JavaFX

Using JavaFX Charts

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This tutorial teaches Java developers how to use JavaFX 2 charts such as pie chart, area chart, bar chart, bubble chart, line chart, and scatter chart to develop rich internet applications.

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Part I

About This Tutorial

This tutorial describes the graphical charts available in the `javafx.scene.chart` package of the JavaFX SDK and contains the following chapters:

- Introduction to JavaFX Charts
- Pie Chart
- Line Chart
- Area Chart
- Bubble Chart
- Scatter Chart
- Bar Chart
- Styling Charts with CSS

Each chapter provides code samples and applications to illustrate how to use a particular chart. You can find the source files of the applications and the corresponding NetBeans projects in the Application Files section.

1

Introduction to JavaFX Charts

This chapter provides an overview of the JavaFX charts available in the `javafx.scene.chart` package. The types of charts in Figure 1–1 are currently supported: bar, area, line, bubble, scatter, and pie

Figure 1–1 Types of Charts

With the JavaFX SDK you can build such charts in your application by adding just a few lines of code.

Chart Data

When you define the data model for a particular chart, you must distinguish between two-axis charts and charts that do not use axes to display data.

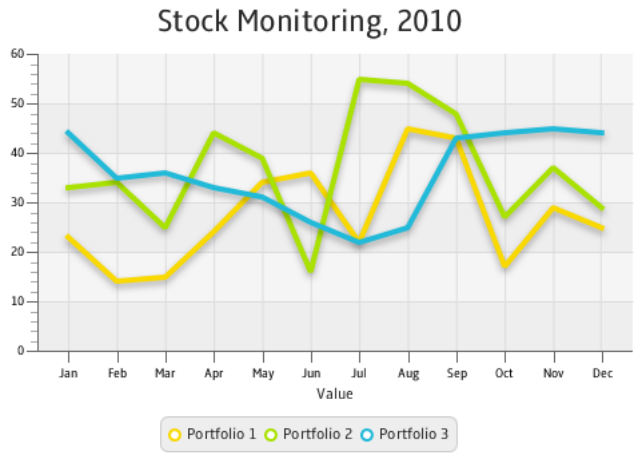
The `XYChart` class, a super class for all two-axis charts, provides basic capabilities for building area, line, bar, scatter, and bubble charts. Use the `XYChart.Data` class to specify the data model for these types of charts. The `xValue` property defines the value of a chart element to be plotted on the X axis, and the `yValue` property defines the value for the Y axis. You can also set the extra value for each chart element. This value can be plotted in any way the chart needs, or it can be used to store additional information about the chart element. For example, it can be used to define a radius for bubble charts.

Unlike a two-axis chart, the pie chart does not require defining values for x and y axes. You use the `PieChart.Data` class to specify values for each slice in the pie.

Series of Data

For two-axis charts, you can define several series of data by using the `XYChart.Series` class. For example, the line chart shown in Figure 1–2 has three series of data to demonstrate the changes dynamic in three different stock portfolios.

Figure 1–2 Line Chart with Three Series of Data



Use the `XYChart.Series` class to define as many sets of data as you need to represent on your graph. You can also assign a particular name to each series to display in the chart legend.

Chart Settings

For each chart, you can specify the title and its position relative to the graph. The title can be located on the top, right, left, or bottom of the graph. Similarly, you can specify the position of the chart legend.

For a two-axis graph, you can manage the appearance of the chart plot, the chart area where the graphical symbols corresponding to data values are rendered. You can set alternative columns and rows as well as horizontal and vertical grid lines and zero lines.

Axis Settings

You can alter the default appearance of each chart by defining the following settings:

- The axis label
- The axis position relative to the chart plot
- The upper and lower boundaries of the axis range
- The minimum and maximum tick marks, tick units, the gap between two tick marks, and tick labels

You can also specify that any changes to the axis and its range will be animated, or you can enable the axis to automatically determine its range from the data.

Processing Events for Chart Elements

All chart classes in the JavaFX SDK API extend the `Node` class and inherit all methods and properties of that class, which let you apply visual effects or handle mouse and key events. If you need to handle events for a particular chart element that is not a `Node` object, for example, for a slice of a pie chart, then use the `node` property and the `setNode` and `getNode` methods to associate a particular `Node` object with an element of the chart. You can process events for this chart element in the way you handle events for any other node: user interface control or shape. Example 1–1 demonstrates a code pattern to process events for a two-axis chart.

Example 1–1 Event Handling

```
for (final XYChart.Data data : chart.getData()) {
    data.getNode().addEventHandler(
       //Event handling
    );
}
```

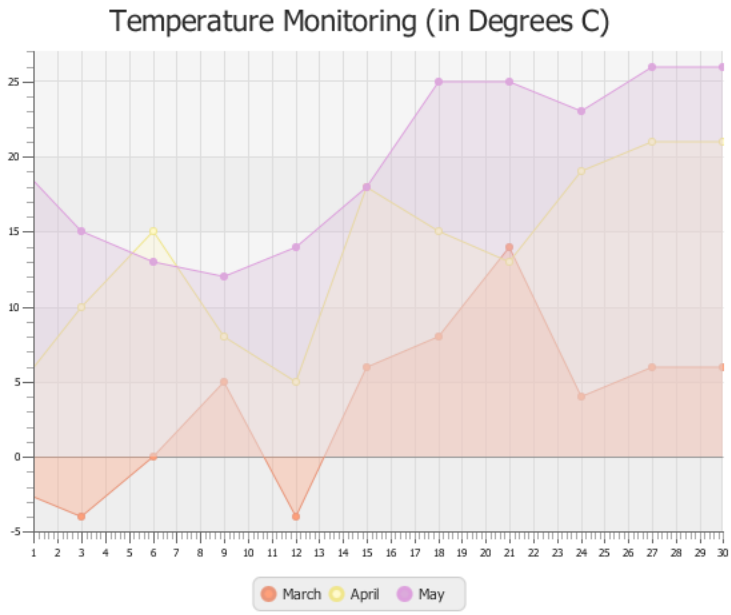
Animated Charts

With the JavaFX SDK, you can make your chart change dynamically as the data changes. Use the `animated` property and the `setAnimated` method of the `Chart` class to toggle this functionality for the chart. You can use the `animated` property and the `setAnimated` method of the `Axis` class to animate any changes to either axis and its range.

Styling Charts

The colors of the chart elements are defined by the implementation of each particular chart class. However, you can alter these colors as well as chart symbols by applying CSS styles. Figure 1–3 shows an area chart with the modified colors of its areas, lines, and symbols.

Figure 1–3 Area Chart Styled with CSS



The CSS file with the corresponding styles are shown in Example 1–2.

Example 1–2 Area Chart Styles

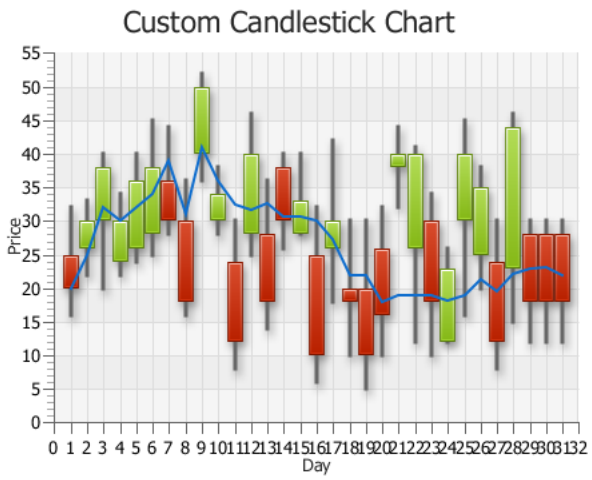
```
.default-color0.chart-area-symbol { -fx-background-color: #e9967a, #ffa07a; }
.default-color1.chart-area-symbol { -fx-background-color: #f0e68c, #fffacd; }
.default-color2.chart-area-symbol { -fx-background-color: #dda0dd, #d8bfd855; }

.default-color0.chart-series-area-line { -fx-stroke: #e9967a; }
.default-color1.chart-series-area-line { -fx-stroke: #f0e68c; }
.default-color2.chart-series-area-line { -fx-stroke: #dda0dd; }

.default-color0.chart-series-area-fill { -fx-fill: #ffa07a55; }
.default-color1.chart-series-area-fill { -fx-fill: #fffacd55; }
.default-color2.chart-series-area-fill { -fx-fill: #d8bfd855; }
```

Find the complete list of the JavaFX CSS properties in JavaFX CSS Reference Guide.

Custom Chart

You can invent your own type of chart by extending the `Chart` class or the `XYChart` class. Figure 1–4 shows a custom implementation of the candlestick chart.

Figure 1–4 Sample of a Custom Chart



To create a custom chart, you must override the methods of the `Chart` or `XYChart` classes that are necessary to enable specific chart capabilities. You also must create a new `Node` object to represent a single data item.

See the Charts section of the `Ensemble` application available on the product site to evaluate the implementation details.

2

Pie Chart

This chapter describes a chart that represents data in a form of circle divided into triangular wedges called slices. Each slice represents a percentage that corresponds to a particular value.

Figure 2–1 shows a pie chart created by using the `PieChart` class. The colors of the slices are defined by the order of the corresponding data items added to the `PieChart.Data` array.

Figure 2–1 Typical Pie Chart

Creating a Pie Chart

To create a pie chart in your JavaFX application, at a minimum, you must instantiate the `PieChart` class, define the data, assign the data items to the `PieChart` object, and add the chart to the application. When creating the chart data, define as many `PieChart.Data` objects for as many slices you want to appear. Each `PieChart.Data` object has two fields: the name of the pie slice and its corresponding value. Example 2–1 creates the basic pie chart.

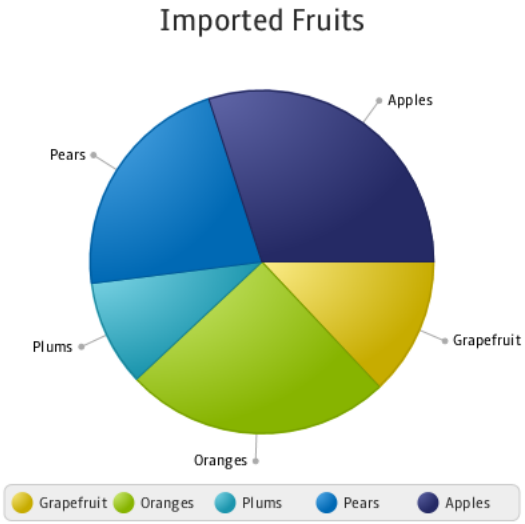
Example 2–1 Creating a Pie Chart

```
import javafx.application.Application;
import javafx.collections.FXCollections;
import javafx.collections.ObservableList;
import javafx.scene.Scene;
import javafx.stage.Stage;
import javafx.scene.chart.*;
```

```
import javafx.scene.Group;

public class PieChartSample extends Application {

    @Override public void start(Stage stage) {
        Scene scene = new Scene(new Group());
        stage.setTitle("Imported Fruits");
        stage.setWidth(500);
        stage.setHeight(500);

        ObservableList<PieChart.Data> pieChartData =
                FXCollections.observableArrayList(
                new PieChart.Data("Grapefruit", 13),
                new PieChart.Data("Oranges", 25),
                new PieChart.Data("Plums", 10),
                new PieChart.Data("Pears", 22),
                new PieChart.Data("Apples", 30));
        final PieChart chart = new PieChart(pieChartData);
        chart.setTitle("Imported Fruits");

        ((Group) scene.getRoot()).getChildren().add(chart);
        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

The result of compiling and running this application is shown in Figure 2–2.

Figure 2–2 Imported Fruits Charts



In addition to the basic settings, Example 2–1 specifies the title of the chart by calling the `setTitle` method.

Setting a Pie Chart and a Legend

The default view of a pie chart includes the pie with the labels and the chart legend. The values of the labels are retrieved from the name field of a `PieChart.Data` object. You can manage the appearance of the labels by using the `setLabelsVisile` method. Similarly, you can manage the appearance of the chart legend by calling the `setLegendVisible` method.

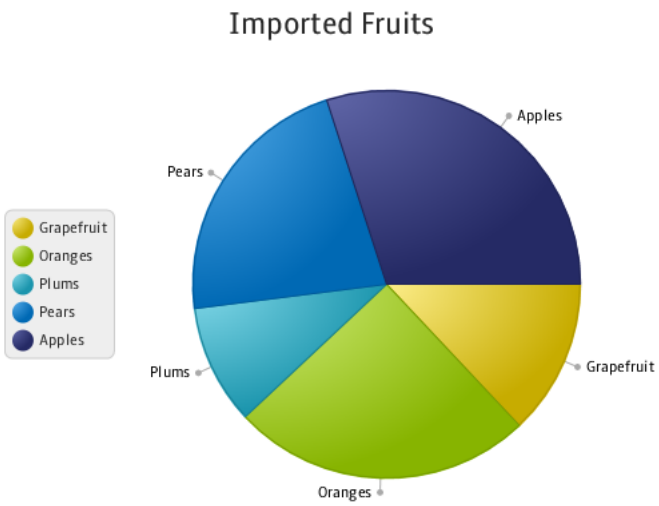
You can alter the position of the labels and the legend. With the `setLabelLineLength` method, you can specify the length of the line between the circumference of the pie and the labels. Use the `setLegendSide` method to alter the default position of the legend relative to the pie. Example 2–2 demonstrates how to apply these methods to the chart created in Example 2–1.

Example 2–2 Changing Position of the Labels and the Legend

```
chart.setLabelLineLength(10);
chart.setLegendSide(Side.LEFT);
```

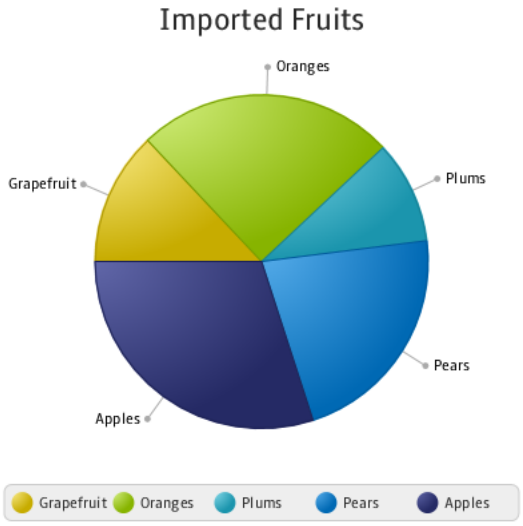
The result of adding these lines to the application code, compiling, and then running the application is shown in Figure 2–3.

Figure 2–3 Alternative Position of the Chart Legend and Labels



Your application might require that you alter the direction in which the slices are placed in the pie. By default, the slices are placed clockwise. However, you can change this by specifying the `false` value for the `setClockwise` method `chart.setClockwise(false)`. Use this method in combination with the `setStartAngle` method to attain the desired position of the slices. Figure 2–4 shows how the appearance of the pie chart changes when the `setStartAngle(180)` method is called for the `chart` object.

Figure 2–4 Changing the Start Angle of the Pie Chart Slices



Processing Events for a Pie Chart

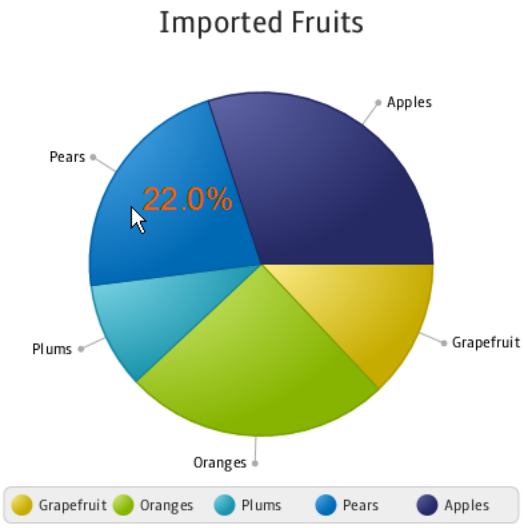
Although a pie chart slice is not a `Node` object, each `PieChart.Data` element has a node associated with it, which can be used to analyze events and process them accordingly. The code fragment shown in Example 2–3 creates an `EventHandler` object to process a `MOUSE_PRESSED` event that falls into a particular chart slice.

Example 2–3 Processing Mouse Events for a Pie Chart

```
final Label caption = new Label("");
caption.setTextFill(Color.DARKORANGE);
caption.setStyle("-fx-font: 24 arial;");

for (final PieChart.Data data : chart.getData()) {
    data.getNode().addEventHandler(MouseEvent.MOUSE_PRESSED,
        new EventHandler<MouseEvent>() {
            @Override public void handle(MouseEvent e) {
                caption.setTranslateX(e.getSceneX());
                caption.setTranslateY(e.getSceneY());
                caption.setText(String.valueOf(data.getPieValue()) + "%");
             }
        });
}
```

When you add this code fragment to the application code and compile and run it, the application starts reacting to the mouse clicks. Figure 2–5 shows the value displayed for Pears when a user clicks the corresponding slice.

Figure 2–5 Processing the Mouse-Pressed Events for a Pie Chart



By using this coding pattern, you can process various events or apply visual effects to the whole chart as well as to its slices.

Related API Documentation

- `PieChart`
- `PieChart.Data`
- `Chart`

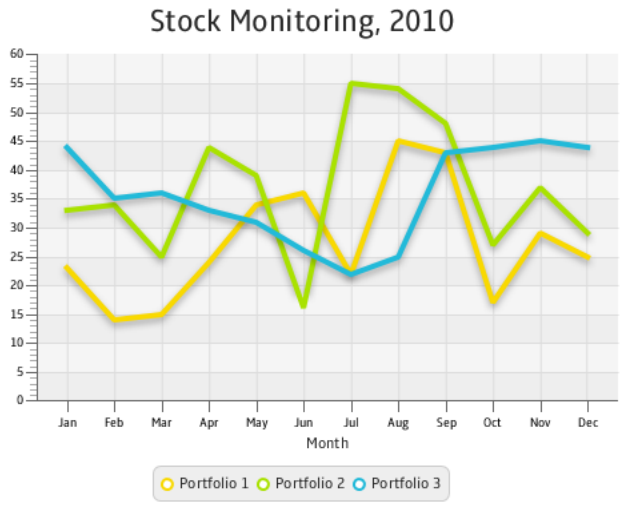
3

Line Chart

This chapter describes the line chart, a type of two-axis chart that presents data as a series of points connected by straight lines.

The line chart is often used to illustrate the dynamics of data over a particular interval of time. Figure 3–1 demonstrates a typical line chart with three series of data.

Figure 3–1 Example of a Line Chart



Each two-axis chart has two axes, the plot of data points, and the legend. You can also specify a title for the chart.

Creating a Line Chart

To create a line chart, at a minimum, you must define two axes, create the `LineChart` object by instantiating the `LineChart` class, create one or more series of data by using the `XYChart.Series` class, and assign the data to the chart. Example 3–1 implements these tasks.

Example 3–1 Simple Line Chart

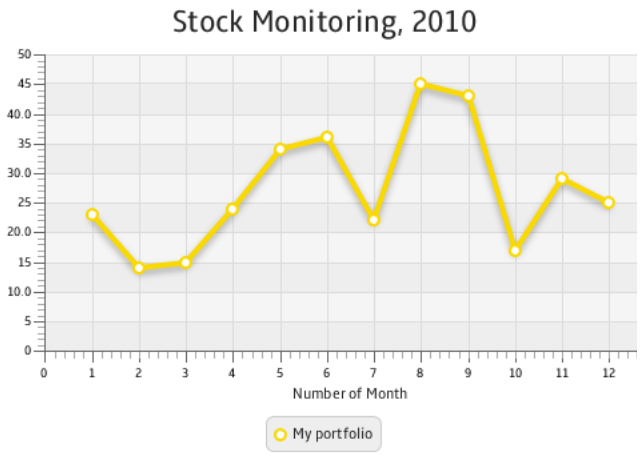
```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.chart.LineChart;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.XYChart;
```

