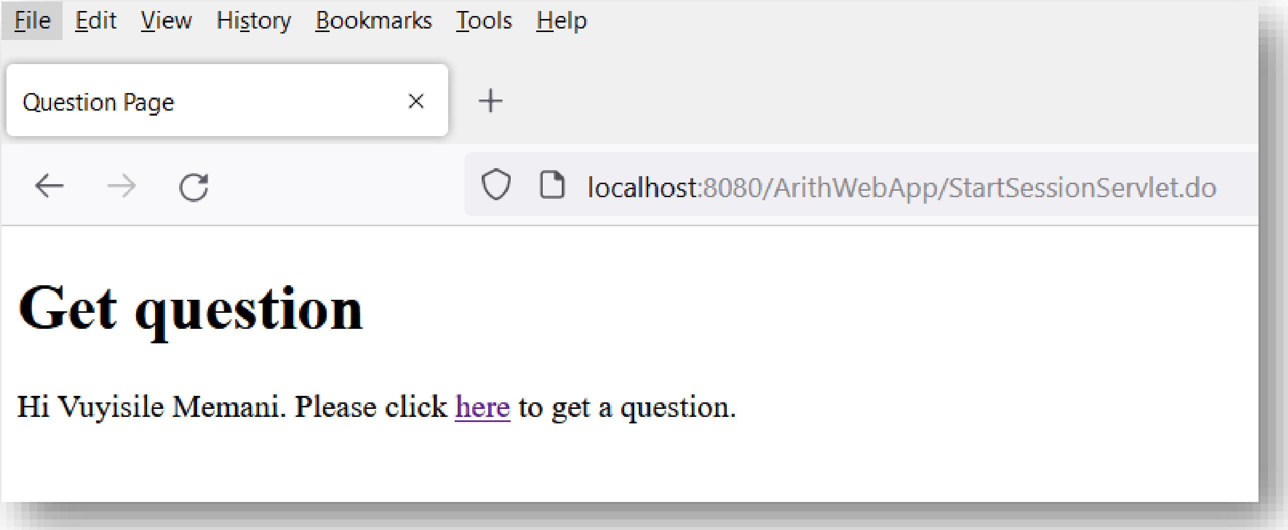
Please enter your name below:

Name:

