



Using the JSP Standard Tag Library (JSTL)

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Taught by the author of *Core Servlets and JSP*, *More Servlets and JSP*, and this tutorial. Available at public venues, or customized versions can be held on-site at your organization.

- Courses developed and taught by Marty Hall
 - Java 5, Java 6, intermediate/beginning servlets/JSP, advanced servlets/JSP, Struts, JSF, Ajax, GWT, custom mix of topics
- Courses developed and taught by coreservlets.com experts (edited by Marty)
 - Spring, Hibernate, EJB3, Ruby/Rails

Contact hall@coreservlets.com for details

Agenda

- **Obtaining JSTL documentation and code**
- **The JSTL Expression Language**
- **Looping Tags**
 - Looping a certain number of times
 - Looping over data structures
 - Improving Ajax MVC data-handling examples
- **Conditional Evaluation Tags**
 - Single choice
 - Multiple choices
- **Database Access Tags**
- **Other Tags**

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Overview and Installation

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JSTL Overview

- **JSTL was based on the Struts looping and logic tags**
- **JSTL is not part of the JSP 1.2 or 2.0 Specs**
 - It is a separate specification that requires a separate download
 - Available only in servers that support servlets 2.3 and JSP 1.2 or later. Cannot be retrofitted into JSP 1.1.
- **The JSTL expression language is part of JSP 2.0, JSP 2.1, and JSF**
- **The JSTL Specification is available in PDF**
 - <http://jcp.org/en/jsr/detail?id=52>

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Downloading JSTL

- **JSTL 1.1**
 - Home page
 - <http://jakarta.apache.org/taglibs/doc/standard-doc/intro.html>
 - Download
 - http://jakarta.apache.org/site/downloads/downloads_taglibs-standard.cgi
 - Documentation (Javadoc)
 - <http://java.sun.com/products/jsp/jstl/1.1/docs/tlddocs/>
 - Note
 - Many server packages (e.g., MyFaces) and IDEs (e.g., MyEclipse) *already* have JSTL 1.1 bundled
- **JSTL 1.2**
 - As of 2/2008, only available as part of Java EE 5
 - Not as a separate download for use in other servers

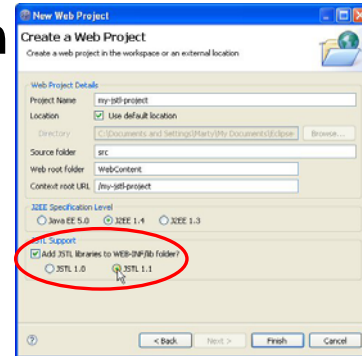
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Enabling JSTL with MyEclipse

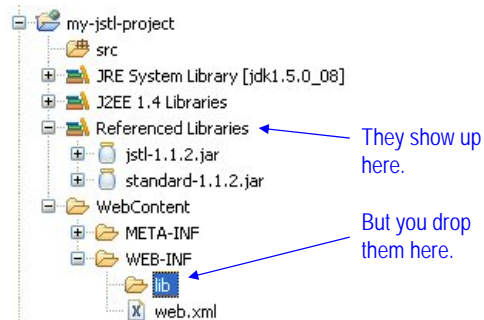
- **Using bundled JSTL version**

- File → New → Web Project, select JSTL 1.1 option



- **Using latest JSTL version**

- Download from Apache site
- Drag jstl.jar and standard.jar onto WEB-INF/lib
 - They get listed in "Referenced Libraries"
 - I usually rename JAR files to show exact version



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Enabling JSTL Manually

- **Put in Web App**

- Drop JAR files in the WEB-INF/lib folder of your Web app

- **Put in CLASSPATH**

- Add the JAR files to the CLASSPATH used by your development environment
- Do *not* add to the CLASSPATH used by the server

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The JSTL Expression Language

- Accessed via `${expression}`
- Similar to JavaScript and XPath
- Provides shorthand notation to access:
 - Attributes of standard servlet objects
 - Bean properties
 - Map, List, and Array elements
- Is standard part of JSP 2.0 and 2.1
 - In JSTL, EL can be used only in attributes of JSTL tags
 - In JSP 2.0, the EL can be used anywhere
 - `web.xml` element and page directive attribute let you disable the EL for backward compatibility
- Covered in separate lecture

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Iteration Tags

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Constructs for Handling Variable-Length Data

Simplest
for Page
Author

- **Bean**
 - `${cust.withdrawals}`
- **Custom tag (non-looping)**
 - `<mytags:withDrawalTable customer="${cust}" border="..." headerStyles="..." .../>`
- **Custom tag (looping)**
 - See examples in Advanced Custom Tags lecture

↓
Most
Control
for Page
Author

- **JSTL loop**
- **JSP scripting loop**

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Looping Tags: Summary

- **Looping with explicit numeric values**

```
<c:forEach var="name" begin="x" end="y" step="z">
  Blah, blah ${name}
</c:forEach>
```
- **Looping over data structures**
 - Can loop down arrays, strings, collections, maps

```
<c:forEach var="name"
  items="array-or-collection">
  Blah, blah ${name}
</c:forEach>
```
- **Looping down delimited strings**
 - `forTokens`

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Looping Tags: Motivation

- **JSP without JSTL**

```
<UL>
<%
  for(int i=0; i<messages.length; i++) {
    String message = messages[i];
  %>
  <LI><%= message %>
<% } %>
</UL>
```

- **JSP with JSTL**

```
<UL>
<c:forEach var="message" items="${messages}">
  <LI>${message}
</c:forEach>
</UL>
```