```
import javafx.stage.Stage;


public class LineChartSample extends Application {

    @Override public void start(Stage stage) {
        stage.setTitle("Line Chart Sample");
        //defining the axes
        final NumberAxis xAxis = new NumberAxis();
        final NumberAxis yAxis = new NumberAxis();
        xAxis.setLabel("Number of Month");
        //creating the chart
        final LineChart<Number,Number> lineChart =
                new LineChart<Number,Number>(xAxis,yAxis);

        lineChart.setTitle("Stock Monitoring, 2010");
        //defining a series
        XYChart.Series series = new XYChart.Series();
        series.setName("My portfolio");
        //populating the series with data
        series.getData().add(new XYChart.Data(1, 23));
        series.getData().add(new XYChart.Data(2, 14));
        series.getData().add(new XYChart.Data(3, 15));
        series.getData().add(new XYChart.Data(4, 24));
        series.getData().add(new XYChart.Data(5, 34));
        series.getData().add(new XYChart.Data(6, 36));
        series.getData().add(new XYChart.Data(7, 22));
        series.getData().add(new XYChart.Data(8, 45));
        series.getData().add(new XYChart.Data(9, 43));
        series.getData().add(new XYChart.Data(10, 17));
        series.getData().add(new XYChart.Data(11, 29));
        series.getData().add(new XYChart.Data(12, 25));

        Scene scene  = new Scene(lineChart,800,600);
        lineChart.getData().add(series);

        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

In this example, both vertical and horizontal axes are created by using the `NumberAxis` class, a subclass of the `Axis` class, to represent numerical values. Having declared both `X` and `Y` axes numerical, you should specify `Number` parameters for `XYChart.Data` objects when creating a series of data. The first parameters of `XYChart.Data` objects define values for the horizontal axis, whereas, the second parameters of the `XYChart.Data` objects define values for the vertical axis.

The result of compiling and running this application is shown in Figure 3–2.

Figure 3–2 Line Chart with One Series of Data



The line chart shown in Figure 3–2 uses symbols to highlight each data item on the chart. If you want to show trends instead of specific data values on your line chart, you can disable the chart symbols as shown in Example 3–2.

Example 3–2 Disabling Symbols for a Line Chart

```
lineChart.setCreateSymbols(false);
```

The sample of a trend chart is shown in Figure 3–1.

In Figure 3–1, axes are shown in their default positions relative to the chart plot. However, you can display an axis on another side of the chart plot by applying the `setSide` method. Example 3–3 demonstrates how to move the horizontal axis to the top of the chart plot.

Example 3–3 Specifying the Axis Side

```
xAxis.setSide(Side.TOP);
```

Creating Categories for a Line Chart

Use the `CategoryAxis` class instead of the `NumberAxis` class to render non-numerical data in a line chart.

Examine the modified code of the application shown in Example 3–4. It creates the horizontal axis by instantiating the `CategoryAxis` class. The declaration of the `LineChart` object is modified to accommodate the change of the X axis type.

Example 3–4 Using Category Axis to Show Months

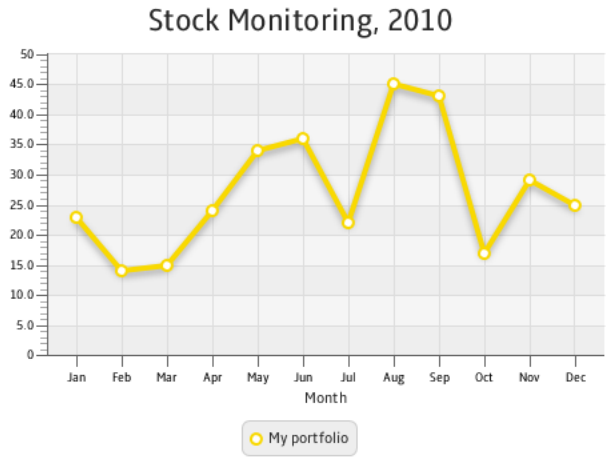
```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.chart.CategoryAxis;
import javafx.scene.chart.LineChart;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.XYChart;
import javafx.stage.Stage;


public class LineChartSample extends Application {
```

```
    @Override public void start(Stage stage) {
        stage.setTitle("Line Chart Sample");
        final CategoryAxis xAxis = new CategoryAxis();
        final NumberAxis yAxis = new NumberAxis();
        xAxis.setLabel("Month");

        final LineChart<String,Number> lineChart =
                new LineChart<String,Number>(xAxis,yAxis);

        lineChart.setTitle("Stock Monitoring, 2010");

        XYChart.Series series = new XYChart.Series();
        series.setName("My portfolio");

        series.getData().add(new XYChart.Data("Jan", 23));
        series.getData().add(new XYChart.Data("Feb", 14));
        series.getData().add(new XYChart.Data("Mar", 15));
        series.getData().add(new XYChart.Data("Apr", 24));
        series.getData().add(new XYChart.Data("May", 34));
        series.getData().add(new XYChart.Data("Jun", 36));
        series.getData().add(new XYChart.Data("Jul", 22));
        series.getData().add(new XYChart.Data("Aug", 45));
        series.getData().add(new XYChart.Data("Sep", 43));
        series.getData().add(new XYChart.Data("Oct", 17));
        series.getData().add(new XYChart.Data("Nov", 29));
        series.getData().add(new XYChart.Data("Dec", 25));


        Scene scene  = new Scene(lineChart,800,600);
        lineChart.getData().add(series);

        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

The `XYChartData` objects contain the month name and the corresponding numerical value. The label of the horizontal axis is modified accordingly.

The result of compiling and running the modified code of the application is shown in Figure 3–3.

Figure 3–3 Horizontal Category Axis



Often, line charts enable analyzing different set of data over the same period of time. Use several series of `XYChart.Data` objects to implement this task in your application.

Adding Series to the Line Chart

Example 3–5 provides source code for the stock monitoring application with three series of data. In addition to the series used in Example 3–4, the previous example, two new series are declared.

The series are assigned to the chart by using consecutive calls of the `getData` and `addAll` methods.

Example 3–5 Adding Two More Series to the Stock Monitoring Sample

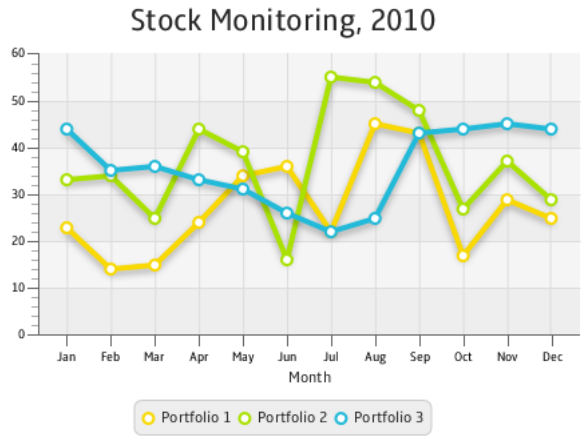
```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.chart.CategoryAxis;
import javafx.scene.chart.LineChart;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.XYChart;
import javafx.stage.Stage;


public class LineChartSample extends Application {

    @Override public void start(Stage stage) {
        stage.setTitle("Line Chart Sample");
        final CategoryAxis xAxis = new CategoryAxis();
        final NumberAxis yAxis = new NumberAxis();
         xAxis.setLabel("Month");
        final LineChart<String,Number> lineChart =
                new LineChart<String,Number>(xAxis,yAxis);

        lineChart.setTitle("Stock Monitoring, 2010");

        XYChart.Series series1 = new XYChart.Series();
        series1.setName("Portfolio 1");

        series1.getData().add(new XYChart.Data("Jan", 23));
```

```
        series1.getData().add(new XYChart.Data("Feb", 14));
        series1.getData().add(new XYChart.Data("Mar", 15));
        series1.getData().add(new XYChart.Data("Apr", 24));
        series1.getData().add(new XYChart.Data("May", 34));
        series1.getData().add(new XYChart.Data("Jun", 36));
        series1.getData().add(new XYChart.Data("Jul", 22));
        series1.getData().add(new XYChart.Data("Aug", 45));
        series1.getData().add(new XYChart.Data("Sep", 43));
        series1.getData().add(new XYChart.Data("Oct", 17));
        series1.getData().add(new XYChart.Data("Nov", 29));
        series1.getData().add(new XYChart.Data("Dec", 25));

        XYChart.Series series2 = new XYChart.Series();
        series2.setName("Portfolio 2");
        series2.getData().add(new XYChart.Data("Jan", 33));
        series2.getData().add(new XYChart.Data("Feb", 34));
        series2.getData().add(new XYChart.Data("Mar", 25));
        series2.getData().add(new XYChart.Data("Apr", 44));
        series2.getData().add(new XYChart.Data("May", 39));
        series2.getData().add(new XYChart.Data("Jun", 16));
        series2.getData().add(new XYChart.Data("Jul", 55));
        series2.getData().add(new XYChart.Data("Aug", 54));
        series2.getData().add(new XYChart.Data("Sep", 48));
        series2.getData().add(new XYChart.Data("Oct", 27));
        series2.getData().add(new XYChart.Data("Nov", 37));
        series2.getData().add(new XYChart.Data("Dec", 29));

        XYChart.Series series3 = new XYChart.Series();
        series3.setName("Portfolio 3");
        series3.getData().add(new XYChart.Data("Jan", 44));
        series3.getData().add(new XYChart.Data("Feb", 35));
        series3.getData().add(new XYChart.Data("Mar", 36));
        series3.getData().add(new XYChart.Data("Apr", 33));
        series3.getData().add(new XYChart.Data("May", 31));
        series3.getData().add(new XYChart.Data("Jun", 26));
        series3.getData().add(new XYChart.Data("Jul", 22));
        series3.getData().add(new XYChart.Data("Aug", 25));
        series3.getData().add(new XYChart.Data("Sep", 43));
        series3.getData().add(new XYChart.Data("Oct", 44));
        series3.getData().add(new XYChart.Data("Nov", 45));
        series3.getData().add(new XYChart.Data("Dec", 44));

        Scene scene  = new Scene(lineChart,800,600);
        lineChart.getData().addAll(series1, series2, series3);

        stage.setScene(scene);
        stage.show();
    }


    public static void main(String[] args) {
        launch(args);
    }
}
```

Each series of data has its unique name defined by using the `setName` method.

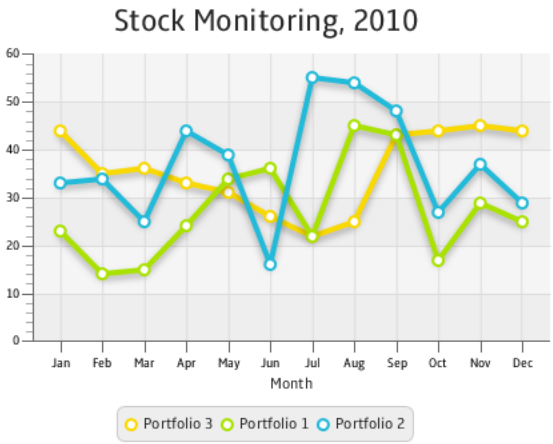
The result of compiling and running this application is shown in Figure 3–4.

Figure 3–4 Stock Monitoring Example with Tree Series of Data



Note that the different colors of the lines are defined by the declared order of the corresponding series in the `addAll` method. Change the order as follows: `lineChart.getData().addAll(series3, series1, series2)`, and then compile and run the application. The modified output is shown in Figure 3–5.

Figure 3–5 Alternative Order of Series in the Line Chart



Related API Documentation

- `LineChart`
- `Chart`
- `XYChart`
- `XYChart.Data`
- `XYChart.Series`
- `Axis`
- `NumberAxis`
- `CategoryAxis`

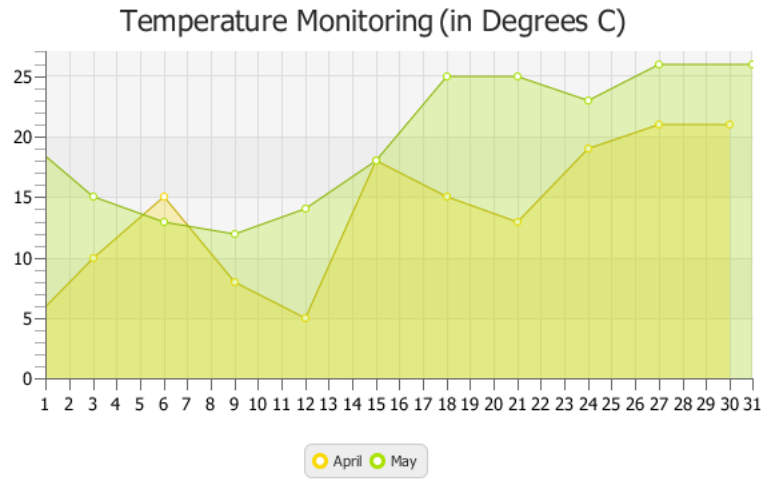
4

Area Chart

This chapter describes the area chart, yet another type of a two-axis chart.

Similar to line charts, it presents data as a series of points connected by straight lines. However, the area between the axis and the line is painted with color. Each series of data is painted with a different color. Figure 4–1 shows an area chart with two series of data.

Figure 4–1 Typical Area Chart



Creating an Area Chart

To create a simple area chart in your application, at minimum, you must define two axes, create the `AreaChart` object by instantiating the `AreaChart` class, create one or more series of data by using the `XYChart.Series` class, and assign the data to the chart.

When instantiating the `AreaChart` class, you can specify the observable list with a series of data within a constructor, or add the series later by calling the `getData` and `addAll` methods on the `AreaChart` object.

Example 4–1 creates an area chart to illustrate temperature monitoring data. The example uses two series of data collected for the periods of April and May.

Example 4–1 Creating an Area Chart

```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.chart.AreaChart;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.XYChart;
import javafx.stage.Stage;


public class AreaChartSample extends Application {

    @Override public void start(Stage stage) {
        stage.setTitle("Area Chart Sample");
        final NumberAxis xAxis = new NumberAxis(1, 31, 1);
        final NumberAxis yAxis = new NumberAxis();
        final AreaChart<Number,Number> ac =
            new AreaChart<Number,Number>(xAxis,yAxis);
        ac.setTitle("Temperature Monitoring (in Degrees C)");

        XYChart.Series seriesApril= new XYChart.Series();
        seriesApril.setName("April");
        seriesApril.getData().add(new XYChart.Data(1, 4));
        seriesApril.getData().add(new XYChart.Data(3, 10));
        seriesApril.getData().add(new XYChart.Data(6, 15));
        seriesApril.getData().add(new XYChart.Data(9, 8));
        seriesApril.getData().add(new XYChart.Data(12, 5));
        seriesApril.getData().add(new XYChart.Data(15, 18));
        seriesApril.getData().add(new XYChart.Data(18, 15));
        seriesApril.getData().add(new XYChart.Data(21, 13));
        seriesApril.getData().add(new XYChart.Data(24, 19));
        seriesApril.getData().add(new XYChart.Data(27, 21));
        seriesApril.getData().add(new XYChart.Data(30, 21));

        XYChart.Series seriesMay = new XYChart.Series();
        seriesMay.setName("May");
        seriesMay.getData().add(new XYChart.Data(1, 20));
        seriesMay.getData().add(new XYChart.Data(3, 15));
        seriesMay.getData().add(new XYChart.Data(6, 13));
        seriesMay.getData().add(new XYChart.Data(9, 12));
        seriesMay.getData().add(new XYChart.Data(12, 14));
        seriesMay.getData().add(new XYChart.Data(15, 18));
        seriesMay.getData().add(new XYChart.Data(18, 25));
        seriesMay.getData().add(new XYChart.Data(21, 25));
        seriesMay.getData().add(new XYChart.Data(24, 23));
        seriesMay.getData().add(new XYChart.Data(27, 26));
        seriesMay.getData().add(new XYChart.Data(31, 26));

        Scene scene  = new Scene(ac,800,600);
        ac.getData().addAll(seriesApril, seriesMay);
        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

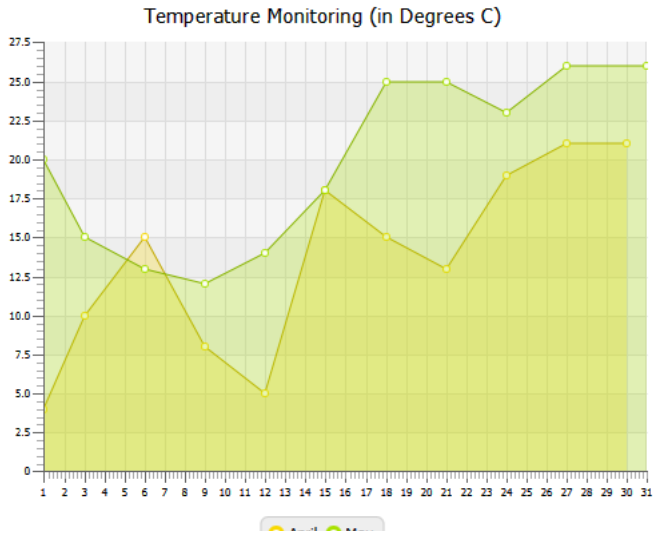
This example creates two `NumberAxis` objects to present numerical data on horizontal and vertical axes. Values rendered on the horizontal axis (X) are retrieved from the first

parameter of the `XYChart.Data` objects, whereas the second parameter provides data for the vertical axis (Y).