SEND

Step 3

Enter name and click SEND

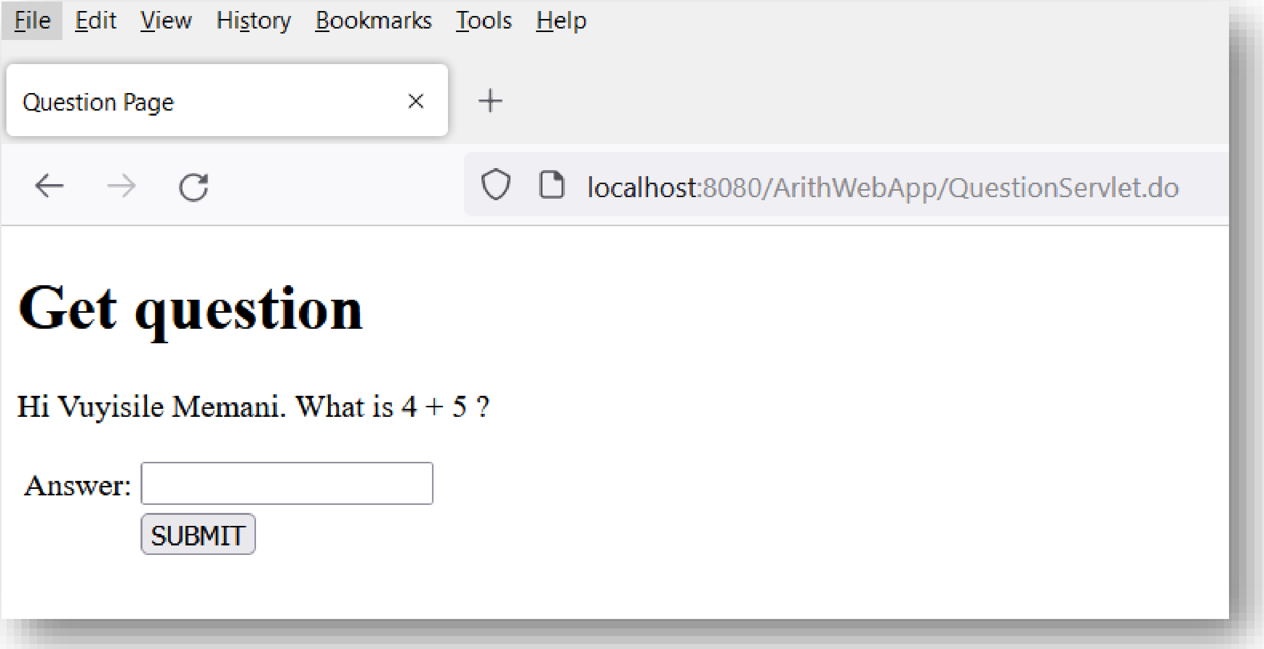

File Edit View History Bookmarks Tools Help
Question Page
localhost:8080/ArithWebApp/StartSessionServlet.do

Get question

Hi Vuyisile Memani. Please click here to get a question.

Step 4

Click on the link


File Edit View History Bookmarks Tools Help
Question Page
localhost:8080/ArithWebApp/QuestionServlet.do

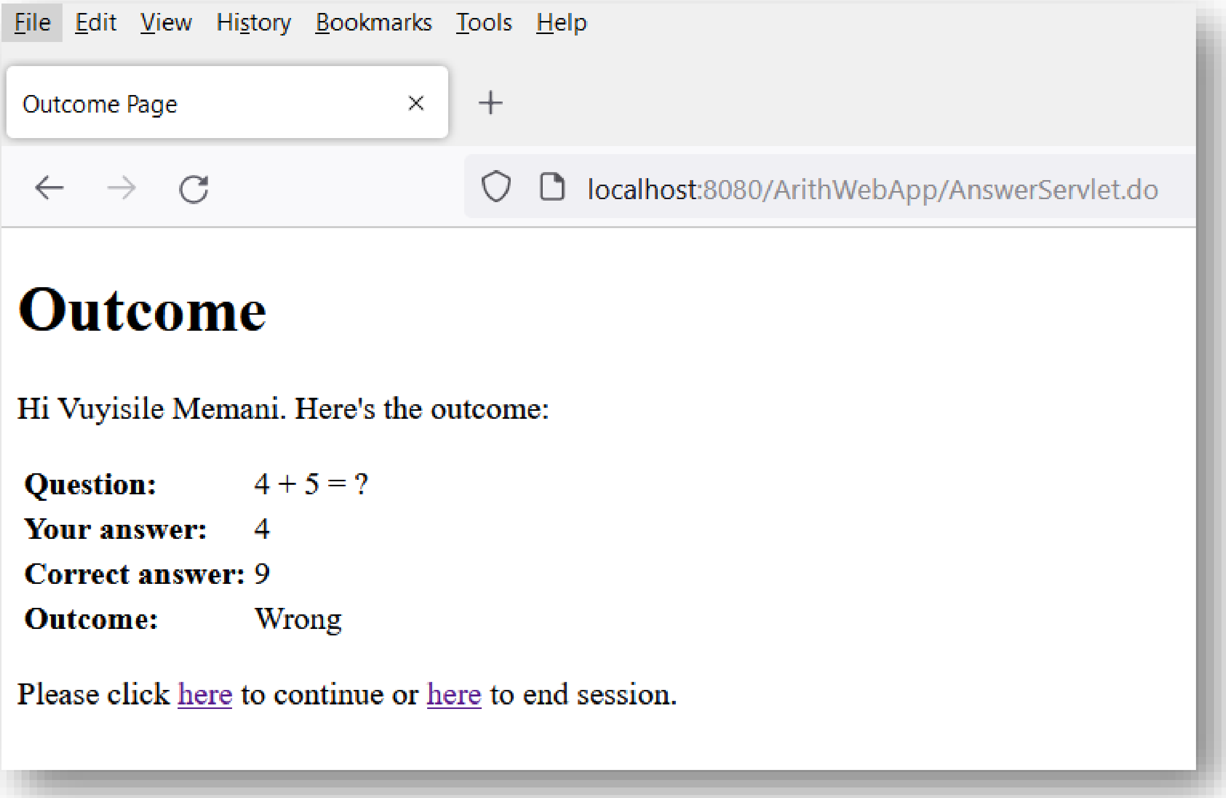
Get question

Hi Vuyisile Memani. What is 4 + 5 ?