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Looping with Simple Numeric Values

```
<%@ taglib prefix="c"
      uri="http://java.sun.com/jsp/jstl/core"%>
<UL>
<c:forEach var="i" begin="1" end="10">
  <LI>${i}
</c:forEach>
</UL>
```

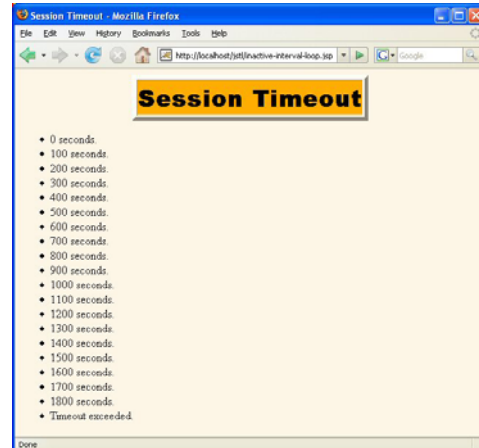


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Looping with a Designated Step Size

```
<%@ taglib prefix="c"
        uri="http://java.sun.com/jsp/jstl/core"%>

<UL>
<c:forEach
    var="seconds"
    begin="0"
    end="{pageContext.session.maxInactiveInterval}"
    step="100">
    <LI>${seconds} seconds.
</c:forEach>
    <LI>Timeout exceeded.
</UL>
```



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Looping Down Arrays (Servlet)

```
public class ArrayServlet extends HttpServlet {
    public void doGet(HttpServletRequest request,
                      HttpServletResponse response)
        throws ServletException, IOException {
        String[] words = { "foo", "bar", "baz"};
        request.setAttribute("words", words);
        String address = "/WEB-INF/results/array-loop.jsp";
        RequestDispatcher dispatcher =
            request.getRequestDispatcher(address);
        dispatcher.forward(request, response);
    }
}
```

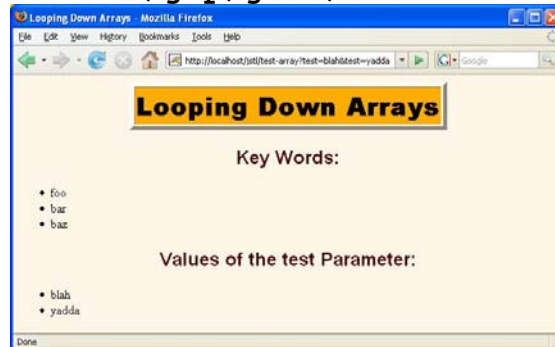
- **Note**
 - url-pattern in web.xml is /test-array

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Looping Down Arrays

```
<%@ taglib prefix="c"
      uri="http://java.sun.com/jsp/jstl/core"%>
<H2>Key Words:</H2>
<UL>
  <c:forEach var="word"
             items="${words}">
    <LI>${word}
  </c:forEach>
</UL>

<H2>Values of the test Parameter:</H2>
<UL>
  <c:forEach var="val"
             items="${paramValues.test}">
    <LI>${val}
  </c:forEach>
</UL>
```



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Note for Older Servers

- **Examples in this lecture assume JSP 2.0+**
 - JSTL also runs in older servers, but you have to replace direct output of `${foo}` with `<c:out value="${foo}" />`
- **Previous example (JSP 2.0+)**

```
<UL>
  <c:forEach var="word" items="${words}">
    <LI>${word}
  </c:forEach>
</UL>
```
- **Previous example (JSP 1.2)**

```
<UL>
  <c:forEach var="word" items="${words}">
    <LI><c:out value="${word}" />
  </c:forEach>
</UL>
```

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`${foo}` vs. `<c:out value="${foo}"/>`

- **c:out runs on older servers**
 - Oracle 9i, BEA WebLogic 8.x, IBM WebSphere 5.x
- **c:out escapes HTML (XML) characters**
 - `<c:out value="<h1>"/>` outputs `<h1>`
 - Very important if value being output comes from end user.
 - Disable with `<c:out value="..." escapeXml="false"/>`
- **c:out lets you supply a default value**
 - `<c:out value="${foo}" default="explicit value"/>` or `<c:out value="${foo}" default="${calculatedValue}"/>`
 - The default is output when `${foo}` evaluates to null

Looping Down Collections: Notes

- **Can loop down collections other than arrays**
 - "items" can refer to an array, collection (List, Map, Set, etc.), comma-separated String, Iterator, or Enumeration
- **Can access sub-elements of local variable**
 - `<c:forEach var="bean" items="${collectionOfBeans}">`
 `${bean.property}`
 `</c:forEach>`
 - `<c:forEach var="collection"`
 `items="${collectionOfCollections}">`
 `${collection[part]}`
 `</c:forEach>`
 - For details, see separate lecture on the JSP expression language

Looping Down Arrays: Accessing SubElements (Servlet)

```
public class ArrayServlet2 extends HttpServlet {
    public void doGet(HttpServletRequest request,
                      HttpServletResponse response)
        throws ServletException, IOException {
        Name[] names =
            { new Name("Bill", "Gates"),
              new Name("Larry", "Ellison"),
              new Name("Sam", "Palmisano"),
              new Name("Scott", "McNealy"),
              new Name("Eric", "Schmidt"),
              new Name("Jeff", "Bezos") };
        request.setAttribute("names", names);
        String[][] sales =
            { { "2005", "12,459", "15,622" },
              { "2006", "18,123", "17,789" },
              { "2007", "21,444", "23,555" } };
        request.setAttribute("sales", sales);
        String address = "/WEB-INF/results/array-loop2.jsp";
        RequestDispatcher dispatcher =
            request.getRequestDispatcher(address);
        dispatcher.forward(request, response);
    }
}
```