The series of data is assigned to the chart by using the `getData` and `addAll` methods. Because the `seriesMay` data is added last, the corresponding green area overlays the yellow area that shows April data.

The result of compiling and running the application, is shown in Figure 4–2.

Figure 4–2 Area Chart with Two Series of Data



Creating a Stacked Area Chart

You can represent data in the area chart by using the `StackedAreaChart` class. This class builds areas that are stacked so that each series adjoins but does not overlap the preceding series. Example 4–2 implements this task.

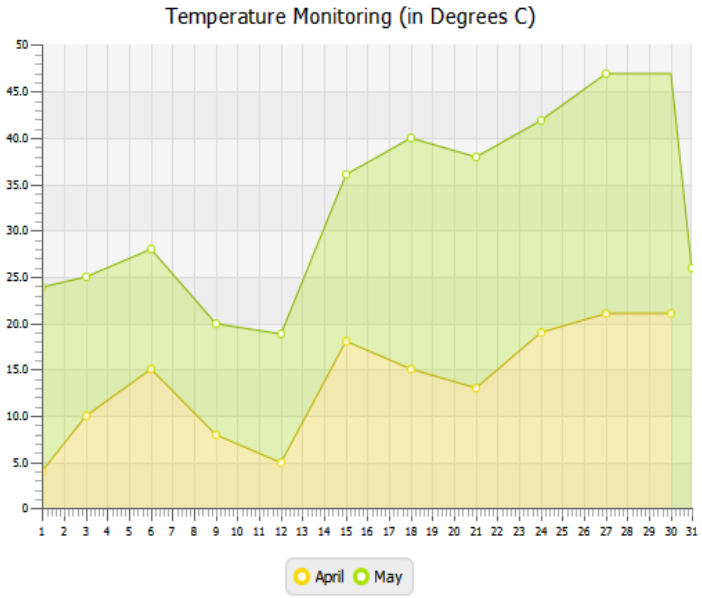
Example 4–2 Creating a Stacked Area Chart

```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.StackedAreaChart;
import javafx.scene.chart.XYChart;
import javafx.stage.Stage;

public class StackedAreaChartSample extends Application {

    final NumberAxis xAxis = new NumberAxis(1, 31, 1);
    final NumberAxis yAxis = new NumberAxis();
    final StackedAreaChart<Number, Number> sac =
            new StackedAreaChart<Number, Number>(xAxis, yAxis);

    @Override
    public void start(Stage stage) {
        stage.setTitle("Area Chart Sample");
        sac.setTitle("Temperature Monitoring (in Degrees C)");
        XYChart.Series<Number, Number> seriesApril =
```

```
                new XYChart.Series<Number, Number>();
        seriesApril.setName("April");
        seriesApril.getData().add(new XYChart.Data(1, 4));
        seriesApril.getData().add(new XYChart.Data(3, 10));
        seriesApril.getData().add(new XYChart.Data(6, 15));
        seriesApril.getData().add(new XYChart.Data(9, 8));
        seriesApril.getData().add(new XYChart.Data(12, 5));
        seriesApril.getData().add(new XYChart.Data(15, 18));
        seriesApril.getData().add(new XYChart.Data(18, 15));
        seriesApril.getData().add(new XYChart.Data(21, 13));
        seriesApril.getData().add(new XYChart.Data(24, 19));
        seriesApril.getData().add(new XYChart.Data(27, 21));
        seriesApril.getData().add(new XYChart.Data(30, 21));
        XYChart.Series<Number, Number> seriesMay =
                new XYChart.Series<Number, Number>();
        seriesMay.setName("May");
        seriesMay.getData().add(new XYChart.Data(1, 20));
        seriesMay.getData().add(new XYChart.Data(3, 15));
        seriesMay.getData().add(new XYChart.Data(6, 13));
        seriesMay.getData().add(new XYChart.Data(9, 12));
        seriesMay.getData().add(new XYChart.Data(12, 14));
        seriesMay.getData().add(new XYChart.Data(15, 18));
        seriesMay.getData().add(new XYChart.Data(18, 25));
        seriesMay.getData().add(new XYChart.Data(21, 25));
        seriesMay.getData().add(new XYChart.Data(24, 23));
        seriesMay.getData().add(new XYChart.Data(27, 26));
        seriesMay.getData().add(new XYChart.Data(31, 26));
        Scene scene = new Scene(sac, 800, 600);
        sac.getData().addAll(seriesApril, seriesMay);
        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

When you compile and run this application, it creates the chart shown in Figure 4–3.

Figure 4–3 Stacked Area Chart with Two Areas



Compare the data shown in Figure 4–3 with the same data in Figure 4–2. The areas in the stacked area chart show cumulative values on the vertical axis at any given point along the horizontal axis. For example, the value on the vertical axis shown for May 15th in the stacked area chart is 36, which does not correspond to the actual temperature that day. This value represents the cumulative result for temperatures on April 15th and May 15th.

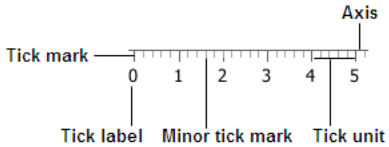
When you develop area charts in your JavaFX applications, remember that data on the vertical axes is interpreted according to the type of area charts (`AreaChart` or `StackedAreaChart`). Choose the data representation best suited for the task of the application.

Setting Axis and Tick Properties

The output of the Temperature Monitoring application in Figure 4–2 and Figure 4–3 presents the numerical values on the axes in the default double format., rather than in a user-friendly manner. For example, the month days should be integers and in the range of 1 to 31, instead of float numbers.

The JavaFX SDK API provides several methods to adjust the appearance of values rendered on chart axes. Figure 4–4 shows the main elements of the chart axis, including tick marks and tick labels that indicate numeric values of the range.

Figure 4–4 Elements of an Axis



You can specify the minimum and maximum values in the numerical range by using a constructor of the `NumberAxis` class or the corresponding methods, as shown in

Example 4–3.

Example 4–3 Specifying a Data Range for the Horizontal Axis

```
//Using the NumberAxis constructor
final NumberAxis xAxis = new NumberAxis(1, 31, 1);
//Using the corresponding methods
xAxis.setLowerBound(1);
xAxis.setUpperBound(30);
xAxis.setTickUnit(1);
```

When using the three-parameter constructor of the `NumberAxis` class, remember that the first parameter defines the minimum value in the range, the second parameter is the maximum value in the range, and the third parameter defines the tick unit, a value between two tick marks on the axis.

Additionally, if you want to prohibit showing minor ticks on the horizontal axis, then specify 0 for the `minorTickCount` property, as shown in Example 4–4.

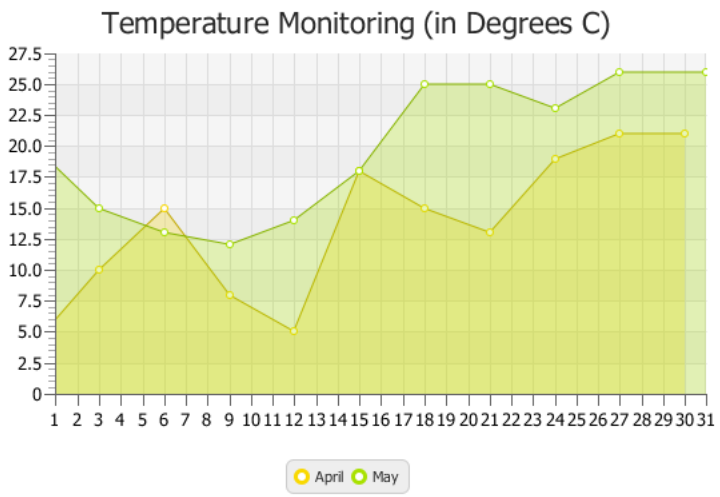
Example 4–4 Setting Zero Value for Minor Tick Count

```
xAxis.setMinorTickCount(0);
```

This property defines the number of minor ticks to be displayed between each major tick mark. By setting its value to 0, you disable the minor ticks for the horizontal axis.

When you add the code lines from Example 4–3 and Example 4–4 to the Temperature Monitoring application, the horizontal axis changes as shown in Figure 4–5.

Figure 4–5 Setting the Horizontal Axis



If your application requires no tick labels to be shown, use the `setTickLabelsVisible` method with the `false` value. Similarly, use `setTickMarkVisible` method with the `false` value if you do not want tick marks to be visible.

Use the code line shown in Example 4–5 to adjust the range of values for the vertical axis.

Example 4–5 Specifying a Data Range for the Vertical Axis

```
final NumberAxis yAxis = new NumberAxis(0, 27, 5);
```

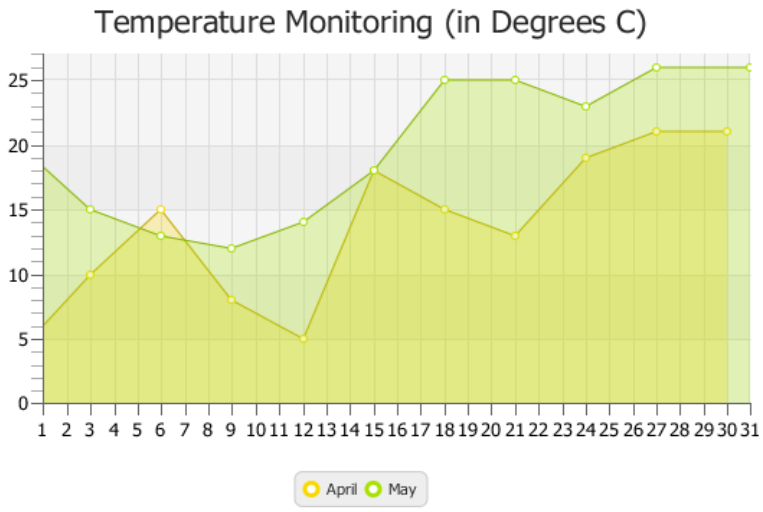
You can also adjust tick marks so that minor and major tick marks have equal length. Use the `tickLength` and `minorTickLength` properties as shown in Example 4–6.

Example 4–6 Adjusting the Length of Major and Minor Tick Marks

```
yAxis.setMinorTickLength(yAxis.getTickLength());
```

When you add code lines from Example 4–5 and Example 4–6 to the Temperature Monitoring application, the vertical axes changes as shown in Figure 4–6.

Figure 4–6 Setting the Vertical Axis



Adding Negative Values

Because the vertical axis in the Temperature Monitoring application is created by using the `NumberAxis` class, you can specify negative values for the area chart data.

Create one more series of data as shown in Example 4–7.

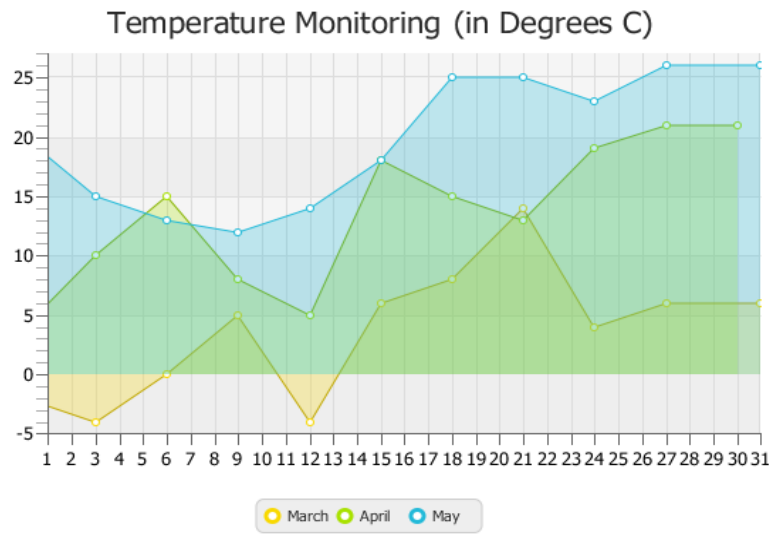
Example 4–7 Adding a Series of Data with Negative Values

```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.chart.AreaChart;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.XYChart;
import javafx.stage.Stage;


public class AreaChartSample extends Application {

    @Override public void start(Stage stage) {
        stage.setTitle("Area Chart Sample");
        final NumberAxis xAxis = new NumberAxis(1, 31, 1);
        xAxis.setMinorTickCount(0);
        final NumberAxis yAxis = new NumberAxis(-5, 27, 5);
        yAxis.setMinorTickLength(yAxis.getTickLength());
        yAxis.setForceZeroInRange(false);

        final AreaChart<Number,Number> ac =
```

```
            new AreaChart<Number,Number>(xAxis,yAxis);
        ac.setTitle("Temperature Monitoring (in Degrees C)");

        XYChart.Series seriesApril= new XYChart.Series();
        seriesApril.setName("April");
        seriesApril.getData().add(new XYChart.Data(0, 4));
        seriesApril.getData().add(new XYChart.Data(3, 10));
        seriesApril.getData().add(new XYChart.Data(6, 15));
        seriesApril.getData().add(new XYChart.Data(9, 8));
        seriesApril.getData().add(new XYChart.Data(12, 5));
        seriesApril.getData().add(new XYChart.Data(15, 18));
        seriesApril.getData().add(new XYChart.Data(18, 15));
        seriesApril.getData().add(new XYChart.Data(21, 13));
        seriesApril.getData().add(new XYChart.Data(24, 19));
        seriesApril.getData().add(new XYChart.Data(27, 21));
        seriesApril.getData().add(new XYChart.Data(30, 21));

        XYChart.Series seriesMay = new XYChart.Series();
        seriesMay.setName("May");
        seriesMay.getData().add(new XYChart.Data(0, 20));
        seriesMay.getData().add(new XYChart.Data(3, 15));
        seriesMay.getData().add(new XYChart.Data(6, 13));
        seriesMay.getData().add(new XYChart.Data(9, 12));
        seriesMay.getData().add(new XYChart.Data(12, 14));
        seriesMay.getData().add(new XYChart.Data(15, 18));
        seriesMay.getData().add(new XYChart.Data(18, 25));
        seriesMay.getData().add(new XYChart.Data(21, 25));
        seriesMay.getData().add(new XYChart.Data(24, 23));
        seriesMay.getData().add(new XYChart.Data(27, 26));
        seriesMay.getData().add(new XYChart.Data(31, 26));

        XYChart.Series seriesMarch = new XYChart.Series();
        seriesMarch.setName("March");
        seriesMarch.getData().add(new XYChart.Data(0, -2));
        seriesMarch.getData().add(new XYChart.Data(3, -4));
        seriesMarch.getData().add(new XYChart.Data(6, 0));
        seriesMarch.getData().add(new XYChart.Data(9, 5));
        seriesMarch.getData().add(new XYChart.Data(12, -4));
        seriesMarch.getData().add(new XYChart.Data(15, 6));
        seriesMarch.getData().add(new XYChart.Data(18, 8));
        seriesMarch.getData().add(new XYChart.Data(21, 14));
        seriesMarch.getData().add(new XYChart.Data(24, 4));
        seriesMarch.getData().add(new XYChart.Data(27, 6));
        seriesMarch.getData().add(new XYChart.Data(31, 6));


        Scene scene  = new Scene(ac,800,600);
        ac.getData().addAll(seriesMarch, seriesApril, seriesMay);
        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

Figure 4–7 demonstrates the Temperature Monitoring application modified to display the weather data for three months: March, April, and May.

Figure 4–7 Adding Negative Data



Styling Area Charts

The color for each month in Example 4–7 is defined by the order of the corresponding data series as declared in the `addAll` method. That is why the March area in Figure 4–7 is painted yellow. You can set the color for `AreaChart` objects through CSS.

Create the `Chart.css` file and save it in the same directory as the main class of the `AreaChartSample` application. Add the lines shown in Example 4–8 to the `Chart.css` file.

Example 4–8 CSS Styles for an Area Chart

```
.default-color0.chart-area-symbol { -fx-background-color: #e9967a, #ffa07a; }
.default-color1.chart-area-symbol { -fx-background-color: #f0e68c, #fffacd; }
.default-color2.chart-area-symbol { -fx-background-color: #dda0dd, #d8bfd855; }

.default-color0.chart-series-area-line { -fx-stroke: #e9967a; }
.default-color1.chart-series-area-line { -fx-stroke: #f0e68c; }
.default-color2.chart-series-area-line { -fx-stroke: #dda0dd; }

.default-color0.chart-series-area-fill { -fx-fill: #ffa07a55; }
.default-color1.chart-series-area-fill { -fx-fill: #fffacd55; }
.default-color2.chart-series-area-fill { -fx-fill: #d8bfd855; }
```

The `chart-area-symbol` CSS class defines parameters of the symbol in the chart legend for a particular data series. Example 4–8 sets the inner and outer colors for the circles in the chart legend.

The `chart-series-area-line` CSS class sets parameters for the area chart lines. In this example, the color of the line stroke. The `chart-series-area-fill` CSS class defines the color and the opacity level of the areas.