Answer:

Step 5

Provide an answer and click SUBMIT



Outcome

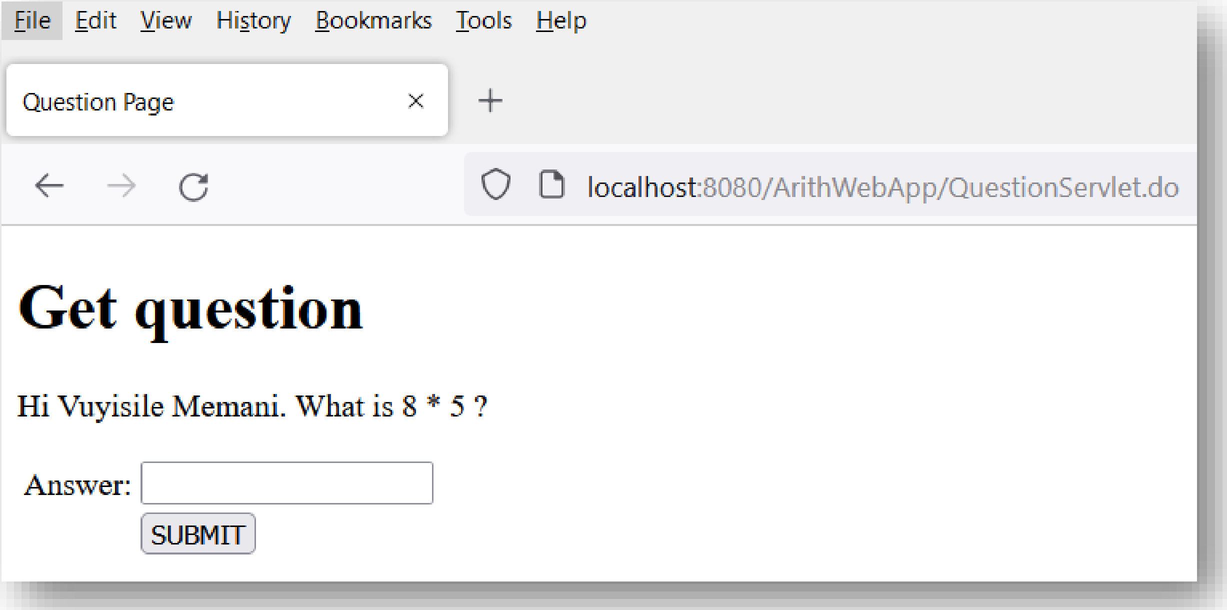
Hi Vuyisile Memani. Here's the outcome:

Question:	4 + 5 = ?
Your answer:	4
Correct answer:	9
Outcome:	Wrong

Please click here to continue or here to end session.