Note: url-pattern is /test-array2

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Looping Down Arrays: Accessing SubElements (Bean)

```
public class Name {
    private String firstName;
    private String lastName;

    public Name(String firstName, String lastName) {
        setFirstName(firstName);
        setLastName(lastName);
    }

    public String getFirstName() { return(firstName); }

    public void setFirstName(String firstName) {
        this.firstName = firstName;
    }

    public String getLastName() { return(lastName); }

    public void setLastName(String lastName) {
        this.lastName = lastName;
    }
}
```

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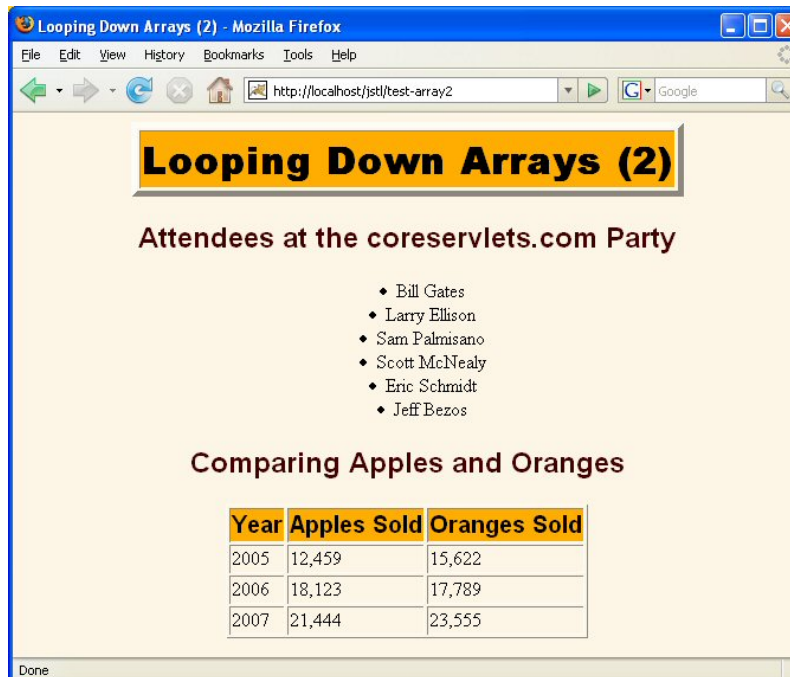
Looping Down Arrays: Accessing SubElements (JSP)

```
<H2>Attendees at the coreservlets.com Party</H2>
<UL>
  <c:forEach var="name" items="{names}">
    <LI>${name.firstName} ${name.lastName}
  </c:forEach>
</UL>
<H2>Comparing Apples and Oranges</H2>
<TABLE BORDER="1">
  <TR><TH>Year</TH>
    <TH>Apples Sold</TH>
    <TH>Oranges Sold</TH></TR>
  <c:forEach var="row" items="{sales}">
    <TR><c:forEach var="col" items="{row}">
      <TD>${col}</TD>
    </c:forEach>
  </c:forEach>
</TABLE>
```

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Looping Down Arrays: Accessing SubElements (Result)



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Loop Status

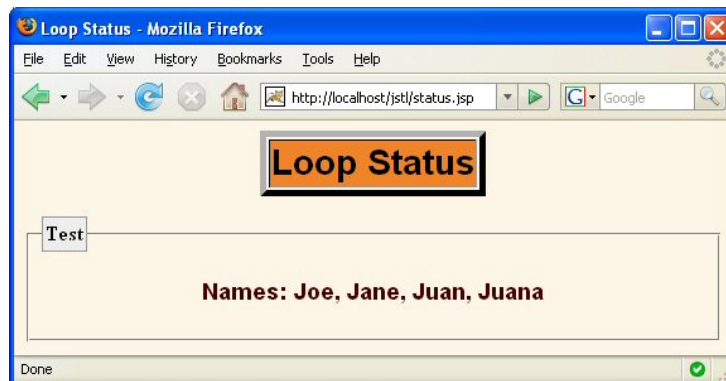
- **You can assign varStatus**
 - `<c:forEach var="name" items="${names}"
varStatus="status">`
- **You can check status.subProperty**
 - Usually using `c:if` (covered later in this lecture)
- **Status subproperties**
 - `index` (int: the current index)
 - `first` (boolean: is this the first entry?)
 - `last` (boolean: is this the first entry?)
 - `begin` (Integer: value of 'begin' attribute)
 - `end` (Integer: value of end' attribute)
 - `step` (Integer: value of 'step' attribute)

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Loop Status: Example

```
<%@ taglib prefix="c"
    uri="http://java.sun.com/jsp/jstl/core" %>
<% String[] names = {"Joe", "Jane", "Juan", "Juana"};
    request.setAttribute("names", names); %>
<h2>Names:
<c:forEach var="name" items="${names}" varStatus="status">
    ${name}<c:if test="${!status.last}">,</c:if>
</c:forEach>
</h2>
```