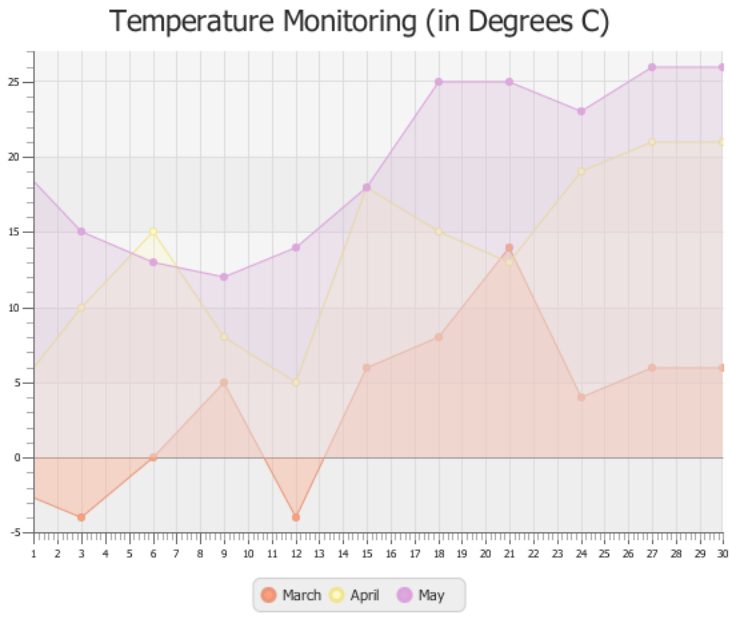
These styles are applied to the `AreaChartSample` application by using the `getStylesheets()` method of the `Scene` class, as shown Example 4–9.

Example 4–9 Applying CSS Styles to the Scene

```
scene.getStylesheets().add("areachartsample/Chart.css");
```

Compiling and running this application produces the modified appearance of the area chart shown in Figure 4–8.

Figure 4–8 Styled Area Chart



You can learn more about using CSS styles in JavaFX applications from the JavaFX CSS Reference Guide and the Skinning JavaFX Applications with CSS tutorial.

Related API Documentation

- `AreaChart`
- `Chart`
- `XYChart`
- `XYChart.Data`
- `XYChart.Series`
- `NumberAxis`

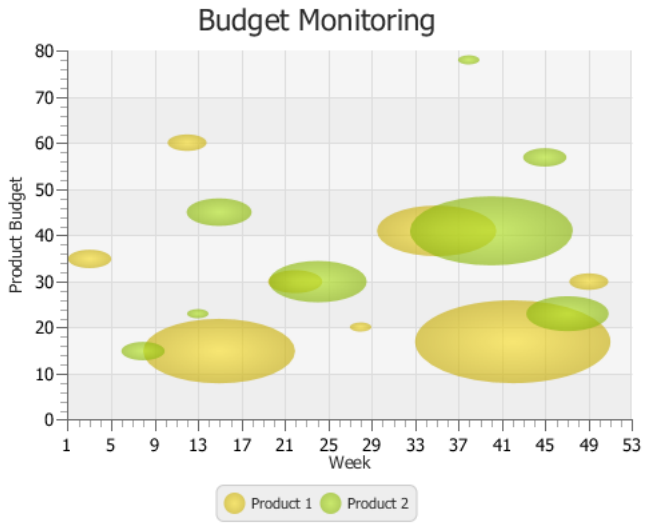
5

Bubble Chart

This chapter describes the bubble chart, a two-axis chart that plots bubbles for the data points in a series.

Each data item can be defined by two or three parameters. Figure 5–1 shows a typical bubble chart, where each data item is presented by the three following parameters: X value, Y value, and the radius of the bubble.

Figure 5–1 Typical Bubble Chart



Creating a Bubble Chart

To create a bubble chart in your JavaFX application, at minimum, you must instantiate the `BubbleChart` class, define horizontal and vertical axes, and specify one or more series of data by using constructors of the `XYChart.Data` class with two or three parameters. Example 5–1 creates a bubble chart with two series of data. Each data item is represented by X and Y values: a number of a week and an amount of product budget.

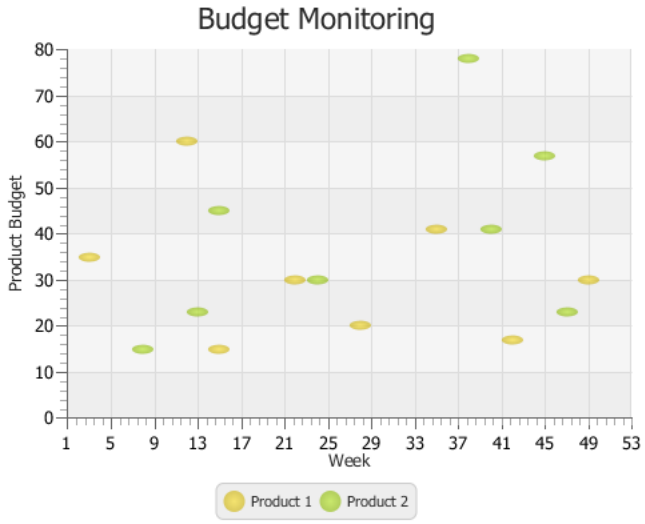
Example 5–1 Creating a Bubble Chart with Two Data Parameters

```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.chart.BubbleChart;
import javafx.scene.chart.NumberAxis;
```

```
import javafx.scene.chart.XYChart;
import javafx.stage.Stage;


public class BubbleChartSample extends Application {

    @Override public void start(Stage stage) {
        stage.setTitle("Bubble Chart Sample");
        final NumberAxis xAxis = new NumberAxis(1, 53, 4);
        final NumberAxis yAxis = new NumberAxis(0, 80, 10);
        final BubbleChart<Number,Number> blc = new
            BubbleChart<Number,Number>(xAxis,yAxis);
        xAxis.setLabel("Week");
        yAxis.setLabel("Product Budget");
        blc.setTitle("Budget Monitoring");

        XYChart.Series series1 = new XYChart.Series();
        series1.setName("Product 1");
        series1.getData().add(new XYChart.Data(3, 35));
        series1.getData().add(new XYChart.Data(12, 60));
        series1.getData().add(new XYChart.Data(15, 15));
        series1.getData().add(new XYChart.Data(22, 30));
        series1.getData().add(new XYChart.Data(28, 20));
        series1.getData().add(new XYChart.Data(35, 41));
        series1.getData().add(new XYChart.Data(42, 17));
        series1.getData().add(new XYChart.Data(49, 30));

        XYChart.Series series2 = new XYChart.Series();
        series2.setName("Product 2");
        series2.getData().add(new XYChart.Data(8, 15));
        series2.getData().add(new XYChart.Data(13, 23));
        series2.getData().add(new XYChart.Data(15, 45));
        series2.getData().add(new XYChart.Data(24, 30));
        series2.getData().add(new XYChart.Data(38, 78));
        series2.getData().add(new XYChart.Data(40, 41));
        series2.getData().add(new XYChart.Data(45, 57));
        series2.getData().add(new XYChart.Data(47, 23));

        Scene scene  = new Scene(blc);
        blc.getData().addAll(series1, series2);
        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

The result of compiling and running this application is shown in Figure 5–2.

Figure 5–2 Bubble Chart with Two Data Parameters



This application defines lower and upper boundaries of the data ranges and the tick units within the constructors of the `NumberAxis` class. Additionally, the minor tick count is set to 4, so that each minor tick corresponds to a particular week.

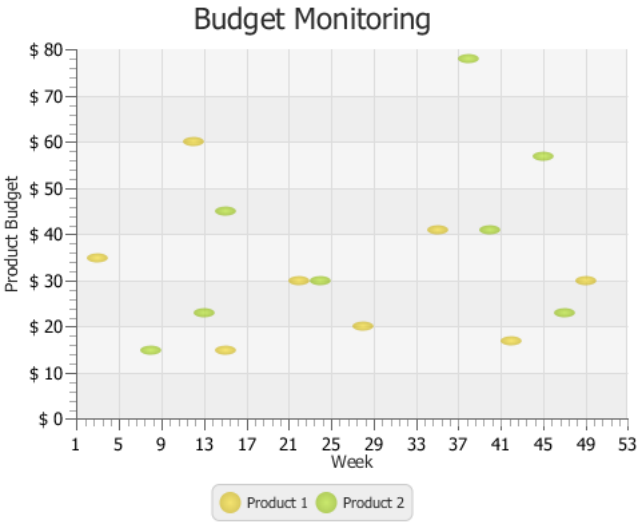
To indicate that the vertical axis renders the amount of money in US dollars, use a tick label formatter as shown in Example 5–2.

Example 5–2 Formatting Tick Labels

```
yAxis.setTickLabelFormatter(new NumberAxis.DefaultFormatter(yAxis,"$ ",null));
```

The `NumberAxis.DefaultFormatter` class adds prefixes and suffixes to the tick labels of the specified axis. In Example 5–2, the formatter defines a dollar sign ($) prefix for each tick label of the vertical axis. The `null` value for the suffix parameter indicates that no suffixes are added. Figure 5–3 shows the bubble chart after the formatting has been applied.

Figure 5–3 Specifying Prefixes for Tick Labels



Using the Extra Value Property

The bubble chart shown in Figure 5–1 provides information about budgets of two products for the period of a year. However, you can enhance this application and benefit from the additional capabilities of the `BubbleChart` class. Use the `extraValue` property and define three parameters in `XYChart.Data` objects when specifying the series of data for your bubble chart.

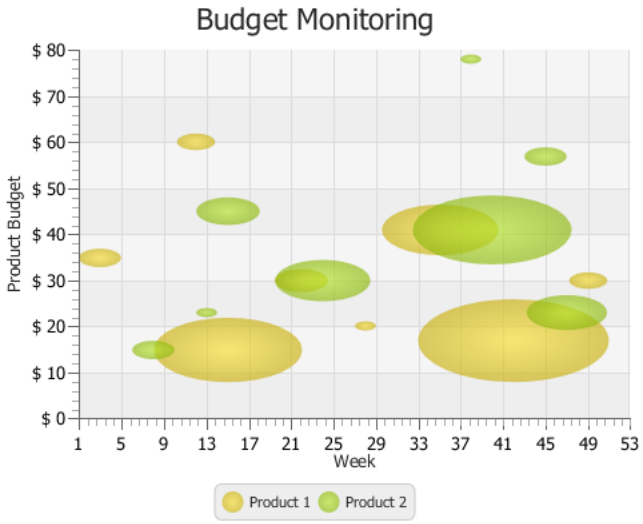
The code fragment shown in Example 5–3 demonstrates how to modify data series for the Budget Monitoring application, so that each bubble shows the percentage of consumed budget for a particular product. The third parameter in the `XYChart.Data` object defines the radius of each bubble: the bigger the radius, the higher the percentage of the budget consumed. Thus, a radius of 7.5 corresponds to consuming 75% of the budget, 5.5 to 55%, and so on.

Example 5–3 Adding Extra Value

```
XYChart.Series series1 = new XYChart.Series();
series1.setName("Product 1");
series1.getData().add(new XYChart.Data(3, 35, 2));
series1.getData().add(new XYChart.Data(12, 60, 1.8));
series1.getData().add(new XYChart.Data(15, 15, 7));
series1.getData().add(new XYChart.Data(22, 30, 2.5));
series1.getData().add(new XYChart.Data(28, 20, 1));
series1.getData().add(new XYChart.Data(35, 41, 5.5));
series1.getData().add(new XYChart.Data(42, 17, 9));
series1.getData().add(new XYChart.Data(49, 30, 1.8));

XYChart.Series series2 = new XYChart.Series();
series2.setName("Product 2");
series2.getData().add(new XYChart.Data(8, 15, 2));
series2.getData().add(new XYChart.Data(13, 23, 1));
series2.getData().add(new XYChart.Data(15, 45, 3));
series2.getData().add(new XYChart.Data(24, 30, 4.5));
series2.getData().add(new XYChart.Data(38, 78, 1));
series2.getData().add(new XYChart.Data(40, 41, 7.5));
series2.getData().add(new XYChart.Data(45, 57, 2));
series2.getData().add(new XYChart.Data(47, 23, 3.8));
```

The result of adding the modified code fragment to the Budget Monitoring application and then compiling and running it is shown in Figure 5–4.

Figure 5–4 Demonstrating Percentage of Consumed Budget



Changing the Appearance Visual Setting of the Plot and Tick Marks

You can alter the appearance of the chart plot and axes. Examine some methods and properties available in the JavaFX SDK API to modify the look of the Budget Monitoring application.

There are four properties in the `XYChart` class to manage the appearance of the chart plot. The `alternativeColumnFillVisible` and `alternativeRowFillVisible` properties define whether the alternative rows and columns have the fill colors. The `verticalGridLinesVisible` and `horizontalGridLinesVisible` properties enable and disable showing the grid lines. Table 5–1 shows the default values for these properties.

Table 5–1 Default Values of the Chart Plot Properties

Property	Default Value
`alternativeColumnFillVisible`	`false`
`alternativeRowFillVisible`	`true`
`verticalGridLinesVisible`	`true`
`verticalZeroLineVisible`	`true`

Alter these properties by using the corresponding methods as shown in Example 5–4 to modify the look of the chart plot.

Example 5–4 Visualizing Alternative Columns

```
blc.setAlternativeColumnFillVisible(true);
blc.setAlternativeRowFillVisible(false);
```

In addition to the plot properties, you can modify the properties of the axis to attain the required appearance. Code lines in Example 5–5 specify the `CHOCOLATE` color for the tick labels.

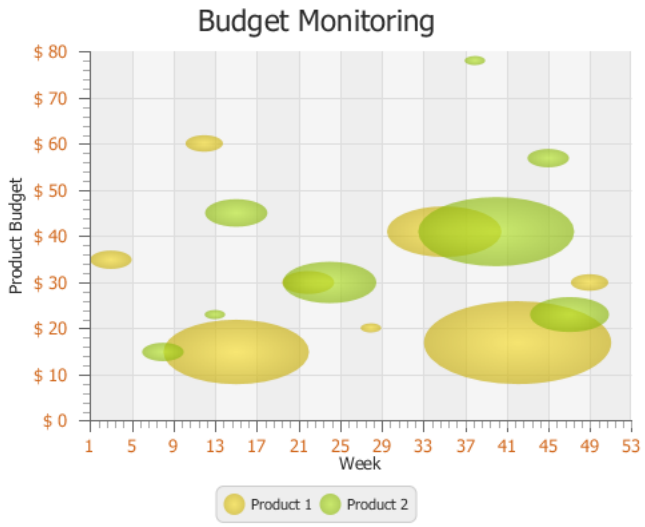
Example 5–5 Defining a Fill Color for the Tick Labels

```
xAxis.setTickLabelFill(Color.CHOCOLATE);
yAxis.setTickLabelFill(Color.CHOCOLATE);
```

Finally, you can adjust the position of the tick labels relative to the tick marks. Use the `setTickLabelGap` method to specify the gap between tick labels and the tick mark lines on the vertical axis: `yAxis.setTickLabelGap(10).`

Figure 5–5 shows the output of the Budget Monitoring application after all the modifications are incorporated in the code.

Figure 5–5 Changes in the Appearance of the Bubble Chart



Related API Documentation

- `BubbleChart`
- `Chart`
- `XYChart`
- `XYChart.Data`
- `XYChart.Series`
- `NumberAxis`
- `NumberAxis.DefaultFormatter`

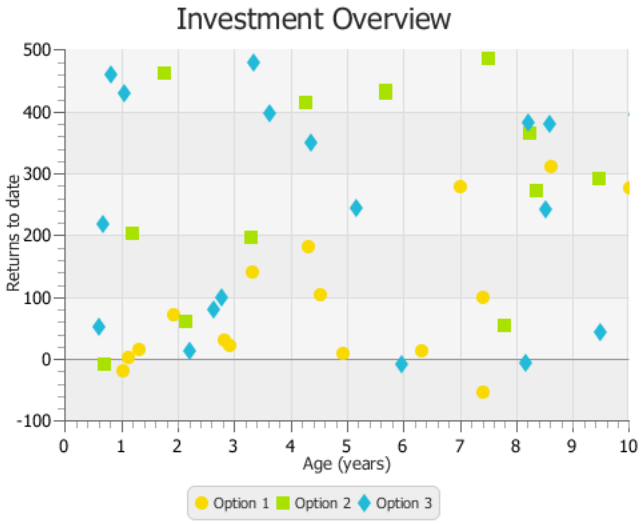
6

Scatter Chart

This chapter describes the scatter chart, a two-axis chart that presents its data as a set of points.

Each point is defined by an X and Y value. Similar to any other two-axis chart, you can create one or several series of data. Figure 6–1 illustrates a scatter chart with three series of data.

Figure 6–1 Sample of the Scatter Chart



Creating a Scatter Chart

To create a scatter chart, define at least one series of data, set horizontal and vertical axes, create the chart by instantiating the `ScatterChart` class, and assign data to the chart. Example 6–1 demonstrates how to create a simple scatter charts with two series of data.

Example 6–1 Scatter Chart with Two Series of Data

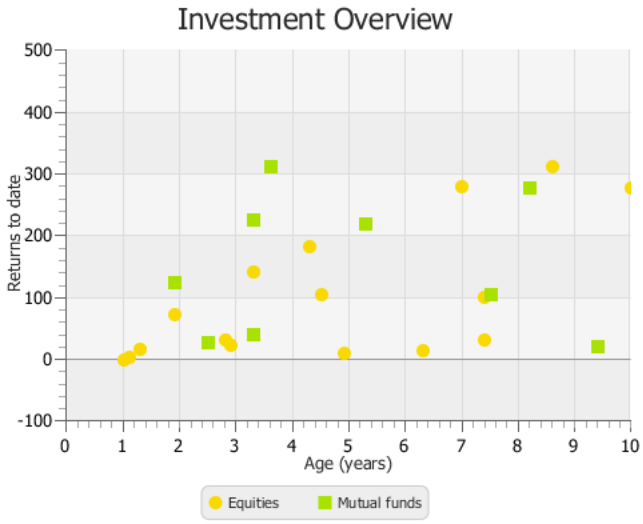
```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.ScatterChart;
```

```
import javafx.scene.chart.XYChart;
import javafx.stage.Stage;


public class ScatterChartSample extends Application {

    @Override public void start(Stage stage) {
        stage.setTitle("Scatter Chart Sample");
        final NumberAxis xAxis = new NumberAxis(0, 10, 1);
        final NumberAxis yAxis = new NumberAxis(-100, 500, 100);
        final ScatterChart<Number,Number> sc = new
            ScatterChart<Number,Number>(xAxis,yAxis);
        xAxis.setLabel("Age (years)");
        yAxis.setLabel("Returns to date");
        sc.setTitle("Investment Overview");

        XYChart.Series series1 = new XYChart.Series();
        series1.setName("Equities");
        series1.getData().add(new XYChart.Data(4.2, 193.2));
        series1.getData().add(new XYChart.Data(2.8, 33.6));
        series1.getData().add(new XYChart.Data(6.2, 24.8));
        series1.getData().add(new XYChart.Data(1, 14));
        series1.getData().add(new XYChart.Data(1.2, 26.4));
        series1.getData().add(new XYChart.Data(4.4, 114.4));
        series1.getData().add(new XYChart.Data(8.5, 323));
        series1.getData().add(new XYChart.Data(6.9, 289.8));
        series1.getData().add(new XYChart.Data(9.9, 287.1));
        series1.getData().add(new XYChart.Data(0.9, -9));
        series1.getData().add(new XYChart.Data(3.2, 150.8));
        series1.getData().add(new XYChart.Data(4.8, 20.8));
        series1.getData().add(new XYChart.Data(7.3, -42.3));
        series1.getData().add(new XYChart.Data(1.8, 81.4));
        series1.getData().add(new XYChart.Data(7.3, 110.3));
        series1.getData().add(new XYChart.Data(2.7, 41.2));

        XYChart.Series series2 = new XYChart.Series();
        series2.setName("Mutual funds");
        series2.getData().add(new XYChart.Data(5.2, 229.2));
        series2.getData().add(new XYChart.Data(2.4, 37.6));
        series2.getData().add(new XYChart.Data(3.2, 49.8));
        series2.getData().add(new XYChart.Data(1.8, 134));
        series2.getData().add(new XYChart.Data(3.2, 236.2));
        series2.getData().add(new XYChart.Data(7.4, 114.1));
        series2.getData().add(new XYChart.Data(3.5, 323));
        series2.getData().add(new XYChart.Data(9.3, 29.9));
        series2.getData().add(new XYChart.Data(8.1, 287.4));

        sc.getData().addAll(series1, series2);
        Scene scene  = new Scene(sc, 500, 400);
        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

In this example, the `ScatterChart` object is created with two `Number` axes to present numerical data for years and amounts of returns. The range of the data and the tick unit are defined within constructors of the `NumberAxis` class.