Step 6

Click on the first link



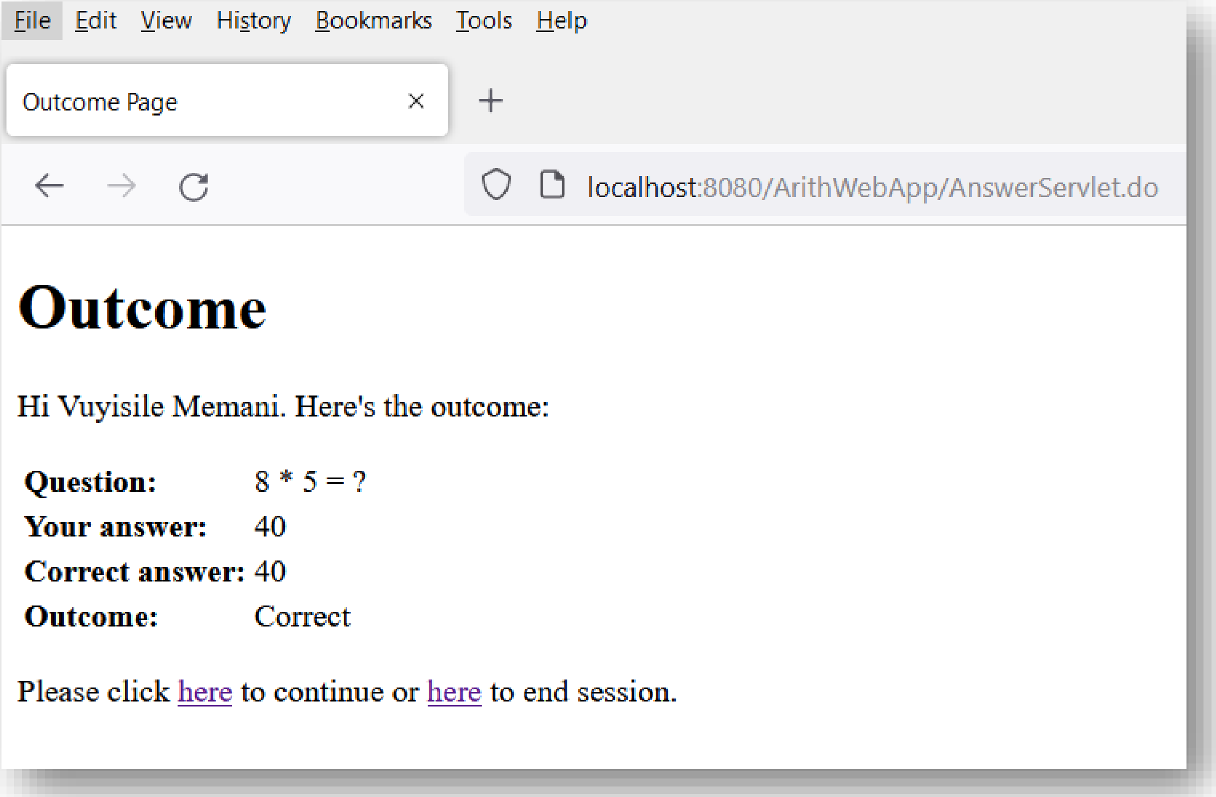
Get question

Hi Vuyisile Memani. What is 8 * 5 ?

Answer:

Step 7

Provide an answer and click SUBMIT



Outcome

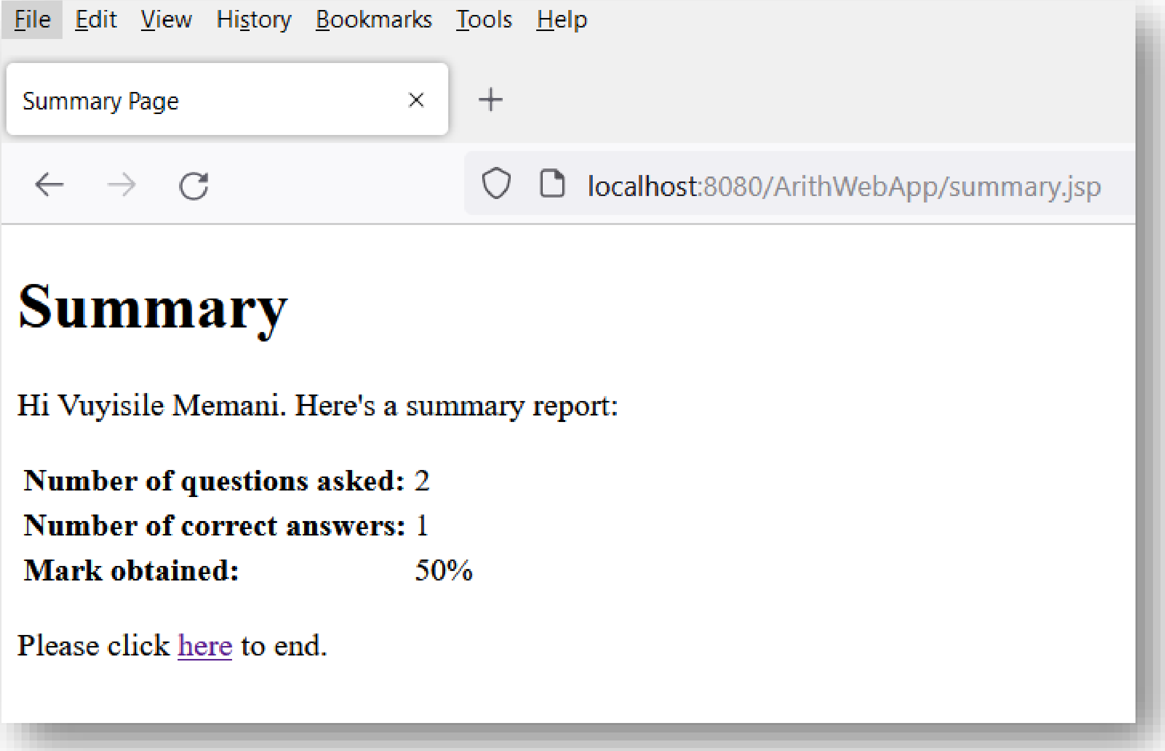
Hi Vuyisile Memani. Here's the outcome:

Question:	8 * 5 = ?
Your answer:	40
Correct answer:	40
Outcome:	Correct

Please click here to continue or here to end session.