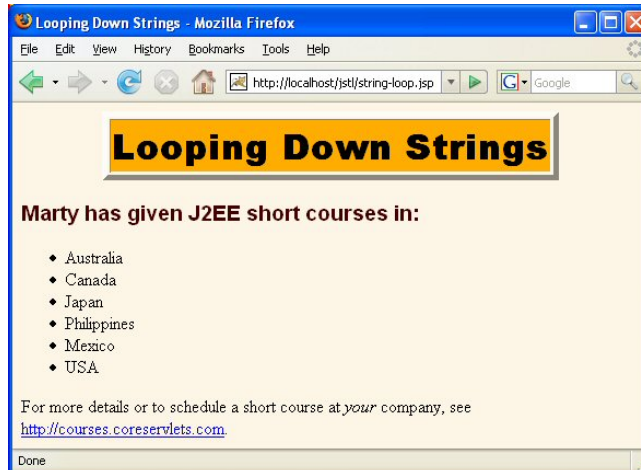
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Looping Down Comma-Delimited Strings

```
<%@ taglib prefix="c"
      uri="http://java.sun.com/jsp/jstl/core"%>

<UL>
<c:forEach
  var="country"
  items="Australia,Canada,Japan,Philippines,Mexico,USA">
  <LI>${country}
</c:forEach>
</UL>
```



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Looping Down Arbitrarily-Delimited Strings

```
<%@ taglib prefix="c"
      uri="http://java.sun.com/jsp/jstl/core" %>

<UL>
<c:forTokens var="color"
  items="(red (orange) yellow)(green)((blue) violet)"
  delims="( )">
  <LI>${color}
</c:forTokens>
</UL>
```

- **Point:**
forTokens
built on forEach:
you can build your
own custom tags
based on JSTL tags



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Looping Tags in Action: Ajax Data Handling

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Original Version

- In "Ajax Data Handling" showed, showed example that displayed lists of cities
 - JavaScript
 - Sent out request to server
 - Took data back in XML, JSON, or string format
 - Extracted information and produced HTML table
 - Inserted table into page
 - HTML
 - Loaded JavaScript files
 - Had button that triggered the action
 - Servlet
 - Produced List of City objects
 - JSP
 - Put city info into XML, JSON, or string format
 - Repeated entries for each city in List
 - Notes and source code for original example
 - <http://courses.coreservlets.com/Course-Materials/ajax.html>

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HTML Code

```
...
<fieldset>
  <legend>Getting XML Data from Server...</legend>
  <form action="#">
    <label for="city-type-1">City Type:</label>
    <select id="city-type-1">
      <option value="top-5-cities">
        Largest Five US Cities</option>
      <option value="second-5-cities">
        Second Five US Cities</option>
      ...
    </select>
    <br/>
    <input type="button" value="Show Cities"
      onclick='xmlCityTable("city-type-1",
        "xml-city-table")' />
  </form>
</p>
<div id="xml-city-table"></div>
</fieldset>
```

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Servlet Code

```
public class ShowCities extends HttpServlet {
  public void doGet(HttpServletRequest request,
    HttpServletResponse response)
    throws ServletException, IOException {
    response.setHeader("Cache-Control", "no-cache");
    response.setHeader("Pragma", "no-cache");
    String cityType = request.getParameter("cityType");
    List<City> cities = findCities(cityType);
    request.setAttribute("cities", cities);
    String format = request.getParameter("format");
    String outputPage;
    if ("xml".equals(format)) {
      response.setContentType("text/xml");
      outputPage = "/WEB-INF/results/cities-xml.jsp";
    } ...
    RequestDispatcher dispatcher =
      request.getRequestDispatcher(outputPage);
    dispatcher.include(request, response);
  }
}
```

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Original JSP Code (before-jstl/cities-xml.jsp)

```
<?xml version="1.0" encoding="UTF-8"?>
<cities>
  <headings>
    <heading>City</heading>
    <heading>Time</heading>
    <heading>Population</heading>
  </headings>
  <city>
    <name>${cities[0].name}</name>
    <time>${cities[0].shortTime}</time>
    <population>${cities[0].population}</population>
  </city>
  ...    <!-- Repeated for cities 1, 2, and 3 -->
  <city>
    <name>${cities[4].name}</name>
    <time>${cities[4].shortTime}</time>
    <population>${cities[4].population}</population>
  </city>
</cities>
```

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Problems with JSP Code

- **Repetitive**
 - Almost-identical city entries repeated five times
 - If the city format changes, all five entries need to change
- **Presumes exactly five cities**
 - Will not work with a different number of cities
- **Solution**
 - Use JSTL

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Updated JSP Code (cities-xml.jsp)

```
<?xml version="1.0" encoding="UTF-8"?>
<cities>
  <headings>
    <heading>City</heading>
    <heading>Time</heading>
    <heading>Population</heading>
  </headings>
  <%@ taglib prefix="c"
      uri="http://java.sun.com/jsp/jstl/core" %>
  <c:forEach var="city" items="${cities}">
    <city>
      <name>${city.name}</name>
      <time>${city.shortTime}</time>
      <population>${city.population}</population>
    </city>
  </c:forEach>
</cities>
```

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Alternative Version (Using XML Syntax: cities-xml.jspx)

```
<?xml version="1.0" encoding="UTF-8"?>
<cities xmlns:c="http://java.sun.com/jsp/jstl/core">
  <headings>
    <heading>City</heading>
    <heading>Time</heading>
    <heading>Population</heading>
  </headings>
  <c:forEach var="city" items="${cities}">
    <city>
      <name>${city.name}</name>
      <time>${city.shortTime}</time>
      <population>${city.population}</population>
    </city>
  </c:forEach>
</cities>
```

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XML Data: Results

The image shows three screenshots of a web application titled "Ajax: Handling Server Data - Microsoft Internet Explorer". The application is running at <http://localhost/ajax-data/>. The page title is "Getting XML Data from Server, Building HTML Table".