The result of compiling and running this application is shown in Figure 6–2.

Figure 6–2 Scatter Chart with Two Series to Display Investment Overview



Managing Chart Data

Example 6–1 creates a scatter chart whose data is coded into the application and cannot be changed from its user interface. Use UI controls in your application to manage the set of data presented by the chart, for example, adding and removing a series of data.

Examine the code shown in Example 6–2. It creates two buttons, Add Series and Remove Series, to alter the set of data.

Example 6–2 Using Buttons to Manager Chart Data

```
import javafx.application.Application;
import javafx.geometry.Insets;
import javafx.scene.Group;
import javafx.scene.Scene;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.ScatterChart;
import javafx.scene.chart.XYChart;
import javafx.scene.control.Button;
import javafx.scene.layout.HBox;
import javafx.scene.layout.VBox;
import javafx.stage.Stage;


public class ScatterChartSample extends Application {

    @Override public void start(Stage stage) {
        stage.setTitle("Scatter Chart Sample");
        final NumberAxis xAxis = new NumberAxis(0, 10, 1);
        final NumberAxis yAxis = new NumberAxis(-100, 500, 100);
        final ScatterChart<Number,Number> sc =
```

```
            new ScatterChart<Number,Number>(xAxis,yAxis);
        xAxis.setLabel("Age (years)");
        yAxis.setLabel("Returns to date");
        sc.setTitle("Investment Overview");

        XYChart.Series series1 = new XYChart.Series();

        series1.setName("Option 1");
        series1.getData().add(new XYChart.Data(4.2, 193.2));
        series1.getData().add(new XYChart.Data(2.8, 33.6));
        series1.getData().add(new XYChart.Data(6.2, 24.8));
        series1.getData().add(new XYChart.Data(1, 14));
        series1.getData().add(new XYChart.Data(1.2, 26.4));
        series1.getData().add(new XYChart.Data(4.4, 114.4));
        series1.getData().add(new XYChart.Data(8.5, 323));
        series1.getData().add(new XYChart.Data(6.9, 289.8));
        series1.getData().add(new XYChart.Data(9.9, 287.1));
        series1.getData().add(new XYChart.Data(0.9, -9));
        series1.getData().add(new XYChart.Data(3.2, 150.8));
        series1.getData().add(new XYChart.Data(4.8, 20.8));
        series1.getData().add(new XYChart.Data(7.3, -42.3));
        series1.getData().add(new XYChart.Data(1.8, 81.4));
        series1.getData().add(new XYChart.Data(7.3, 110.3));
        series1.getData().add(new XYChart.Data(2.7, 41.2));

        sc.setPrefSize(500, 400);
        sc.getData().addAll(series1);
        Scene scene  = new Scene(new Group());
        final VBox vbox = new VBox();
        final HBox hbox = new HBox();

        final Button add = new Button("Add Series");
        final Button remove = new Button("Remove Series");

        hbox.setSpacing(10);
        hbox.getChildren().addAll(add, remove);

        vbox.getChildren().addAll(sc, hbox);
        hbox.setPadding(new Insets(10, 10, 10, 50));

        ((Group)scene.getRoot()).getChildren().add(vbox);
        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

Whereas Example 6–1 adds the scatter chart directly to the scene, Example 6–2 uses `VBox` and `HBox` layout containers to arrange components in the application scene.

Define the `setOnAction` methods for the Add Series button as shown in Example 6–3. It creates a new series of data by populating the `XYChart.Series` objects with randomly calculated values. Each new series is assigned to the chart by using the `add(series)` method.

Example 6–3 Adding Series of Data

```
add.setOnAction(new EventHandler<ActionEvent>() {
```

```
    @Override public void handle(ActionEvent e) {
        if (sc.getData() == null)
            sc.setData(
                FXCollections.<XYChart.Series<Number,
                    Number>>observableArrayList());
        ScatterChart.Series<Number, Number> series =
            new ScatterChart.Series<Number, Number>();
        series.setName("Option "+(sc.getData().size()+1));
        for (int i=0; i<100; i++) series.getData().add(
            new ScatterChart.Data<Number,
                Number>(Math.random()*100, Math.random()*500));
        sc.getData().add(series);
    }
});
```

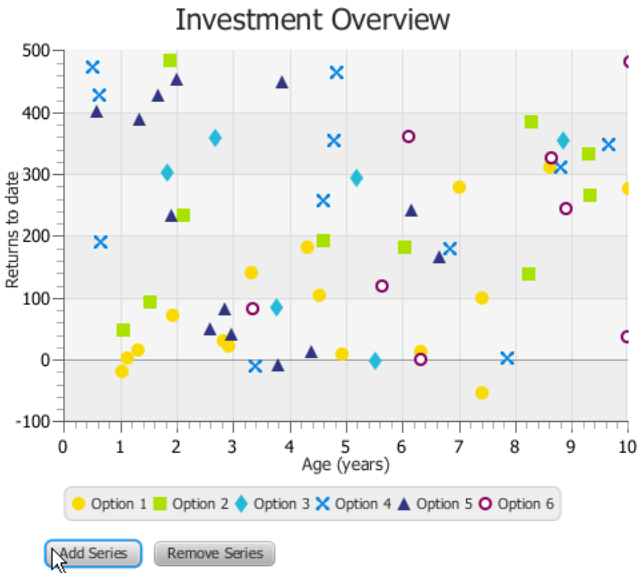
To remove a data series from the chart, define the `setOnAction` method for the Remove Series button as shown in Example 6–4. The `remove(int)` method called on the scatter chart removes a series of data by using a randomly generated index.

Example 6–4 Removing Series of Data

```
remove.setOnAction(new EventHandler<ActionEvent>() {
    @Override public void handle(ActionEvent e) {
        if (!sc.getData().isEmpty())
            sc.getData().remove((int)(Math.random()*(sc.getData().size()-1)));
    }
});
```

When you add Example 6–3 and Example 6–4 into the application in Example 6–2, the output shown in Figure 6–3 appears. It captures the moment when five series are added to the Option 1 series.

Figure 6–3 Added Series of Data



The symbols used to indicate a series of data are coded into the implementation of the `ScatterChart` class. Example 6–5 shows the default styles for one of the scatter chart symbols.

Example 6–5 Styling a ScatterChart Symbol

```
.default-color5.chart-symbol { /* hollow circle */
    -fx-background-color: #860061, white;
    -fx-background-insets: 0, 2;
    -fx-background-radius: 5px;
    -fx-padding: 5px;
}
```

You can change the styles for this symbol by setting the alternative values for the `.default-color5.chart-symbol` property. See the JavaFX CSS Reference Guide for more information.

Adding Effects to Charts

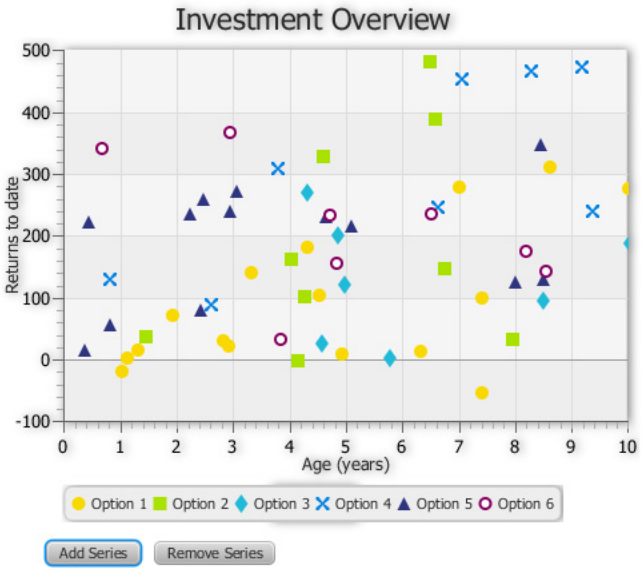
All the chart classes available in the `javafx.scene.chart` are extensions of the `Node` class. Therefore, you can apply visual effects or transformation to every type of charts. Examine the code fragment in Example 6–6. It creates and applies a drop shadow effect to the scatter chart.

Example 6–6 Creating and Applying a Drop Shadow

```
final DropShadow shadow = new DropShadow();
shadow.setOffsetX(2);
shadow.setColor(Color.GREY);
sc.setEffect(shadow);
```

When you add this code fragment to the Investment Overview application, then compile and run it, the scatter chart is highlighted by the shadow as shown in Figure 6–4.

Figure 6–4 Scatter Chart with a Drop Shadow



Note that the visual effect of the drop shadow is applied to all elements of the chart including axes, tick marks, and tick labels.

Changing the Chart Symbol

Each data series in a scatter chart is represented by the symbols defined in the `caspian.css`, the default style sheet for JavaFX applications. However, you can change the chart symbol by implementing your own style sheet.

Create the `Chart.css` file and save it in the same directory as the main class of the `AreaChartSample` application. Add the lines shown in Example 6–7 to the `Chart.css` file.

Example 6–7 Creating a New Chart Symbol with CSS

```
.chart-symbol{
    -fx-stroke: #a9e200;
    -fx-shape: "M0,4 L2,4 L4,8 L7,0 L9,0 L4,11 Z";
}
```

This code fragment creates the symbol shape by defining its SVG path in the `-fx-shape` parameter and sets the stroke color for the symbol.

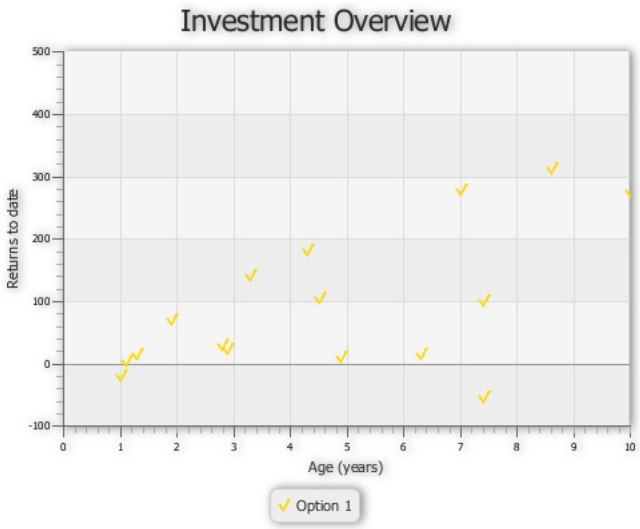
Use the `getStylesheets()` method of the `Scene` class to apply the style sheet to the application, as shown in Example 6–8.

Example 6–8 Applying a CSS Style to the Scene

```
scene.getStylesheets().add("scaterchartsample/Chart.css");
```

Compiling and running this application produces the modified appearance of the area chart shown in Figure 6–5.

Figure 6–5 Scatter Chart with the Modified Chart Symbol



You can learn more about using CSS styles in JavaFX applications from the JavaFX CSS Reference Guide and the Skinning JavaFX Applications with CSS tutorial.

Related API Documentation

- `ScatterChart`
- `Chart`

- `XYChart`
- `XYChart.Data`
- `XYChart.Series`
- `NumberAxis`
- `Button`

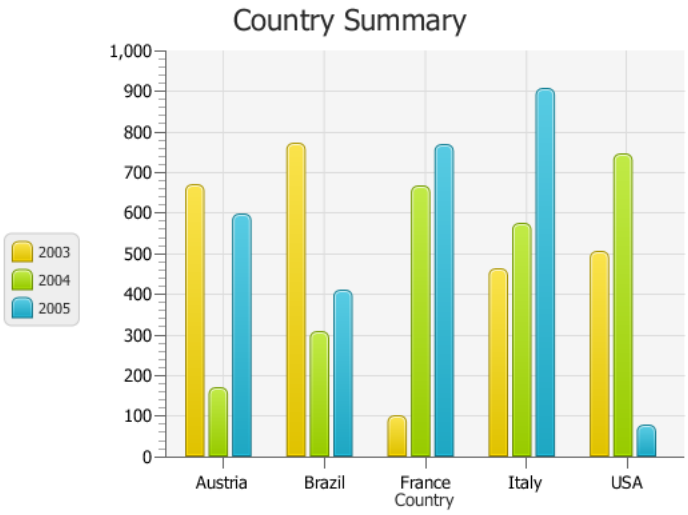
7

Bar Chart

This chapter describes the bar chart, a two-axis chart with rectangular bars that can be either vertical or horizontal.

The length of each bar is proportional to a particular value that the chart presents. Typically, bar charts are used to display discrete data. You can use groups of bars as categories to plot data, as shown in Figure 7–1.

Figure 7–1 Sample Bar Chart



Creating a Bar Chart

To build a bar chart in your JavaFX application, create two axes, instantiate the `BarChar` class, define the series of data, and assign the data to the chart. Example 7–1 creates a bar chart with three series of data to present financial information about five countries. Each country is presented as a category that is a group of bars on the horizontal axis.

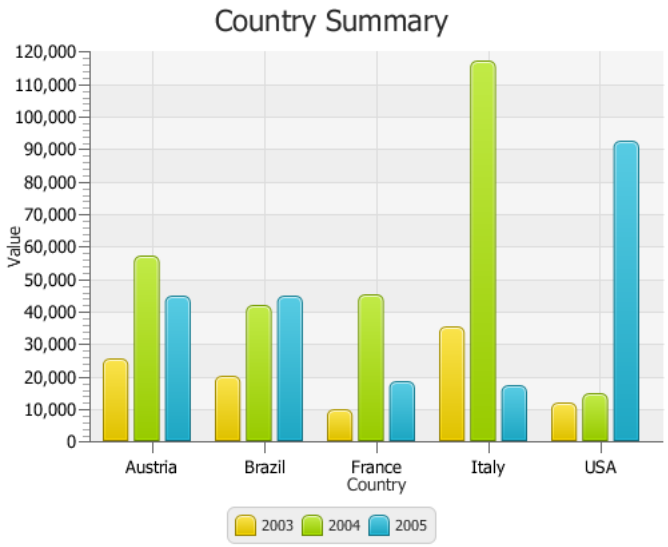
Example 7–1 Creating a Bar Chart with Three Series of Data

```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.chart.BarChart;
import javafx.scene.chart.CategoryAxis;
import javafx.scene.chart.NumberAxis;
```

```
import javafx.scene.chart.XYChart;
import javafx.stage.Stage;

public class BarChartSample extends Application {
    final static String austria = "Austria";
    final static String brazil = "Brazil";
    final static String france = "France";
    final static String italy = "Italy";
    final static String usa = "USA";

    @Override public void start(Stage stage) {
        stage.setTitle("Bar Chart Sample");
        final CategoryAxis xAxis = new CategoryAxis();
        final NumberAxis yAxis = new NumberAxis();
        final BarChart<String,Number> bc =
            new BarChart<String,Number>(xAxis,yAxis);
        bc.setTitle("Country Summary");
        xAxis.setLabel("Country");
        yAxis.setLabel("Value");

        XYChart.Series series1 = new XYChart.Series();
        series1.setName("2003");
        series1.getData().add(new XYChart.Data(austria, 25601.34));
        series1.getData().add(new XYChart.Data(brazil, 20148.82));
        series1.getData().add(new XYChart.Data(france, 10000));
        series1.getData().add(new XYChart.Data(italy, 35407.15));
        series1.getData().add(new XYChart.Data(usa, 12000));

        XYChart.Series series2 = new XYChart.Series();
        series2.setName("2004");
        series2.getData().add(new XYChart.Data(austria, 57401.85));
        series2.getData().add(new XYChart.Data(brazil, 41941.19));
        series2.getData().add(new XYChart.Data(france, 45263.37));
        series2.getData().add(new XYChart.Data(italy, 117320.16));
        series2.getData().add(new XYChart.Data(usa, 14845.27));

        XYChart.Series series3 = new XYChart.Series();
        series3.setName("2005");
        series3.getData().add(new XYChart.Data(austria, 45000.65));
        series3.getData().add(new XYChart.Data(brazil, 44835.76));
        series3.getData().add(new XYChart.Data(france, 18722.18));
        series3.getData().add(new XYChart.Data(italy, 17557.31));
        series3.getData().add(new XYChart.Data(usa, 92633.68));

        Scene scene  = new Scene(bc,800,600);
        bc.getData().addAll(series1, series2, series3);
        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

Figure 7–2 shows the expected output of this application when you compile and run it.

