

> Unit Summary and Outcomes

In this unit, students will learn determine whether or not a given year is a leap year. To do this, they will implement an algorithm as part of a class called `LeapYear`. They will then develop an applet called `LeapYearApplet`, in which users can input a given year to test against the algorithm. Finally, students will convert the applet into a web (HTML) page. Once the program is up and running, they can modify and improve upon the applet, adding color or other components. They may also add color and other improvements to the web page.

> Student Assessment (see rubric)

How well do students perform each of the following tasks:

- Code and compile the `LeapYear` class
- Code and compile the `LeapYearApplet` class
- Generate the web page with an embedded `LeapYearApplet`

> Prerequisite Knowledge and Skills

BlueJ:

- Creating projects
- Adding new classes
- Running applets
- Converting applets into web pages

Java:

- Understanding the methods required for applets

Math:

- Understanding how to determine whether or not a year is a leap year

HTML:

- Understanding how to create a basic web page

> This Project Targets the Following Subject Areas(s):

Pre-Java	Java Programming
<input type="checkbox"/> Hardware Basics	<input checked="" type="checkbox"/> Applet Programming
<input checked="" type="checkbox"/> Software Basics	<input type="checkbox"/> Subroutine Programming
<input type="checkbox"/> Networks and Servers	<input type="checkbox"/> Full Scale Programming
<input checked="" type="checkbox"/> HTML	
<input type="checkbox"/> Action Scripting	
<input type="checkbox"/> Java Scripting	
<input type="checkbox"/> Other (briefly describe below):	<input type="checkbox"/> Other (briefly describe below):

> Curriculum-Framing Questions

Essential Question	<ul style="list-style-type: none"> • What is the connection between applets and HTML? • How does a web page incorporate an applet?
Activity Questions	<ul style="list-style-type: none"> • How are applets incorporated into web pages? • How is a clock implemented in Java? • How are parameters transferred from HTML to Java? • How is a process started using a thread?
Sample Content Questions	<ul style="list-style-type: none"> • How does the applet interact with the <code>LeapYear</code> class? • What would make this applet more interesting?

> Targeted Content Standards, Benchmarks, or State Frameworks

California state Standards:

Mathematics:

- **Algebra I: Standard 25.0** – Students use properties of the number system to judge the validity of results, to justify each step of a procedure, and to prove

International Society of Technology Education (ISTE):

Information Literacy Standards:

- **Standard 1** – The student who is information literate accesses information efficiently and

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or disprove statements.

- **Algebra I: Standard 25.1** – Students use properties of numbers to construct simple, valid arguments (direct and indirect) for, or formulate counterexamples to, claimed assertions.
- **Algebra I: Standard 25.2** – Students judge the validity of an argument according to whether the properties of the real number system and the order of operations have been applied correctly at each step.
- **Algebra I: Standard 25.3** – Given a specific algebraic statement involving linear, quadratic, or absolute value expressions or equations or inequalities, students determine whether the statement is true sometimes, always, or never.

effectively.

- **Standard 2** – The student who is information literate evaluates information critically and competently.

Technology Foundation Standards for Students:

- **Standard 3** – Students use technology tools to enhance learning, increase productivity, and promote creativity. Students use productivity tools to collaborate in constructing

> Materials and Resources Required for Project

Equipment	<ul style="list-style-type: none">• Computer for each student with BlueJ and Java SDK installed
Consumable Supplies	<ul style="list-style-type: none">• Diskettes• Printed output for prototype
Textbooks/Lesson Guides	<ul style="list-style-type: none">• Any of the better high school–level Java textbooks• Handouts of lessons
Technology	<ul style="list-style-type: none">• Windows-based machines running Windows 98 SE or higher
Internet Resources	<ul style="list-style-type: none">• http://java.sun.com/j2se/1.5.0/docs/api/• http://www.textpad.com/
Others	<ul style="list-style-type: none">• Text editor such as TextPad or NotePad

> Activity/Lesson Plan Outline

Overview: In this activity, students will develop the algorithm to determine whether or not a given year is a leap year. This algorithm will be implemented in the `LeapYear` class. They will then design and code an applet into which the user can enter years to test. The applet will use the `LeapYear` class to perform the calculation and will output the result. Once both of these tasks are completed, students will create HTML code to generate a web page with this applet embedded.

Begin by creating a project called `LeapYear` and within that project create a class called `LeapYear`. What follows is a simple version of the `LeapYear` code. Code and compile the following:

```
/**
 * Write a description of class LeapYear here.
 *
 * @author (your name)
 * @version (a version number or a date)
 */

public class LeapYear
{
    // instance variables
    private int year;
    boolean isLeap;
    /**
     * Constructor for objects of class LeapYear
     */
    public LeapYear(int yr)
    {
        // initialise instance variables
        year = yr;
    }

    public boolean isLeapYear()
    {
        // put your code here

        if (year % 400 == 0)
        {
```

```

        return true;
    }
    else if (year % 100 == 0)
    {
        return false;
    }
    else if (year % 4 == 0)
    {
        return true;
    }
    else return false;
}

```

```
} // end of LeapYear class
```

The algorithm for determining whether or not a year is a leap year is as follows:

- A year that is a multiple of 400 is a leap year.
- A year that is a multiple of 100, but not a multiple of 400, is not a leap year.
- A year that is not a multiple of 100, but is a multiple of 4, is a leap year.