The first screenshot shows the "City Type" dropdown set to "Largest Five US Cities" and the "Show Cities" button being clicked.

The second screenshot shows the results for "Largest Five US Cities" in a table:

City	Time	Population
New York	01:38:33 PM	8,250,567
Los Angeles	10:38:33 AM	3,849,368
Chicago	12:38:33 PM	2,873,326
Houston	12:38:33 PM	2,144,491
Phoenix	11:38:33 AM	1,512,986

The third screenshot shows the results for "Most Recent Superbowl Hosts" in a table:

City	Time	Population
Phoenix	11:38:54 AM	1,512,986
Miami	01:38:54 PM	404,048
Detroit	01:38:54 PM	918,849
Jacksonville	01:38:54 PM	794,555
Houston	12:38:54 PM	2,144,491

JSON Version: Original (before-jstl/cities-json.jsp)

```
{ headings: ["City", "Time", "Population"],
  cities: [
    ["${cities[0].name}", "${cities[0].shortTime}",
      "${cities[0].population}"],
    ["${cities[1].name}", "${cities[1].shortTime}",
      "${cities[1].population}"],
    ["${cities[2].name}", "${cities[2].shortTime}",
      "${cities[2].population}"],
    ["${cities[3].name}", "${cities[3].shortTime}",
      "${cities[3].population}"],
    ["${cities[4].name}", "${cities[4].shortTime}",
      "${cities[4].population}"]
  ]
}
```

JSON Version: Updated (cities-json.jsp)

```
<%@ taglib prefix="c"
    uri="http://java.sun.com/jsp/jstl/core" %>
{ headings: ["City", "Time", "Population"],
  cities: [
    <c:forEach var="city" items="${cities}" varStatus="status">
      ["${city.name}", "${city.shortTime}", "${city.population}"]
      <c:if test="${!status.last}">,</c:if>
    </c:forEach>
  ]
}
```

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JSON Version: Results

The application displays a form titled "Getting JSON Data from Server, Building HTML Table". It includes a "City Type" dropdown menu and a "Show Cities" button. Below the form, an HTML table displays the retrieved data.

City Type: Largest Five US Cities

City	Time	Population
Philadelphia	04:32:09 PM	1,448,396
San Antonio	03:32:09 PM	1,296,682
San Diego	01:32:09 PM	1,256,951
Dallas	03:32:09 PM	1,232,940
San Jose	01:32:09 PM	929,936

City Type: Second Five US Cities

City	Time	Population
San Antonio	03:32:31 PM	1,296,682
San Diego	01:32:31 PM	1,256,951
San Jose	01:32:31 PM	929,936
San Francisco	01:32:31 PM	744,041
Seattle	01:32:31 PM	582,454

City Type: US Cities Starting with 'S'

City	Time	Population
San Antonio	03:32:31 PM	1,296,682
San Diego	01:32:31 PM	1,256,951
San Jose	01:32:31 PM	929,936
San Francisco	01:32:31 PM	744,041
Seattle	01:32:31 PM	582,454

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Delimited String Version: Original (before-jstl/cities-string.jsp)

```
City#Time#Population
${cities[0].name}##${cities[0].shortTime}##${cities[0].population}
${cities[1].name}##${cities[1].shortTime}##${cities[1].population}
${cities[2].name}##${cities[2].shortTime}##${cities[2].population}
${cities[3].name}##${cities[3].shortTime}##${cities[3].population}
${cities[4].name}##${cities[4].shortTime}##${cities[4].population}
```

Delimited String Version: Updated (cities-string.jsp)

```
<%@ taglib uri="http://java.sun.com/jsp/jstl/core"
    prefix="c" %>City#Time#Population
<c:forEach var="city" items="${cities}">
${city.name}##${city.shortTime}##${city.population}</c:forEach>
```

String Version: Results

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Getting String Data from Server, Building HTML Table

City Type: Largest Five US Cities

Show Cities

City	Time	Population
New York	05:02:28 PM	8,250,567
Los Angeles	02:02:28 PM	3,849,368
Chicago	04:02:28 PM	2,873,326
Houston	04:02:28 PM	2,144,491
Phoenix	03:02:28 PM	1,512,986

Getting String Data from Server, Building HTML Table

City Type: Second Five US Cities

Show Cities

City	Time	Population
Philadelphia	05:02:45 PM	1,448,396
San Antonio	04:02:45 PM	1,296,682
San Diego	02:02:45 PM	1,256,951
Dallas	04:02:45 PM	1,232,940
San Jose	02:02:45 PM	929,936

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Logic Tags

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Conditional Evaluation Tags

- **One choice: if**

```
<c:if test="${someTest}">  
    Content  
</c:if>
```

- **Lots of choices: choose**

```
<c:choose>  
    <c:when test="test1">Content1</c:when>  
    <c:when test="test2">Content2</c:when>  
    ...  
    <c:when test="testN">ContentN</c:when>  
    <c:otherwise>Default Content</c:otherwise>  
</c:choose>
```