Figure 7–2 Creating a Bar Chart with Three Series of Data



Two properties of the `BarChart` class enable managing space between categories of data and between bars within the same category. Use the `barGap` and `categoryGap` properties to better distribute bars in the chart plot. Example 7–2 uses the `setBarGap` and `setCategoryGap` methods to set specific values for these properties.

Example 7–2 Setting Gaps Between Bars and Categories

```
bc.setBarGap(3);
bc.setCategoryGap(20);
```

Horizontal Bar Chart

You can change the orientation of the bar chart from vertical to horizontal by defining the category for the vertical axis. Example 7–3 implements this for the Country Summary application. Declare the horizontal axis of the `NumberAxis` type and the vertical axis of the `CategoryAxis` type. Do not forget to modify the declaration of the `BarChart` object.

Example 7–3 Changing Orientation of the Bar Chart

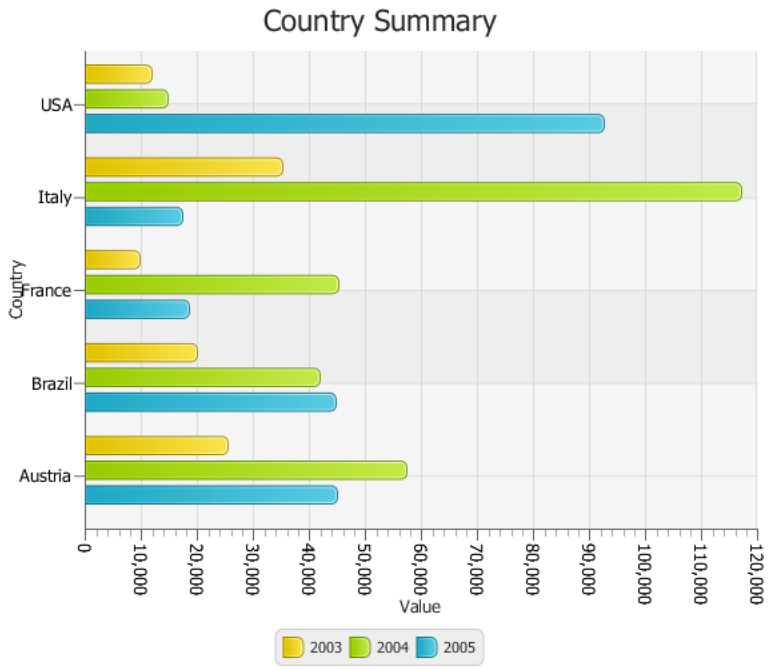
```
import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.chart.BarChart;
import javafx.scene.chart.CategoryAxis;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.XYChart;
import javafx.stage.Stage;

public class BarChartSample extends Application {
    final static String austria = "Austria";
    final static String brazil = "Brazil";
    final static String france = "France";
    final static String italy = "Italy";
    final static String usa = "USA";

    @Override public void start(Stage stage) {
```

```
        stage.setTitle("Bar Chart Sample");
        final NumberAxis xAxis = new NumberAxis();
        final CategoryAxis yAxis = new CategoryAxis();
        final BarChart<Number,String> bc =
            new BarChart<Number,String>(xAxis,yAxis);
        bc.setTitle("Country Summary");
        xAxis.setLabel("Value");
        xAxis.setTickLabelRotation(90);
        yAxis.setLabel("Country");

        XYChart.Series series1 = new XYChart.Series();
        series1.setName("2003");
        series1.getData().add(new XYChart.Data(25601.34, austria));
        series1.getData().add(new XYChart.Data(20148.82, brazil));
        series1.getData().add(new XYChart.Data(10000, france));
        series1.getData().add(new XYChart.Data(35407.15, italy));
        series1.getData().add(new XYChart.Data(12000, usa));

        XYChart.Series series2 = new XYChart.Series();
        series2.setName("2004");
        series2.getData().add(new XYChart.Data(57401.85, austria));
        series2.getData().add(new XYChart.Data(41941.19, brazil));
        series2.getData().add(new XYChart.Data(45263.37, france));
        series2.getData().add(new XYChart.Data(117320.16, italy));
        series2.getData().add(new XYChart.Data(14845.27, usa));

        XYChart.Series series3 = new XYChart.Series();
        series3.setName("2005");
        series3.getData().add(new XYChart.Data(45000.65, austria));
        series3.getData().add(new XYChart.Data(44835.76, brazil));
        series3.getData().add(new XYChart.Data(18722.18, france));
        series3.getData().add(new XYChart.Data(17557.31, italy));
        series3.getData().add(new XYChart.Data(92633.68, usa));

        Scene scene  = new Scene(bc,800,600);
        bc.getData().addAll(series1, series2, series3);
        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

Note that the `setTickLabelRotation` method is called on the horizontal axis to rotate labels and make the value captions easier to read.

The result of compiling and running the modified application is shown in Figure 7–3.

Figure 7–3 Horizontal Bar Chart



Horizontal bar charts can be particularly helpful when you want to represent data as ranked lists.

Creating a Stacked Bar Chart

You can represent data in a bar chart so that the bars in a category are stacked. Use the `StackedBarChart` class available in the JavaFX API, as shown in Example 7–4.

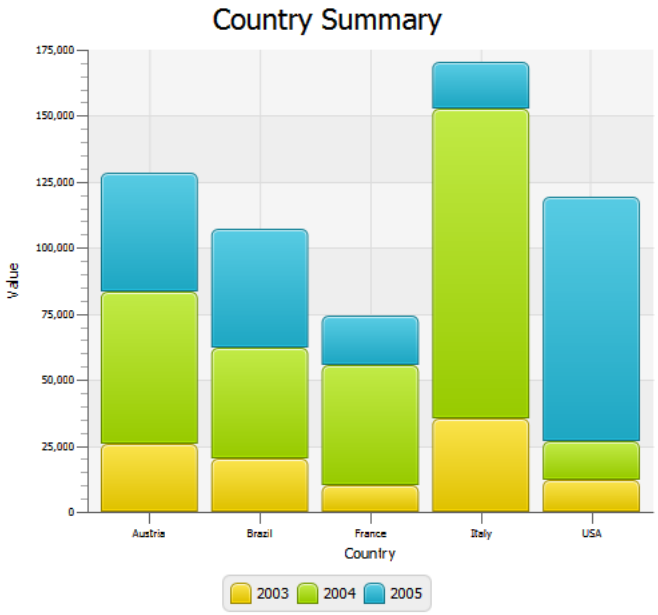
Example 7–4 Creating a Stacked Bar Chart

```
import java.util.Arrays;
import javafx.application.Application;
import javafx.collections.FXCollections;
import javafx.scene.Scene;
import javafx.scene.chart.CategoryAxis;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.StackedBarChart;
import javafx.scene.chart.XYChart;
import javafx.stage.Stage;

public class StackedBarChartSample extends Application {

    final static String austria = "Austria";
    final static String brazil = "Brazil";
    final static String france = "France";
    final static String italy = "Italy";
    final static String usa = "USA";
    final CategoryAxis xAxis = new CategoryAxis();
    final NumberAxis yAxis = new NumberAxis();
    final StackedBarChart<String, Number> sbc =
            new StackedBarChart<String, Number>(xAxis, yAxis);
    final XYChart.Series<String, Number> series1 =
            new XYChart.Series<String, Number>();
```

```
    final XYChart.Series<String, Number> series2 =
            new XYChart.Series<String, Number>();
    final XYChart.Series<String, Number> series3 =
            new XYChart.Series<String, Number>();

    @Override
    public void start(Stage stage) {
        stage.setTitle("Bar Chart Sample");
        sbc.setTitle("Country Summary");
        xAxis.setLabel("Country");
        xAxis.setCategories(FXCollections.<String>observableArrayList(
                Arrays.asList(austria, brazil, france, italy, usa)));
        yAxis.setLabel("Value");
        series1.setName("2003");
        series1.getData().add(new XYChart.Data<String, Number>(austria,
25601.34));
        series1.getData().add(new XYChart.Data<String, Number>(brazil, 20148.82));
        series1.getData().add(new XYChart.Data<String, Number>(france, 10000));
        series1.getData().add(new XYChart.Data<String, Number>(italy, 35407.15));
        series1.getData().add(new XYChart.Data<String, Number>(usa, 12000));
        series2.setName("2004");
        series2.getData().add(new XYChart.Data<String, Number>(austria,
57401.85));
        series2.getData().add(new XYChart.Data<String, Number>(brazil, 41941.19));
        series2.getData().add(new XYChart.Data<String, Number>(france, 45263.37));
        series2.getData().add(new XYChart.Data<String, Number>(italy, 117320.16));
        series2.getData().add(new XYChart.Data<String, Number>(usa, 14845.27));
        series3.setName("2005");
        series3.getData().add(new XYChart.Data<String, Number>(austria,
45000.65));
        series3.getData().add(new XYChart.Data<String, Number>(brazil, 44835.76));
        series3.getData().add(new XYChart.Data<String, Number>(france, 18722.18));
        series3.getData().add(new XYChart.Data<String, Number>(italy, 17557.31));
        series3.getData().add(new XYChart.Data<String, Number>(usa, 92633.68));
        Scene scene = new Scene(sbc, 800, 600);
        sbc.getData().addAll(series1, series2, series3);
        stage.setScene(scene);
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

When you define axes for a stacked bar chart in your application, you must explicitly assign the categories of data to a particular axis. In Example 7–4, the categories are assigned to the horizontal axis by using the `setCategories` method. The bar chart produced by this application is shown in Figure 7–4.

Figure 7–4 Stacked Bar Chart with Five Categories of Data



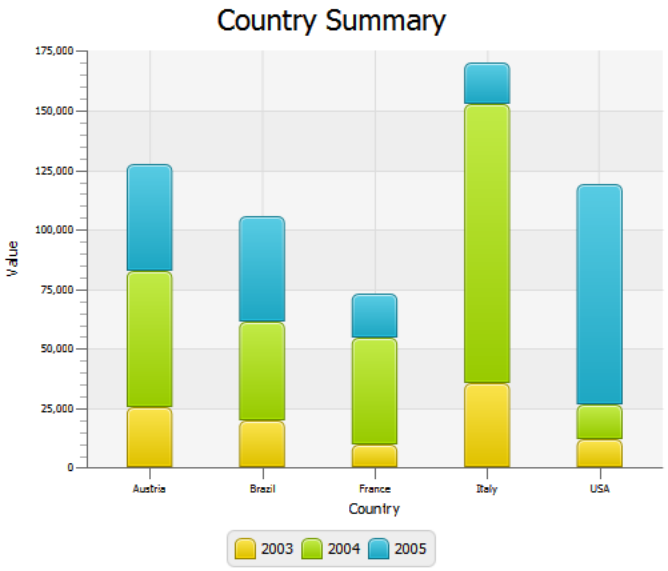
Compare the data shown in Figure 7–3 with the same data in Figure 7–4. The areas in the stacked bar chart show cumulative values on the vertical axis at any given point along the horizontal axis. For example, on the vertical axis of Figure 7–4, the 2004 values for Austria range from approximately 25,000 to approximately 85,000. However, the data in Example 7–4 indicates a value of 57,401.85 for Austria in 2004. The 2004 high value of approximately 85,000 in Figure 7–4 represents the cumulative results for Austria in 2003 and 2004.

When you develop bar charts in your JavaFX application, remember that data on the vertical axes are interpreted differently for a `BarChart` than for a `StackedBarChart`. Choose the type of chart that best illustrates the task of the application.

You can specify the distance between the stacked categories by setting the value in the `setCategoryGap` method. For example, you can set the distance of 50 pixels for the Country Summary bar chart: `sbc.setCategoryGap(50);`

When you apply this method to the stacked bar chart in Example 7–4, the bar categories look as shown in Figure 7–5.

Figure 7–5 Stacked Bar Chart with the Specified Gap Between the Categories



Animating Data in Charts

You can implement animated charts to illustrate dynamic behavior of financial activities. Example 7–5 defines an animation timeline and creates key frames to randomly set the X value for the data of the bar chart. The timeline starts when the application does and continues indefinitely in the auto-reverse mode.

Example 7–5 Animating Data in a Bar Chart

```
Timeline tl = new Timeline();
tl.getKeyFrames().add(
new KeyFrame(Duration.millis(500),
    new EventHandler<ActionEvent>() {
        @Override public void handle(ActionEvent actionEvent) {
            for (XYChart.Series<Number, String> series : bc.getData()) {
                for (XYChart.Data<Number, String> data : series.getData()) {
                    data.setXValue(Math.random() * 1000);
                }
            }
        }
     }
));
tl.setCycleCount(Animation.INDEFINITE);
tl.setAutoReverse(true);
tl.play();
```

When you add this code fragment to the Country Summary application in Example 7–3, and then compile and run the modified code, you will notice that both the axis and the chart plot change smoothly to accommodate new values in ranges and new lengths of the bars. This is because of the `animated` properties of the `Chart` and `Axis` classes. By default, they set to `true` to animate any data changes.

For the Country Summary application, you can prohibit animating data along the vertical axis when the data on this axis is presented in categories and does not change. To avoid undesirable flickering of the country labels, use the `setAnimated` method as

shown in Example 7–6.

Example 7–6 Managing Animation of Data Changes

```
yAxis.setAnimated(false);
```

See the `Ensemble` application and the API documentation for more information about the features and capabilities of JavaFX charts.

Related API Documentation

- `BarChart`
- `Chart`
- `XYChart`
- `XYChart.Data`
- `XYChart.Series`
- `Axis`
- `NumberAxis`
- `CategoryAxis`
- `Timeline`
- `KeyFrame`

8

Styling Charts with CSS

This chapter explains how to change the default appearance of JavaFX charts by applying Cascading Style Sheets (CSS). Learn how to change a chart color scheme, modify its legend or axes, and alter chart symbols.

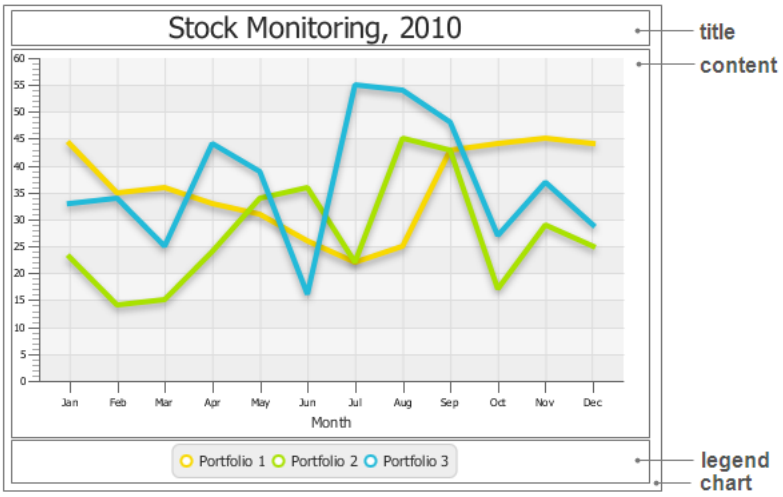
All visual elements of JavaFX charts are defined by the caspian style sheet. The JavaFX API has a limited set of methods and properties to alter these visual elements. Oracle recommends that you use the chart-specific CSS properties to implement an alternative look and feel for charts in your JavaFX application.

You can find a complete list of the chart-specific properties in the JavaFX CSS Reference Guide. When you apply CSS styles to your charts, refer to Skin JavaFX Applications with CSS for implementation details.

Modifying Basic Chart Elements

All JavaFX charts have common properties that can be set though the `.chart`, `.chart-content`, `.chart-title`, and `.chart-legend` CSS classes. Figure 8–1 shows the corresponding areas of the chart.

Figure 8–1 Visual Elements of a Chart



You can change and set the following visual characteristics of these elements:

- Padding and insets

- Background color and image
- Font
- Text fill color

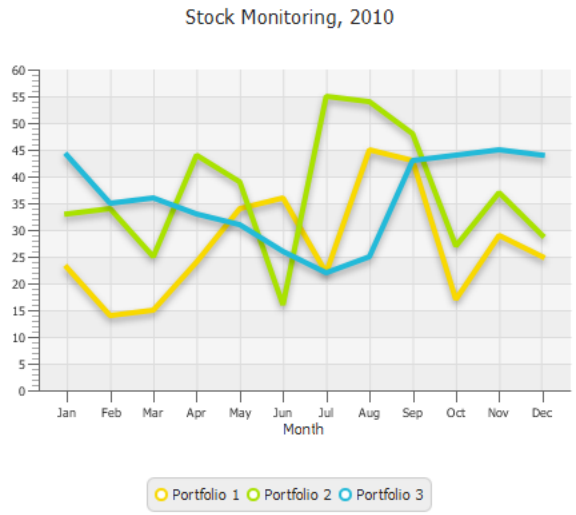
By default, any chart has 5-pixel padding and its content has 10-pixel padding. You can alter these values by using the `-fx-padding` properties of the `.chart` and `.chart-content` CSS classes as shown in Example 8–1.

Example 8–1 Set Chart Padding

```
.chart {
    -fx-padding: 10px;
}
.chart-content {
    -fx-padding: 30px;
}
```

Figure 8–2 shows the view of the line chart after these styles are applied.

Figure 8–2 Setting Chart Top-Level CSS Properties



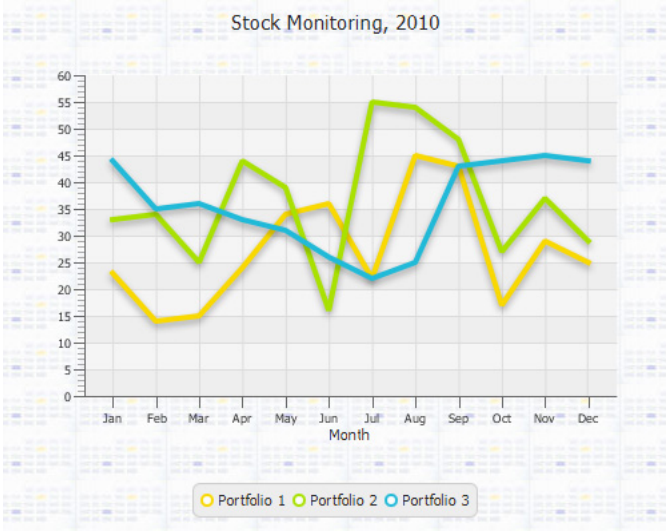
You can define a background color or a background image for the chart. Add the `-fx-background-image` property as shown in Example 8–2.