Step 8

Click on the second link


File Edit View History Bookmarks Tools Help
Summary Page
localhost:8080/ArithWebApp/summary.jsp

Summary

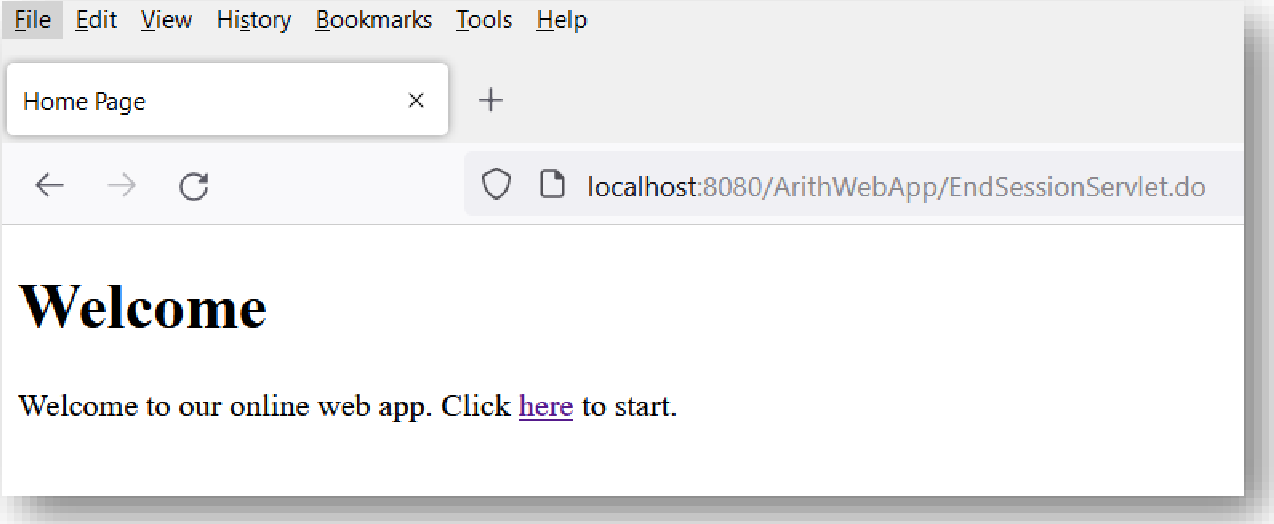
Hi Vuyisile Memani. Here's a summary report:

Number of questions asked:	2
Number of correct answers:	1
Mark obtained:	50%

Please click here to end.

Step 9

Click on the link.



localhost:8080/ArithWebApp/EndSessionServlet.do

Welcome

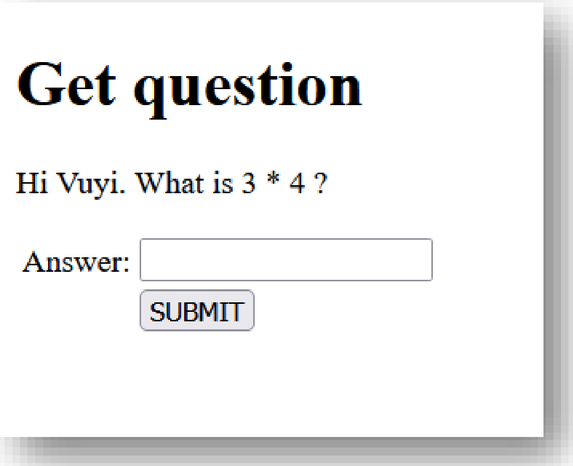
Welcome to our online web app. Click here to start.

PART D

Homework

Modify this exercise as follows:

- When a question is asked, have it numbered. Currently you have the following:



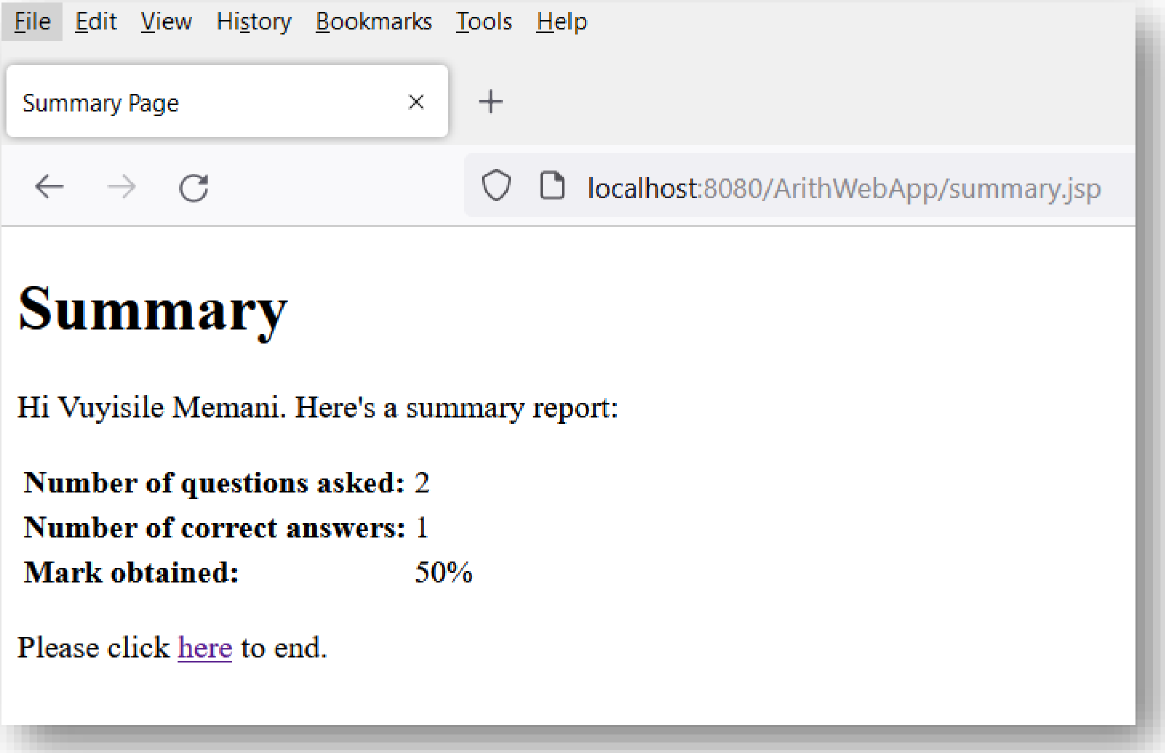
Get question

Hi Vuyi. What is 3 * 4 ?

Answer:

Rather than the heading reading, **“Get question”**, it must read **“Question 1”**, **“Question 2”** etc., depending on the question being answered.

When a summary report is displayed, all the questions that were asked together with the user's answers, correct answers, and outcomes must be displayed. Currently you have a summary report displayed as follows:



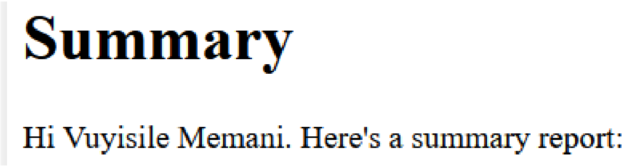
Summary

Hi Vuyisile Memani. Here's a summary report:

Number of questions asked:	2
Number of correct answers:	1
Mark obtained:	50%

Please click here to end.

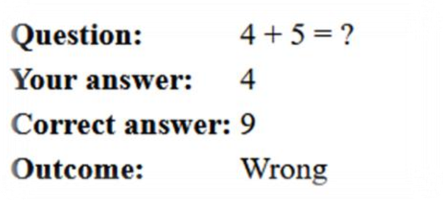
Change it to the following:



Summary

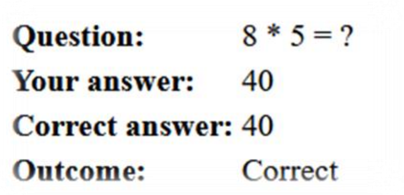
Hi Vuyisile Memani. Here's a summary report:

Question 1

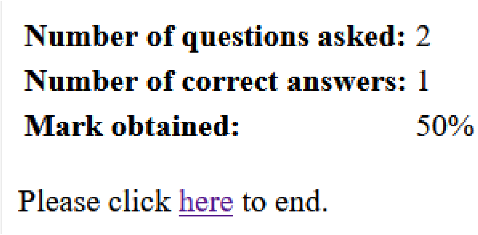


Question:	4 + 5 = ?
Your answer:	4
Correct answer:	9
Outcome:	Wrong

Question 2



Question:	8 * 5 = ?
Your answer:	40
Correct answer:	40
Outcome:	Correct



Number of questions asked:	2
Number of correct answers:	1
Mark obtained:	50%

Please click here to end.

PART E

Conclusion

In the tutorial we managed to create a conversational web application that is fail-safe (handles exceptions). I hope you enjoyed it. Have a lovely day and God bless you.