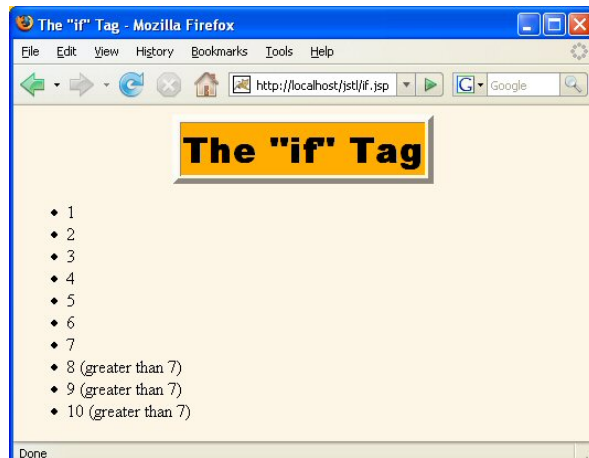
- **Caution: resist use of business logic!**

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The "if" Tag

```
<%@ taglib prefix="c"  
    uri="http://java.sun.com/jsp/jstl/core"%>  
<UL>  
    <c:forEach var="i" begin="1" end="10">  
        <LI>${i}  
            <c:if test="${i > 7}">  
                (greater than 7)  
            </c:if>  
        </c:forEach>  
    </UL>
```

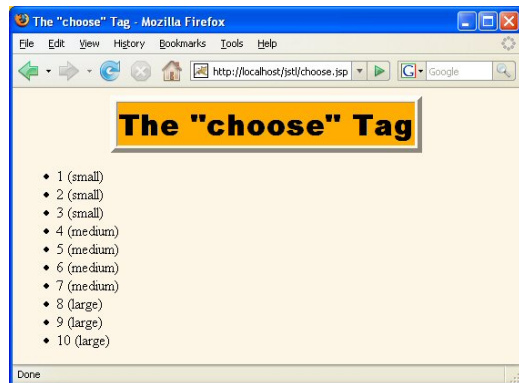


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Done

The "choose" Tag

```
<%@ taglib prefix="c"
      uri="http://java.sun.com/jsp/jstl/core"%>
<UL>
<c:forEach var="i" begin="1" end="10">
  <LI>${i}
    <c:choose>
      <c:when test="${i < 4}">
        (small)
      </c:when>
      <c:when test="${i < 8}">
        (medium)
      </c:when>
      <c:otherwise>
        (large)
      </c:otherwise>
    </c:choose>
  </c:forEach>
</UL>
```



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Using JSTL in JSF Pages

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Output Pages vs. Direct-Access Pages

- **Output pages**
 - In pages that are the result of a navigation rule (i.e., listed under to-view-id), you can use JSTL as shown on previous slides
 - Since bean is *already* in request, session, or application
- **Direct access pages**
 - JSTL does not know about faces-config.xml, so you cannot refer to beans that are listed there but not yet instantiated
 - Using direct-access pages is rare in real life, but is very useful for testing when learning JSTL
 - Solution: use h:outputText to refer to bean once first
 - Declare bean containing array of numbers in faces-config.xml
 - First num: <h:outputText value="#{myBean.numbers[0]}/>
 - <c:forEach var="num" items="\${myBean.numbers}>...

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JSF Does Not Know About JSTL Variables

- **JSTL puts data in page scope**
- **This works**
 - <c:forEach var="name" items="\${names}">
 \${name}
 </c:forEach>
 - Example assumes this is an output page and "names" set earlier by JSF
- **This fails**
 - <c:forEach var="name" items="names">
 <h:outputText value="#{name}"/>
 </c:forEach>
- **Supposedly fixed in JSTL 1.2**
 - But there are no standalone releases of JSTL 1.2
 - Use facelets instead

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Database Access Tags

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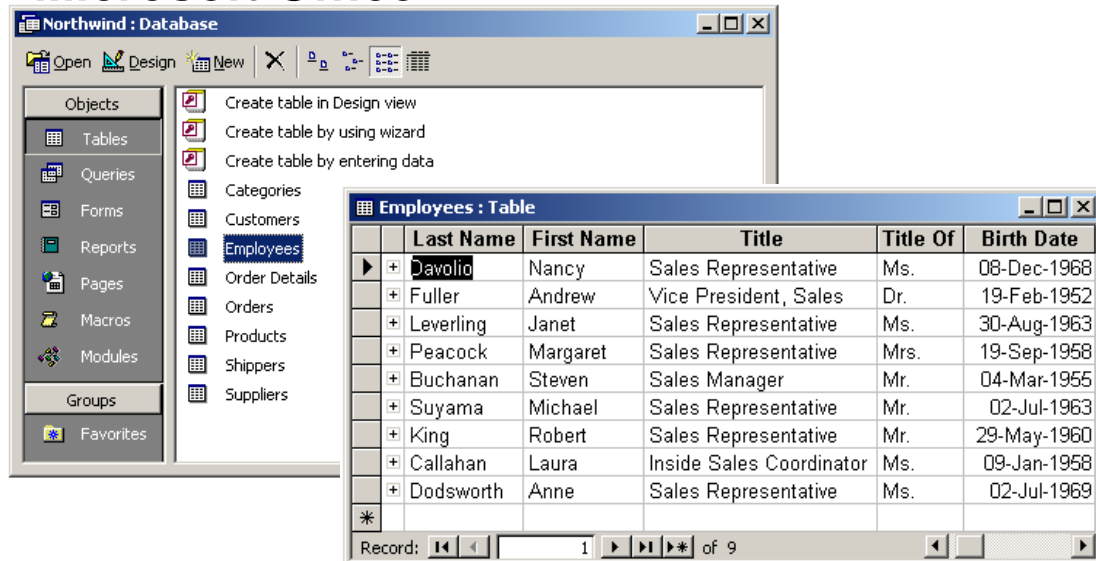
Database Access Tags