Example 8–2 Setting a Background Image

```
.chart {
    -fx-padding: 10px;
    -fx-background-image: url("icon.png");
}
.chart-content {
    -fx-padding: 30px;
}
```

Because the icon is smaller than the line chart, the image is repeated to fill the remaining area. Figure 8–3 shows line chart when the background image is applied.

Figure 8–3 Line Chart with a Background Image



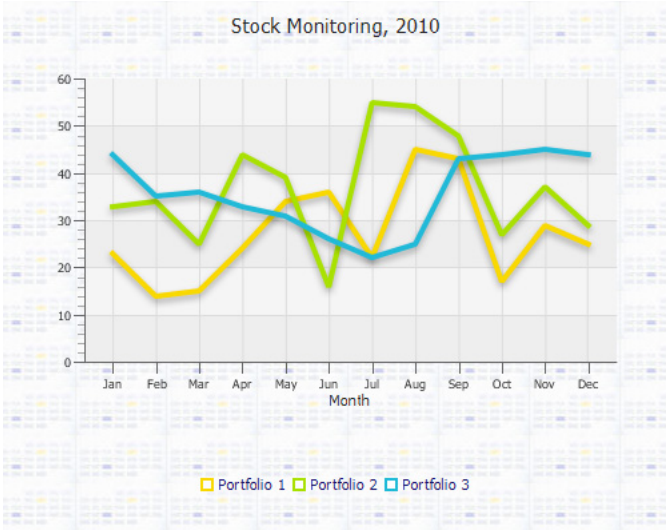
The chart legend for the line chart shown in Figure 8–3 has the default look and feel. You can change its appearance by altering the properties defined in the `.chart-legend` CSS class, as demonstrated in Example 8–3.

Example 8–3 Setting a Chart Legend

```
.chart {
    -fx-padding: 10px;
    -fx-background-image: url("icon.png");
}
.chart-content {
    -fx-padding: 30px;

}
.chart-legend {
   -fx-background-color:  transparent;
   -fx-padding: 20px;
}

.chart-legend-item-symbol{
   -fx-background-radius: 0;
}

.chart-legend-item{
    -fx-text-fill: #191970;
}
```

When you apply these styles, the chart legend is rendered with a transparent background, the labels are painted with dark blue, and the legend symbols change to square, as shown in Figure 8–4.

Figure 8–4 Changing the Chart Legend



By default, legend symbols look like circles, because they are declared as rounded rectangles with a 5-pixel height, 5-pixel width, and 5-pixel radius. When you explicitly set the radius to 0, the circles turn into squares. You can also define the legend symbol by using the `-fx-shape` property. For example, the following line creates a triangle by specifying its SVG path: `-fx-shape: "M5,0 L10,8 L0,8 Z."`

To alter the chart text elements, you should use the corresponding styles as shown in Example 8–4. The `.chart-title` class sets the fill color and the font size for the chart title. The `.axis-label` class define the fill color of the axis label.

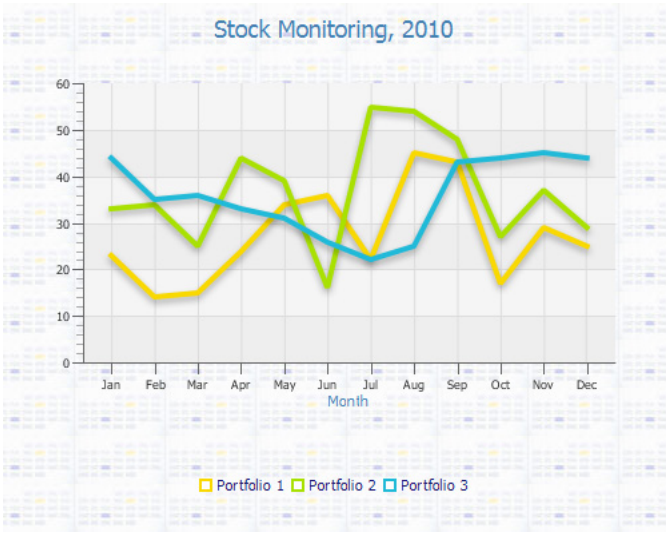
Example 8–4 Changing Color of the Text Elements

```
.chart {
    -fx-padding: 10px;
    -fx-background-image: url("icon.png");
}
.chart-content {
    -fx-padding: 30px;
}

.chart-title {
  -fx-text-fill: #4682b4;
  -fx-font-size: 1.6em;
}

.axis-label {
  -fx-text-fill: #4682b4;
}

.chart-legend {
   -fx-background-color:  transparent;
   -fx-padding: 20px;
}

.chart-legend-item-symbol{
   -fx-background-radius: 0;
}
```

```
.chart-legend-item{
    -fx-text-fill: #191970;
}
```

These modifications result in the appearance shown in Figure 8–5.

Figure 8–5 Line Chart with the Modified Text Elements



Altering Colors of the Chart Plot

When you change the default background color of a chart or set an image as a chart background, the changes do not affect the graph itself. As specified in the caspian style sheet, the chart plot of a two-axis chart has a light gray background, and its alternative rows are gray. Use the `-fx-background-color` and `-fx-background-image` properties of the `.chart-plot-background` class to set the background for the chart plot. Example 8–5 defines the background color for the chart plot, the fill color for the alternative rows, and the color of vertical and horizontal grid lines.

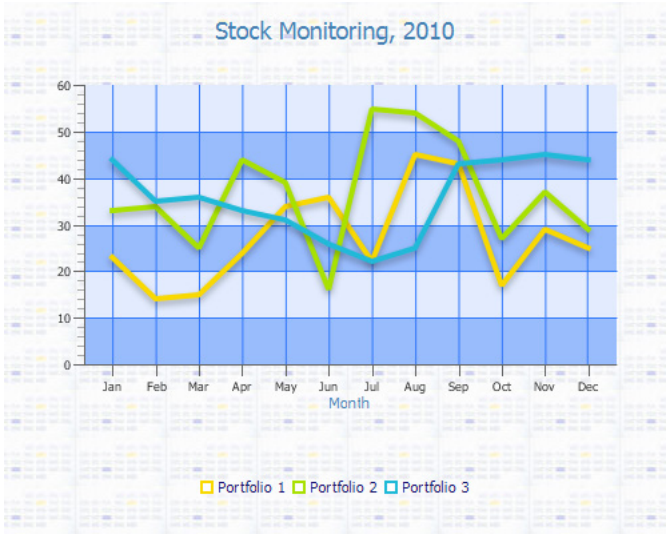
Example 8–5 Setting a Background Color for a Chart Plot

```
.chart {
    -fx-padding: 10px;
    -fx-background-image: url("icon.png");
}
.chart-content {
    -fx-padding: 30px;
}

.chart-title {
  -fx-text-fill: #4682b4;
  -fx-font-size: 1.6em;
}

.axis-label {
  -fx-text-fill: #4682b4;
}

.chart-legend {
   -fx-background-color:  transparent;
```

```
   -fx-padding: 20px;
}

.chart-legend-item-symbol{
   -fx-background-radius: 0;
}

.chart-legend-item{
    -fx-text-fill: #191970;
}

.chart-plot-background {
    -fx-background-color: #e2ecfe;
}
.chart-vertical-grid-lines {
    -fx-stroke: #3278fa;
}
.chart-horizontal-grid-lines {
    -fx-stroke: #3278fa;
}
.chart-alternative-row-fill {
    -fx-fill: #99bcfd;
    -fx-stroke: transparent;
    -fx-stroke-width: 0;
}
```

Figure 8–6 shows the line chart with the modified plot background.

Figure 8–6 Line Chart with an Alternative Plot Color



When you design your chart so that its plot has the same background as the other chart areas, set a transparent background for the plot and alternative rows, as shown in Example 8–6.

Example 8–6 Setting a Transparent Background for the Chart Plot

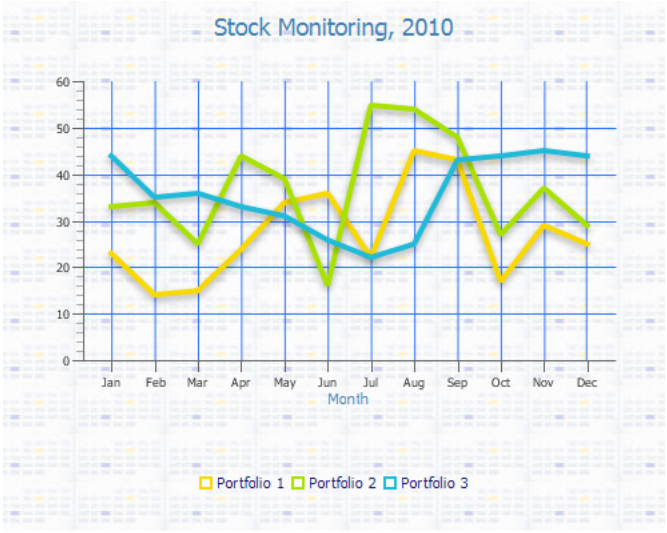
```
.chart {
    -fx-padding: 10px;
    -fx-background-image: url("icon.png");
}
```

```
.chart-content {
    -fx-padding: 30px;
}

.chart-title {
  -fx-text-fill: #4682b4;
  -fx-font-size: 1.6em;
}

.axis-label {
  -fx-text-fill: #4682b4;
}

.chart-legend {
   -fx-background-color:  transparent;
   -fx-padding: 20px;
}

.chart-legend-item-symbol{
   -fx-background-radius: 0;
}

.chart-legend-item{
    -fx-text-fill: #191970;
}

.chart-plot-background {
    -fx-background-color: transparent;
}
.chart-vertical-grid-lines {
    -fx-stroke: #3278fa;
}
.chart-horizontal-grid-lines {
    -fx-stroke: #3278fa;
}
.chart-alternative-row-fill {
    -fx-fill: transparent;
    -fx-stroke: transparent;
    -fx-stroke-width: 0;
}
```

You can make the alternative rows invisible by applying the `setAlternativeRowFillVisible(false)` method to the chart in the JavaFX application.

When the transparent background colors are applied, the chart appears as shown in Figure 8–7.

Figure 8–7 Line Chart with a Transparent Plot Background



Setting the Axes

Although the `Axis` class provides methods and properties to set the tick marks and labels, you can use the corresponding CSS classes and properties to define the appearance for these chart elements.

Consider the bubble chart sample described in the Bubble Chart chapter. Disable the color set for the tick labels in Example 5–5 by either deleting or commenting out the following lines.

- `xAxis.setTickLabelFill(Color.CHOCOLATE);`
- `yAxis.setTickLabelFill(Color.CHOCOLATE);`

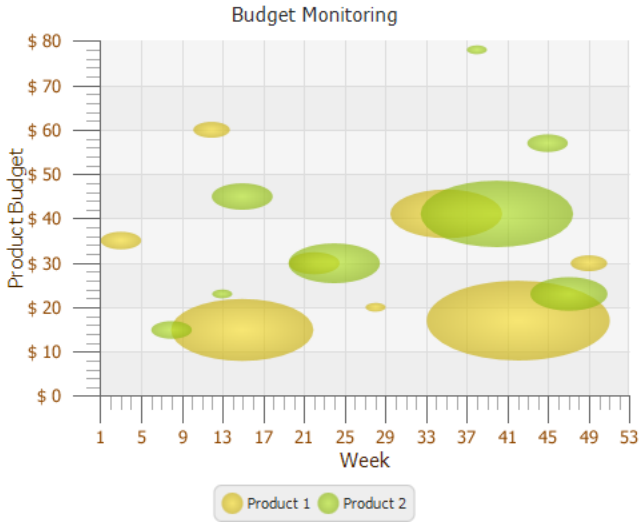
Add the code fragment shown in Example 8–7 to the CSS file of the application.

Example 8–7 Defining Styles for the Chart Axes

```
.axis {
    -fx-font-size: 1.4em;
    -fx-tick-label-fill: #914800;
    -fx-font-family: Tahoma;
    -fx-tick-length: 20;
    -fx-minor-tick-length: 10;
}

.axis-label {
   -fx-text-fill: #462300;
}
```

This style sheet defines the relative font size, font family, and fill colors for the axis labels and tick labels. It also sets the lengths for the tick marks and minor tick marks. When these styles are applied to the chart, it looks as shown in Figure 8–8.

Figure 8–8 Bubble Chart with the Modified Appearance of Its Axes



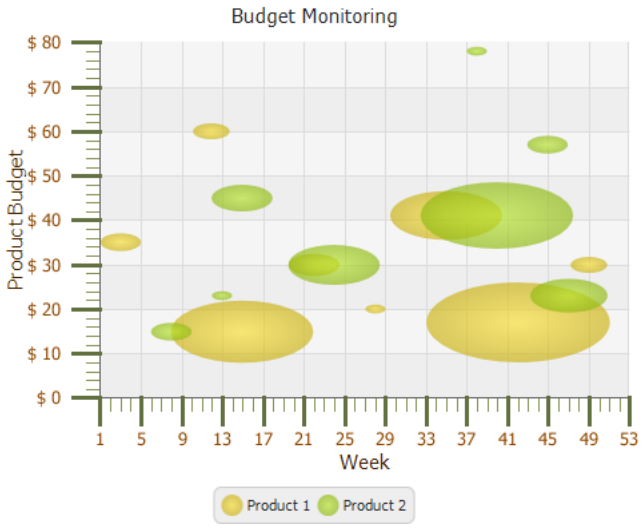
Example 8–7 changes the default values for the length of tick marks and minor tick marks. You can continue changing their appearance by defining a new color scheme, as shown in Example 8–8. This example also sets a 3-pixel width for the basic tick marks, so that they look thicker than minor tick marks.

Example 8–8 Altering Colors of Tick Marks and Minor Tick Marks

```
.axis {
    -fx-font-size: 1.4em;
    -fx-tick-label-fill: #914800;
    -fx-font-family: Tahoma;
    -fx-tick-length: 20;
    -fx-minor-tick-length: 10;
}

.axis-label {
   -fx-text-fill: #462300;
}

.axis-tick-mark {
    -fx-stroke: #637040;
    -fx-stroke-width: 3;
}
.axis-minor-tick-mark {
    -fx-stroke: #859656;
}
```

Figure 8–9 shows how the axes change when you modify the color and width of the chart tick marks.

Figure 8–9 Alternative Color Scheme and Width for the Tick Marks



Setting Chart Colors

Changing the default colors of the charts is the simple way to provide a unique style for your JavaFX application. This section describes some aspects of setting alternative colors for basic types of charts.

By default, the caspian style sheet defines eight colors of line that correspond to the first eight series of data. When the number of data series added to the line chart exceeds eight, the color of the extra lines is defined in the `.chart-series-line` CSS class.

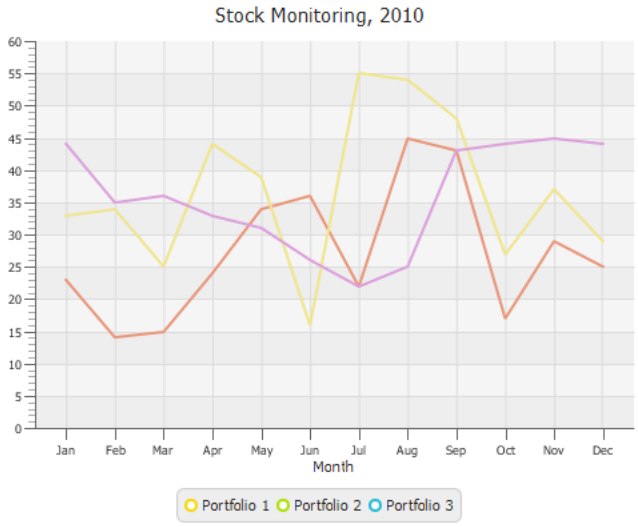
Use the `.chart-series-line` class and `.default-color<x>.chart-series-line` classes to change the style of lines. The style defined in Example 8–9 sets new colors for the lines of the three data series, removes the default effects, and specifies a 2-pixel width.

Example 8–9 Setting Alternative Colors for Three Series in a Line Chart

```
.chart-series-line {
    -fx-stroke-width: 2px;
    -fx-effect: null;
}

.default-color0.chart-series-line { -fx-stroke: #e9967a; }
.default-color1.chart-series-line { -fx-stroke: #f0e68c; }
.default-color2.chart-series-line { -fx-stroke: #dda0dd; }
```

Figure 8–10 shows the line chart after this style has been applied.

Figure 8–10 Line Chart with the Modified Line Colors



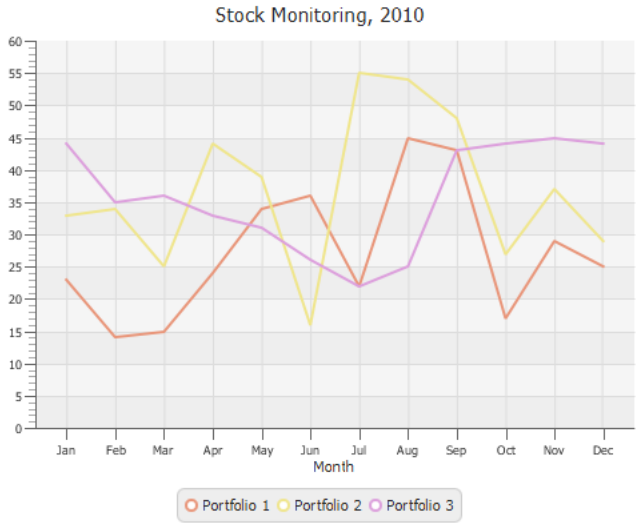
Note that the legend still shows the default colors of the chart series. This is because the corresponding changes were not applied to the chart symbols. Example 8–10 shows how to change the colors of the series in the legend.