Next, create an applet in which the user can enter a year. The program will determine whether or not this is a leap year, responding with “Yes” or “No,” leap year or not leap year.

```

import java.awt.*;
import javax.swing.*;
import java.awt.event.*;

/**
 * Class LeapYearApplet - write a description of the class here
 *
 * @author (your name)
 * @version (a version number)
 */
public class LeapYearApplet extends JApplet implements
ActionListener
{
    private JLabel lblYear;
    private JTextField txtYear;
    private JLabel lblIsLeap;
    private JLabel lblResult;
    private JButton btnCalculate;

```

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```

private LeapYear testYear;

/**
 * Called by the browser or applet viewer to inform this JApplet
that it
 * has been loaded into the system. It is always called before
the first
 * time that the start method is called.
 */
public void init()
{
// this is a workaround for a security conflict with some browsers
// including some versions of Netscape & Internet Explorer
which do
// not allow access to the AWT system event queue which
JApplets do
// on startup to check access. May not be necessary with
your browser.
    JRootPane rootPane = this.getRootPane();
    rootPane.putClientProperty("defeatSystemEventQueueCheck",
                               Boolean.TRUE);

    lblYear = new JLabel("Year");
    txtYear = new JTextField("      ");
    lblIsLeap = new JLabel("Leap Year?");
    lblResult = new JLabel("      ");
    btnCalculate = new JButton("Calculate");

    btnCalculate.addActionListener(this);

    setLayout(new FlowLayout());
    add(lblYear);
    add(txtYear);
    add(lblIsLeap);
    add(lblResult);

    add(btnCalculate);
}

/**
 * Called by the browser or applet viewer to inform this JApplet
that
 * it should stop its execution. It is called when the Web page
that
 * contains this JApplet has been replaced by another page, and
also
 * just before the JApplet is to be destroyed.
 */
public void actionPerformed(ActionEvent evt)
{

```

```

        String strYear;
        strYear = txtYear.getText().trim();
        int year = Integer.parseInt(strYear);
        testYear = new LeapYear(year);

        if (testYear.isLeap())
            lblResult.setText("Yes");
        else
            lblResult.setText("No");
    }
}

```

Now, implement this applet, including the `ActionListener` interface:

```

public class LeapYearApplet extends JApplet implements
ActionListener

```

Note: Because this applet implements `ActionListener`, the code must, in fact, implement the method

```

public void actionPerformed(ActionEvent evt).

```

This method will be invoked when the `btnCalculate` component is clicked. This is because an action listener has been attached to the `btnCalculate` component:

```

btnCalculate.addActionListener(this);

```

When the `btnCalculate` component is clicked or otherwise used (for example, dragged or released), an `ActionEvent` is initiated and passed into the `actionPerformed()` method. In this example, the `btnCalculate` component is the only one to which an `ActionListener` is attached, so it is the only component that can trigger the `actionPerformed()` method. If there were other components to which `ActionListeners` had been attached, you would need to determine the source of the `ActionEvent`. In this case, it can only be the `btnCalculate`, so the method will go ahead and determine whether or not the year input into the `txtYear` `JTextField` box represents a leap year. The method first converts the input into an integer, then instantiates a `LeapYear` object. Once the `LeapYear` object `txtYear`

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has been instantiated, it will be used to invoke the `isLeap()` method to determine whether or not the year entered is a leap year. The result—"Yes" or "No"—will appear in the `lblResult` `JLabel` component.

Next, convert the application into an HTML file. If you are using `BlueJ`, an HTML file will automatically be generated when the `LeapYearApplet` is run. If you are using a different compiler, use a text editor such as `TextPad` (`NotePad` will also work) to create the HTML file as follows:

```
<html>
  <head>
    <title>LeapYearApplet Applet</title>
  </head>
  <body>
    <h1>LeapYearApplet Applet</h1>
    <hr>
    <applet code="LeapYearApplet.class"
      width=500
      height=500
      codebase="."
      alt="Your browser understands the &lt;APPLET&gt; tag but
isn't
      running the applet, for some reason.">
      Your browser is ignoring the &lt;APPLET&gt; tag!
    </applet>
    <hr>
  </body>
</html>
```

Note: When creating an HTML file that includes an applet, make sure that both the `LeapYearApplet` class file (`LeapYearApplet.class`) and the `LeapYear` class file (`LeapYear.class`) are in the same location as the HTML file, that is, in the same directory or folder.

> Pacing/Timeline

- Code and compile `LeapYear` class: 1 day
- Code and compile `LeapYearApplet` class: 1 day
- Convert applet into web page and test: 1 day

> Teacher Reflection (For example, what worked well in this unit? What would you change if you were to teach it again?)

- Were students able to code and compile the `LeapYear` class?
- Were they able to code and compile the `LeapYearApplet` class?
- Were they able to convert the applet into an HTML document?
- Did they improve the applet code and experiment with color and the placement of components?
- Were they able to run and improve upon the HTML code?

> Student Handout: Java Programming Leap Year

In this activity, you will implement an algorithm to determine whether a given year is a leap year or not. Begin by creating a project called `LeapYear` and within that project create a class call `LeapYear`. What follows is a simple version of the `LeapYear` code. Code and compile the following:

```
/**
 * Write a description of class LeapYear here.
 *
 * @author (your name)
 * @version (a version number or a date)
 */

public class LeapYear
{
    // instance variables
    private int year;
    boolean isLeap;
    /**
     * Constructor for objects of class LeapYear
     */
    public LeapYear(int yr)
    {
        // initialise instance variables
        year = yr;
    }

    public boolean isLeapYear()
    {
        // put your code here
        if (year % 400 == 0)
        {
            isLeap = true;
            return true;
        }
        else if (year % 100 == 0)
        {
            isLeap = false;
            return false;
        }
        else if (year % 4 == 0)
            isLeap = true;
        else isLeap = false;
    }
}
```

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```

        return isLeap;
    }

} // end of LeapYear class

```

Once this is coded and compiled, add into the LeapYear project a new class called LeapYearApplet. Sample code is included as follows:

```

import java.awt.*;
import javax.swing.*;
import java.awt.event.*;

/**
 * Class LeapYearApplet - write a description of the class here
 *
 * @author (your name)
 * @version (a version number)
 */
public class LeapYearApplet extends JApplet implements
ActionListener
{
    private JLabel lblYear;
    private JTextField txtYear;
    private JLabel lblIsLeap;
    private JLabel lblResult;
    private JButton btnCalculate;
    private LeapYear testYear;

    /**
     * Called by the browser or applet viewer to inform this JApplet
that it
     * has been loaded into the system. It is always called before
the first
     * time that the start method is called.
     */
    public void init()
    {
        // this is a workaround for a security conflict with some
browsers
        // including some versions of Netscape & Internet Explorer
which do
        // not allow access to the AWT system event queue which
JApplets do
        // on startup to check access. May not be necessary with
your browser.

```

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```

JRootPane rootPane = this.getRootPane();
rootPane.putClientProperty("defeatSystemEventQueueCheck",
                           Boolean.TRUE);

lblYear = new JLabel("Year");
txtYear = new JTextField("      ");
lblIsLeap = new JLabel("Leap Year?");
lblResult = new JLabel("      ");
btnCalculate = new JButton("Calculate");

btnCalculate.addActionListener(this);

setLayout(new FlowLayout());
add(lblYear);
add(txtYear);
add(lblIsLeap);
add(lblResult);

add(btnCalculate);
}

/**
 * Called by the browser or applet viewer to inform this JApplet
that
 * it should stop its execution. It is called when the Web page
that
 * contains this JApplet has been replaced by another page, and
also
 * just before the JApplet is to be destroyed.
 */
public void actionPerformed(ActionEvent evt)
{
    String strYear;
    strYear = txtYear.getText().trim();
    int year = Integer.parseInt(strYear);
    testYear = new LeapYear(year);

    if (testYear.isLeap())
        lblResult.setText("Yes");
    else
        lblResult.setText("No");
}
}

```

Next, compile and run the applet. Once it has been compiled, you can convert the applet into a web (HTML) page. `BlueJ` does this automatically. (Alternatively, you

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could key this in using Notepad or TextPad.) If you are using a different compiler, create a web page as follows, making sure that both `LeapYear.class` and `LeapYearApplet.class` files are located in the same directory (folder) as the HTML document.

```
<html>
  <head>
    <title>LeapYearApplet Applet</title>
  </head>
  <body>
    <h1>LeapYearApplet Applet</h1>
    <hr>
    <applet code="LeapYearApplet.class"
      width=500
      height=500
      codebase="."
      alt="Your browser understands the <APPLET> tag but
isn't
      running the applet, for some reason.">
      Your browser is ignoring the <APPLET> tag!
    </applet>
    <hr>
  </body>
</html>
```

Once you have created the HTML page, run it to verify that the applet works correctly.

> YOUR JOB:

- Code and compile the `LeapYear` file
- Code and compile the `LeapYearApplet` file
- Convert the applet to HTML

> EXTRAS YOU CAN ADD:

- Add color and other features to the applet
- Modify and improve the web page

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