- **<sql:setDataSource>**
 - Specifies data source (can also be set by config settings)
- **<sql:query>**
 - Queries database and stores ResultSet in variable
 - Warning: this usage violates rule of keeping business logic out of presentation layer. Instead, do database access in servlet and pass results to JSP via MVC.
- **<sql:update>**
- **<sql:param>**
- **<sql:dateParam>**
- **<sql:transaction>**
 - Performs the enclosed <sql:query> and <sql:update> actions as a single transaction

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Aside: The Microsoft Access Northwind Database

- Database that comes preinstalled with Microsoft Office

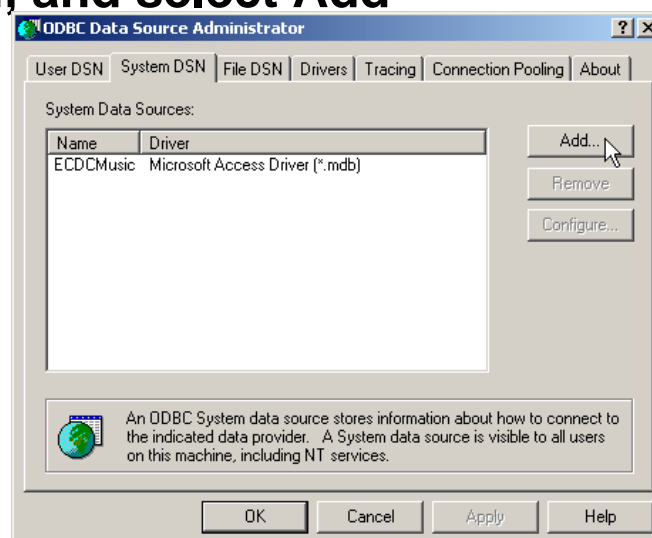


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Using Microsoft Access via ODBC

- Click Start, Settings, Control Panel, Administrative Tools, Data Sources, System DSN, and select Add

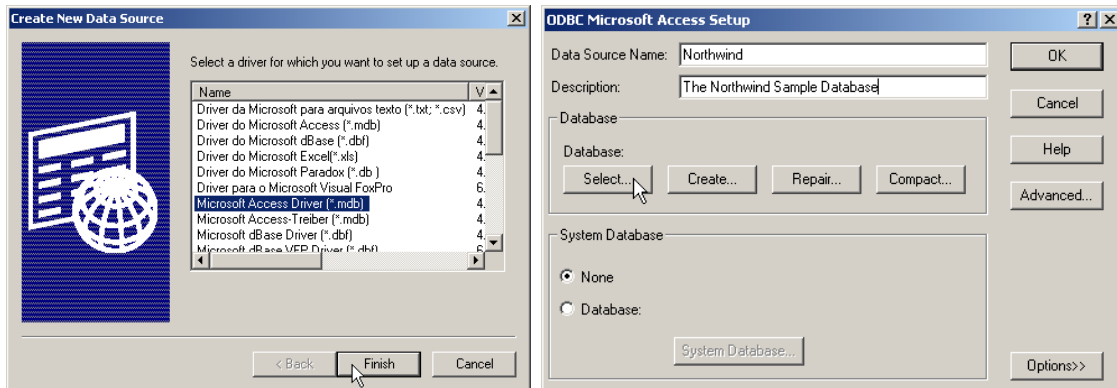


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Using Microsoft Access via ODBC (Continued)

- Select Microsoft Access Driver, Finish, type a name under Data Source Name, and hit Select

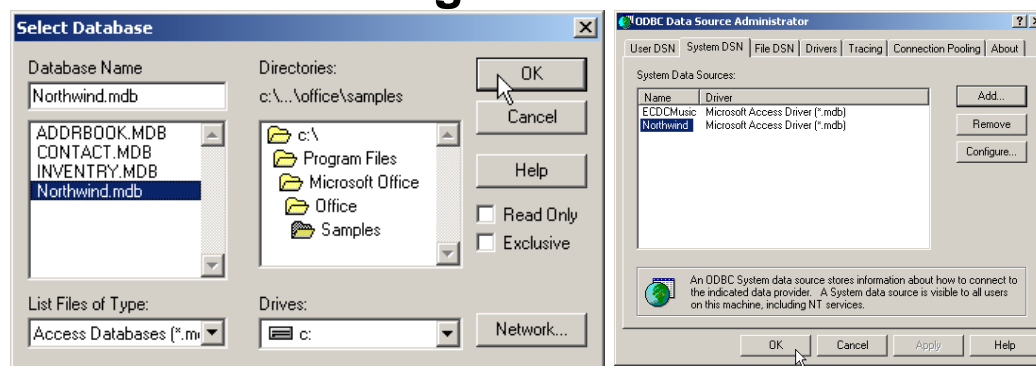


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Using Microsoft Access via ODBC (Continued)

- Navigate to the Samples directory of MS Office, select Northwind.mdb, hit OK, then hit OK in following two windows



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Using Microsoft Access via ODBC (Continued)

- **Driver**
 - sun.jdbc.odbc.JdbcOdbcDriver
 - Comes bundled with JDK
- **URL**
 - jdbc:odbc:Northwind
 - Local access only; for testing. Not for serious applications.
- **Username**
 - Empty string
- **Password**
 - Empty string