Example 8–10 Changing Chart Symbol Color

```
.chart-series-line {
    -fx-stroke-width: 2px;
    -fx-effect: null;
}

.default-color0.chart-series-line { -fx-stroke: #e9967a; }
.default-color1.chart-series-line { -fx-stroke: #f0e68c; }
.default-color2.chart-series-line { -fx-stroke: #dda0dd; }

.default-color0.chart-line-symbol { -fx-background-color: #e9967a, white; }
.default-color1.chart-line-symbol { -fx-background-color: #f0e68c, white; }
.default-color2.chart-line-symbol { -fx-background-color: #dda0dd, white; }
```

Compare Figure 8–10 and Figure 8–11 to observe the change in the chart legend.

Figure 8–11 Line Chart with the Modified Colors of Its Lines and Proper Legend Symbols



When you change colors in a area chart, consider three graphical components: the area for each data series, the corresponding bounding line, and the chart symbol. By default, the caspian styles sheet defines a color scheme for eight series of data, including the colors of their areas, lines, and symbols. The default style also sets the basic color for areas, lines, and symbols of additional series.

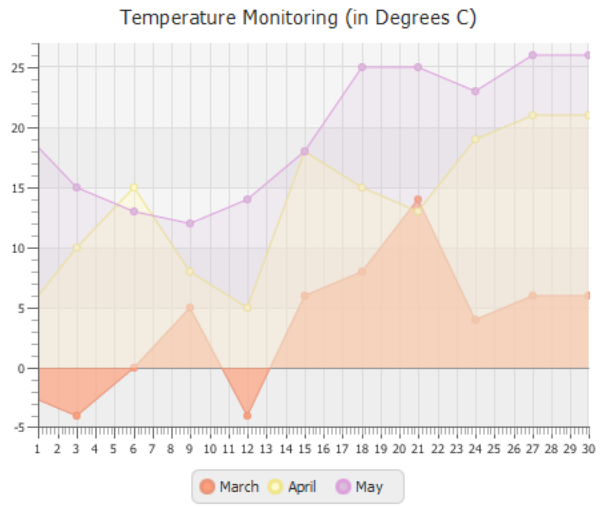
Example 8–11 shows how to change the default color scheme for the areas that correspond to three series of data.

Example 8–11 Creating a New Color Scheme for an Area Chart

```
.default-color0.chart-area-symbol { -fx-background-color: #e9967a, #ffa07a; }
.default-color1.chart-area-symbol { -fx-background-color: #f0e68c, #fffacd; }
.default-color2.chart-area-symbol { -fx-background-color: #dda0dd, #d8bfd8; }

.default-color0.chart-series-area-line { -fx-stroke: #e9967a; }
.default-color1.chart-series-area-line { -fx-stroke: #f0e68c; }
.default-color2.chart-series-area-line { -fx-stroke: #dda0dd; }

.default-color0.chart-series-area-fill { -fx-fill: #ffa07a aa}
.default-color1.chart-series-area-fill { -fx-fill: #fffacd 77; }
.default-color2.chart-series-area-fill { -fx-fill: #d8bfd8 33; }
```

Pay attention to the values in bold. These bold characters set new values for area opacity. By default, all areas have an opacity level of 0.17. Example 8–11 reassigns opacity for the areas so that the first area has the lowest opacity level, and the third area has the highest opacity level. Note that the hexadecimal color syntax with alpha is not a standard W3C CSS format. To conform with the W3C requirements, use the `rgba` CSS function with the fourth parameter as an alpha value. Figure 8–12 shows how these styles change the chart appearance when they are applied.

Figure 8–12 Area Chart with an Alternative Color Scheme



Example 8–12 shows the basic style for all bars in the bar chart defined in the caspian style sheet. This style creates a linear gradient for the background color and sets the radius so that all bar edges look rounded.

Example 8–12 Default Style of the Bar Chart

```
.chart-bar {
    -fx-bar-fill: #22bad9;
    -fx-background-color: linear (0%,0%) to (0%,100%)
        stops (0%, derive(-fx-bar-fill,-30%))
        (100%, derive(-fx-bar-fill,-40%)),
        linear (0%,0%) to (0%,100%)
        stops (0%, derive(-fx-bar-fill,80%))
        (100%, derive(-fx-bar-fill, 0%)),
        linear (0%,0%) to (0%,100%)
        stops (0%, derive(-fx-bar-fill,30%))
        (100%, derive(-fx-bar-fill,-10%));
    -fx-background-insets: 0,1,2;
    -fx-background-radius: 5 5 0 0, 4 4 0 0, 3 3 0 0;
}
```

The background settings are not limited to colors, gradients, and effects. You can also set background image for each data series. To implement this approach, first simplify the BarChartSample application as shown in Example 8–13.

Example 8–13 Simplified Bar Chart Sample

```
package barchartsample;

import javafx.application.Application;
import javafx.scene.Scene;
import javafx.scene.chart.BarChart;
import javafx.scene.chart.CategoryAxis;
import javafx.scene.chart.NumberAxis;
import javafx.scene.chart.XYChart;
```

```
import javafx.stage.Stage;

public class BarChartSample extends Application {

    final static String austria = "Austria";
    final static String brazil = "Brazil";
    final static String france = "France";
    final static String italy = "Italy";
    final static String usa = "USA";

    @Override
    public void start(Stage stage) {
        stage.setTitle("Bar Chart Sample");
        final CategoryAxis xAxis = new CategoryAxis();
        final NumberAxis yAxis = new NumberAxis();
        final BarChart<String, Number> bc =
                new BarChart<String, Number>(xAxis, yAxis);
        bc.setTitle("Country Summary");
        xAxis.setLabel("Country");
        xAxis.setTickLabelRotation(90);
        yAxis.setLabel("Value");

        XYChart.Series series1 = new XYChart.Series();
        series1.setName("2003");
        series1.getData().add(new XYChart.Data(austria, 25601.34));
        series1.getData().add(new XYChart.Data(brazil, 20148.82));
        series1.getData().add(new XYChart.Data(france, 10000));
        series1.getData().add(new XYChart.Data(italy, 35407.15));
        series1.getData().add(new XYChart.Data(usa, 11000));

        Scene scene = new Scene(bc, 400, 600);
        bc.getData().add(series1);
        bc.setLegendVisible(false);
        stage.setScene(scene);
        scene.getStylesheets().add("barchartsample/Chart.css");
        stage.show();
    }

    public static void main(String[] args) {
        launch(args);
    }
}
```

Now define the chart style sheet as shown in Example 8–14.

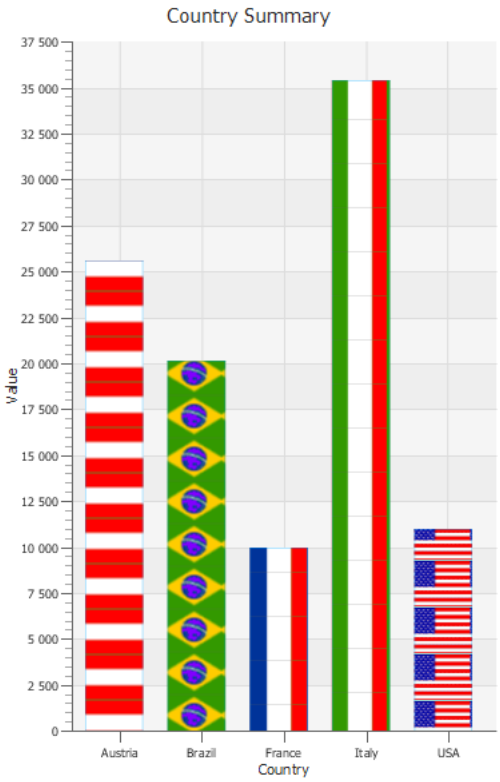
Example 8–14 Adding Images to the Bar Background

```
.chart-bar {
    -fx-background-color: rgba(0,168,355,0.05);
    -fx-border-color: rgba(0,168,355,0.3) rgba(0,168,355,0.3)
        transparent rgba(0,168,355,0.3);
    -fx-background-radius: 0;
    -fx-background-position: left center;
}

.data0.chart-bar {
    -fx-background-image: url("austria.png");
}
.data1.chart-bar {
    -fx-background-image: url("brazil.png");
```

```
}
.data2.chart-bar {
    -fx-background-image: url("france.png");
}
.data3.chart-bar {
    -fx-background-image: url("italy.png");
}
.data4.chart-bar {
    -fx-background-image: url("usa.png");
}
```

This style sets a background image for each data series and defines the position of the image within the bar. Figure 8–13 shows how the BarChartSample looks after the new styles are applied.

Figure 8–13 Using Images to Fill a Bar Chart



When you build pie charts in your JavaFX application, you typically need to set alternative colors for the pie chart slices. You can redefine the default color scheme by setting the `.default-color<x>.chart-pie` CSS classes. Example 8–15 implements this task.

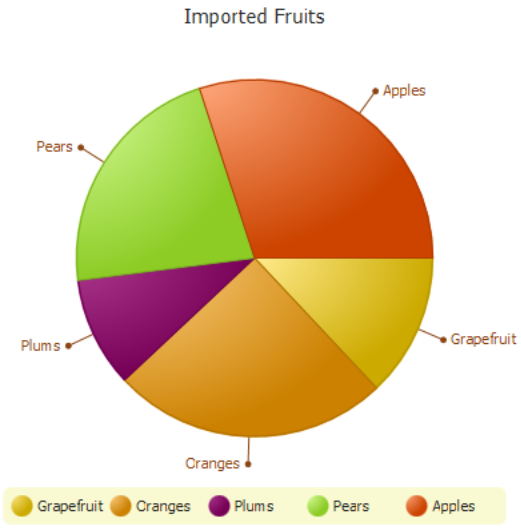
Example 8–15 Setting Colors of a Pie Chart

```
.default-color0.chart-pie { -fx-pie-color: #ffd700; }
.default-color1.chart-pie { -fx-pie-color: #ffa500; }
.default-color2.chart-pie { -fx-pie-color: #860061; }
.default-color3.chart-pie { -fx-pie-color: #adff2f; }
.default-color4.chart-pie { -fx-pie-color: #ff5700; }
```

```
.chart-pie-label-line {
    -fx-stroke: #8b4513;
    -fx-fill: #8b4513;
}

.chart-pie-label {
    -fx-fill: #8b4513;
    -fx-font-size: 1em;
}
.chart-legend {
   -fx-background-color:  #fafad2;
   -fx-stroke: #daa520;
}
```

The pie chart colors now resemble the colors of fruit that they represent. Additionally, the style sheet in Example 8–15 sets alternative colors for the labels and the chart legend. You can observe the new style in Figure 8–14.

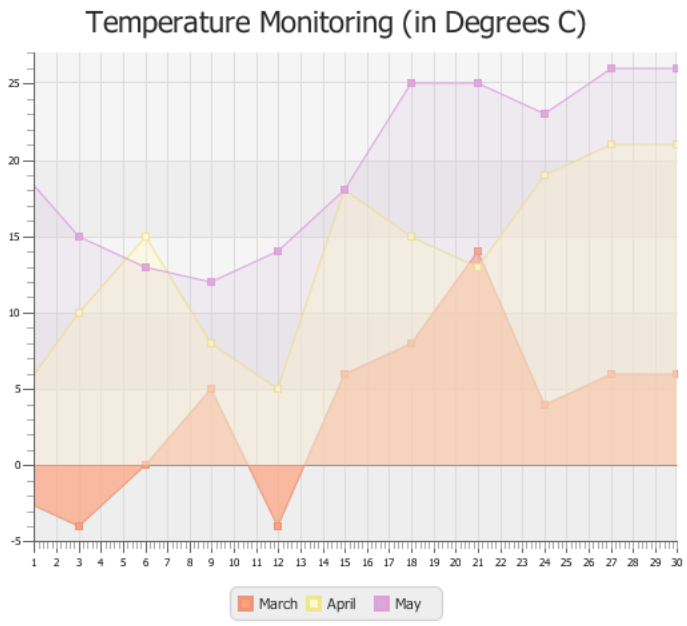
Figure 8–14 Pie Chart with the Redefined Colors of Its Slices



Changing Chart Symbols

Although symbols to display in the chart legend are defined in the caspian style sheet, you can change their appearance by modifying the default color scheme and symbol shape. Example 8–11 changes the colors of the area chart symbols. You can add the following line to change the symbol shape to a square: `.chart-area-symbol{-fx-background-radius: 0;}`. By default, the background radius is 5 pixels. Changing the background radius to 0, turns the circle into a square. This change applies to all series of data, as shown in Figure 8–15.

Figure 8–15 Area Chart with Modified Chart Symbols



In scatter charts, all data is represented by set of points. Each data series has its special symbol. By default, the caspian style defines seven symbols for seven series of data and the basic symbol that it uses for other data series. Example 8–16 shows the default styles for the scatter charts.

Example 8–16 Styles for a Scatter Chart Defined in the Caspian Style Sheet

```
.chart-symbol { /* solid circle */
    -fx-background-color: #f9d900;
    -fx-background-radius: 5px;
    -fx-padding: 5px;
}
.default-color1.chart-symbol { /* solid square */
    -fx-background-color: #a9e200;
    -fx-background-radius: 0;
}
.default-color2.chart-symbol { /* solid diamond */
    -fx-background-color: #22bad9;
    -fx-background-radius: 0;
    -fx-padding: 7px 5px 7px 5px;
    -fx-shape: "M5,0 L10,9 L5,18 L0,9 Z";
}
.default-color3.chart-symbol { /* cross */
    -fx-background-color: #0181e2;
    -fx-background-radius: 0;
    -fx-background-insets: 0;
    -fx-shape: "M2,0 L5,4 L8,0 L10,0 L10,2 L6,5 L10,8 L10,10 L8,10 L5,6 L2,
    10 L0,10 L0,8 L4,5 L0,2 L0,0 Z";
}
.default-color4.chart-symbol { /* solid triangle */
    -fx-background-color: #2f357f;
    -fx-background-radius: 0;
    -fx-background-insets: 0;
    -fx-shape: "M5,0 L10,8 L0,8 Z";
}
```

```
.default-color5.chart-symbol { /* hollow circle */
    -fx-background-color: #860061, white;
    -fx-background-insets: 0, 2;
    -fx-background-radius: 5px;
    -fx-padding: 5px;
}
.default-color6.chart-symbol { /* hollow square */
    -fx-background-color: #c62b00, white;
    -fx-background-insets: 0, 2;
    -fx-background-radius: 0;
}
.default-color7.chart-symbol { /* hollow diamond */
    -fx-background-color: #ff5700, white;
    -fx-background-radius: 0;
    -fx-background-insets: 0, 2.5;
    -fx-padding: 7px 5px 7px 5px;
    -fx-shape: "M5,0 L10,9 L5,18 L0,9 Z";
}
```

You can use these CSS classes and the available CSS properties to change the symbols of scatter charts, or you can invent your own symbols to represent data.

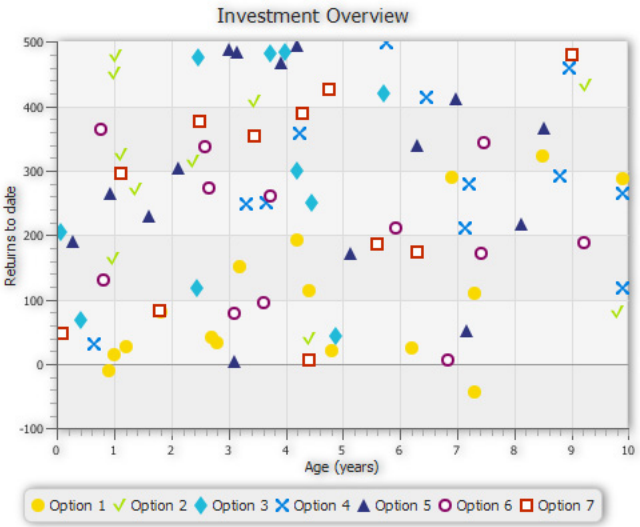
Use the `.default-color1.chart-symbol` CSS class to change the default color and shape of the symbol for the second data series as shown in Example 8–17.

Example 8–17 Redefining the Shape of the Second Series of Data

```
.default-color1.chart-symbol {
    -fx-background-color: #a9e200;
    -fx-shape: "M0,4 L2,4 L4,8 L7,0 L9,0 L4,11 Z";
}
```

When this style is applied to the scatter chart, as shown in Figure 8–16, the points of the second series appear as check marks. The points of other series appear according to the default styles.

Figure 8–16 Scatter Chart with New Check Mark Symbol to Designate the Second Data Series



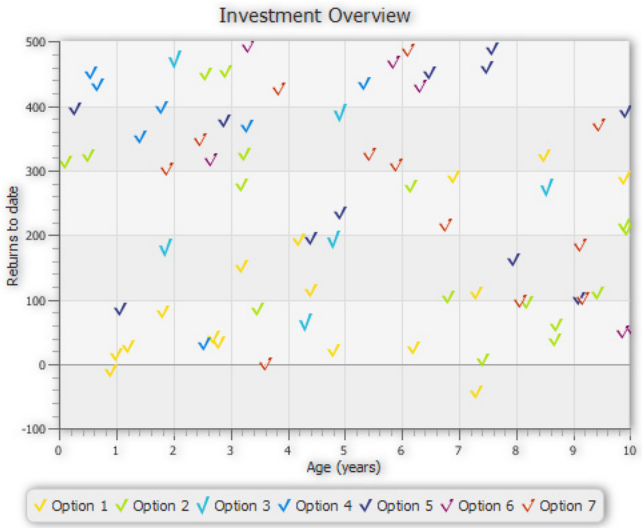
Use the `.chart-symbol` class to set a new chart symbol for the all data series in the scatter chart, as shown in Example 8–18.

Example 8–18 Defining an Alternative Symbol for a Scatter Chart

```
.chart-symbol{
    -fx-shape: "M0,4 L2,4 L4,8 L7,0 L9,0 L4,11 Z";
}
```

Figure 8–17 shows a scatter chart with seven series of data. Each series is represented by a check mark of different color. The color of each series is derived from the caspian style sheet.

Figure 8–17 Scatter Chart with a Check Sign as a Chart Symbol



In conclusion, when you need to style a chart in your JavaFX application, consider the following steps:

- Add a .css file to your JavaFX application.
- Identify the graphical elements of the chart you need to change.
- Determine the corresponding CSS classes.
- Set the properties of the selected CSS classes specifying the values to attain the required appearance.

Refer to Skin JavaFX Applications with CSS for additional information about how to style your JavaFX application with CSS.