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sql:setDataSource

- You can set a data source globally via configuration settings or application-scoped variables.
 - Preferred approach in real applications
- Or, you can set it on a specific page

```
<%@ taglib prefix="sql"
    uri="http://java.sun.com/jstl/sql" %>
<sql:setDataSource
    driver="sun.jdbc.odbc.JdbcOdbcDriver"
    url="jdbc:odbc:Northwind"
    user=""
    password="" />
```

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sql:query

- **Form 1: use the sql attribute**
`<sql:query var="results" sql="SELECT * FROM ..."/>`
- **Form 2: put the query in the body of the tag**
`<sql:query var="results">
 SELECT * FROM ...
</sql:query>`
- **Options**
 - dataSource
 - maxRows
 - startRow
- **Caution**
 - Embedding SQL directly in JSP may be hard to maintain.

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Simple Example

```
<%@ taglib prefix="c"  
    uri="http://java.sun.com/jsp/jstl/core"%>  
<%@ taglib prefix="sql"  
    uri="http://java.sun.com/jstl/sql" %>  
<sql:setDataSource  
    driver="sun.jdbc.odbc.JdbcOdbcDriver"  
    url="jdbc:odbc:Northwind"  
    user=""  
    password=""/>
```

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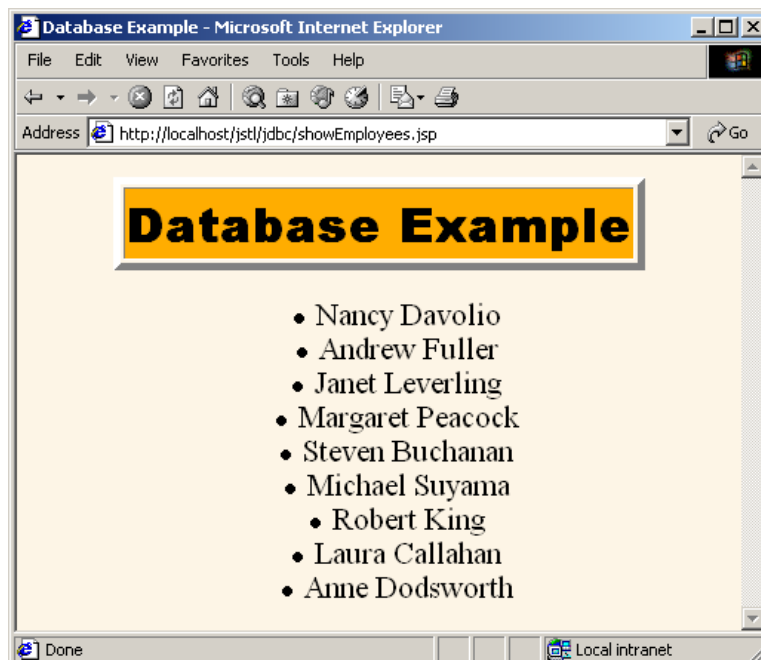
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Simple Example (Continued)

```
<sql:query var="employees">
    SELECT * FROM employees
</sql:query>

<UL>
<c:forEach var="row" items="{employees.rows}">
    <LI>${row.firstname}
        ${row.lastname}
</c:forEach>
</UL>
```

Simple Example: Results





Other Tags

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URL-Handling Tags

- **<c:import>**
 - Read content from arbitrary URLs
 - Insert into page
 - Store in variable
 - Or make accessible via a reader
 - Unlike <jsp:include>, not restricted to own system
- **<c:redirect>**
 - Redirects response to specified URL
- **<c:param>**
 - Encodes a request parameter and adds it to a URL
 - May be used within body of <c:import> or <c:redirect>

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Formatting Tags

- **<fmt:formatNumber>**
 - Formats a numeric value as a number, currency value, or percent, in a locale-specific manner
- **<fmt:parseNumber>**
 - Reads string representations of number, currency value, or percent
- **<fmt:formatDate>**
- **<fmt:parseDate>**
- **<fmt:timeZone>**
- **<fmt:setTimeZone>**

Internationalization (I18N) Tags

- **<fmt:setLocale>**
 - Sets Locale
- **<fmt:setBundle>**
- **<fmt:bundle>**
- **<fmt:message>**
 - Retrieves localized message from a resource bundle
- **<fmt:param>**

XML Manipulation Tags

- **Core**
 - `<x:parse>`
- **XPath**
 - `<x:if>`
 - `<x:choose>`
 - `<x:when>`
 - `<x:otherwise>`
 - `<x:forEach>`
- **XSLT**
 - `<x:transform>`
 - `<x:param>`

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Summary

- **JSTL is similar to the old Struts looping and logic tags, but better**
- **JSTL is standardized, but not a standard part of JSP**
 - It is supposed to be included with all JSF implementations
- **Supports a concise expression language**
 - Lets you access bean properties and implicit objects
 - EL is standard part of JSP 2.0, JSP 2.1, and JSF
- **Looping tags**
 - Explicit numeric values
 - Arrays, collections, maps, strings, etc.
- **Conditional evaluation tags**
 - Single options
 - Multiple options

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Summary (Continued)

- **Database Access Tags**
 - *Always* a bad idea when using MVC approach
 - With or without a framework like JSF or Struts
 - sql:setDataSource to specify a database
 - sql:query to perform query
 - Loop down results using iteration tags
- **Other tags**
 - Handling URLs
 - Internationalizing pages
 - Formatting strings
 - Manipulating XML

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Questions?

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