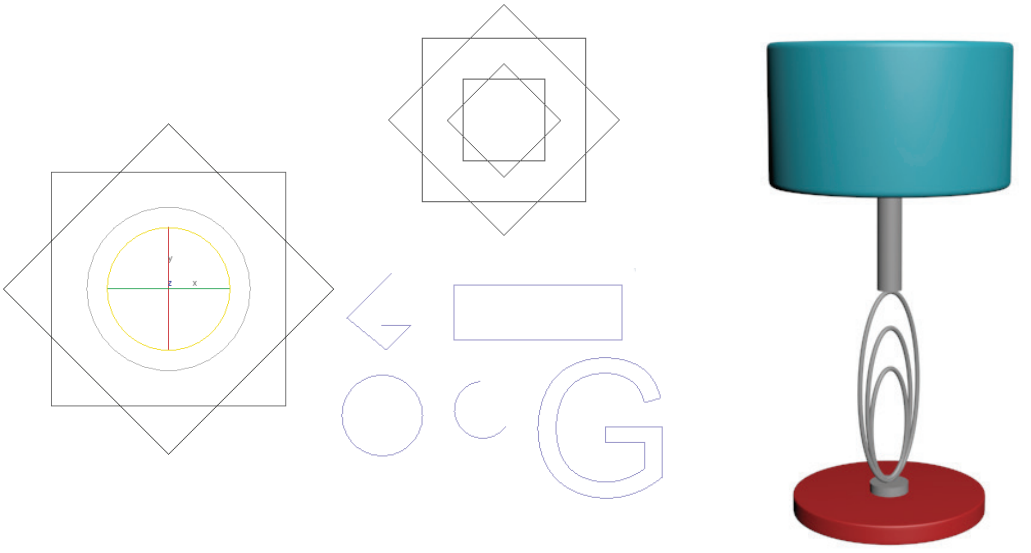
Chapter 4

Working with Splines-I

Learning Objectives

After completing this chapter, you will be able to:

- *Create 2D shapes*
- *Modify splines*
- *Change bezier splines*
- *Work with transform centers*



INTRODUCTION

In 3ds Max, splines are used to create various shapes. The advantage of using splines in place of primitive objects is that they require less number of segments to create an object. In this chapter, you will learn to create and modify different types of splines using the **Edit Spline** modifier.

TUTORIALS

Tutorial 1

In this tutorial, you will create different 2D splines such as a line, circle, rectangle, arc, and text. You will modify the vertices and segments, and also adjust the splines using bezier handles. In addition, you will transform the shapes using different transform centers.

(Expected time: 25 min)

The following steps are required to complete this tutorial:

a. Create the project folder.
b. Create 2D Shapes.
c. Modify vertices, segments, and splines.
d. Change bezier splines.
e. Lock handles.
f. Create and modify splines.
g. Copy an object.

Creating the Project Folder

Create a project folder with the name *c04_tut1* in the *3dsmax 2021* folder as discussed in Tutorial 1 of Chapter 2.

Creating 2D Shapes

In this section, you will create 2D shapes in the form of spline polygons.

1. Activate the Top viewport and then invoke the **Maximize Viewport Toggle** tool from the viewport navigation controls to maximize the Top viewport.

2. Invoke the **2D Snap** tool from the **Snaps Toggle** flyout in the **Main Toolbar** to turn on snaps. Right-click on the **2D Snap** tool; the **Grid and Snap Settings** dialog box is displayed. In the **Snaps** tab, make sure that only the **Grid Points** check box is selected and then close the dialog box.

3. Choose **Create > Shapes** in the **Command Panel**. Next, invoke the **Line** tool from the **Object Type** rollout.

4. Click at a point in the viewport to create the first vertex. Next, move the mouse and click at points where you need to create the rest of the vertices; a line is created in the Top viewport, refer to Figure 4-1 (top-left). Now, right-click to exit the tool.

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5. Invoke the **Zoom** tool from the viewport navigation controls. Click near the center of the viewport and drag the cursor vertically downward. Release the mouse button after increasing the drawing display area.

6. Invoke the **Rectangle** tool from the **Object Type** rollout.

7. Press and hold the mouse button at a point and then drag the cursor to select the diagonally opposite corner; a rectangle is created, refer to Figure 4-1. You can press and hold the CTRL key to make a square. Right-click to exit the tool.

8. Invoke the **Circle** tool from the **Object Type** rollout. Next, press and hold the mouse button at a point as the center of the circle and then drag the cursor to set the radius, refer to Figure 4-1.

9. Invoke the **Arc** tool from the **Object Type** rollout. Press and hold the mouse button at a point to create the first endpoint of the arc. Next, drag to create the second point and then release the left mouse button. Now, drag and click again in the viewport to specify the third and fourth points to set the radius of the arc, refer to Figure 4-1.

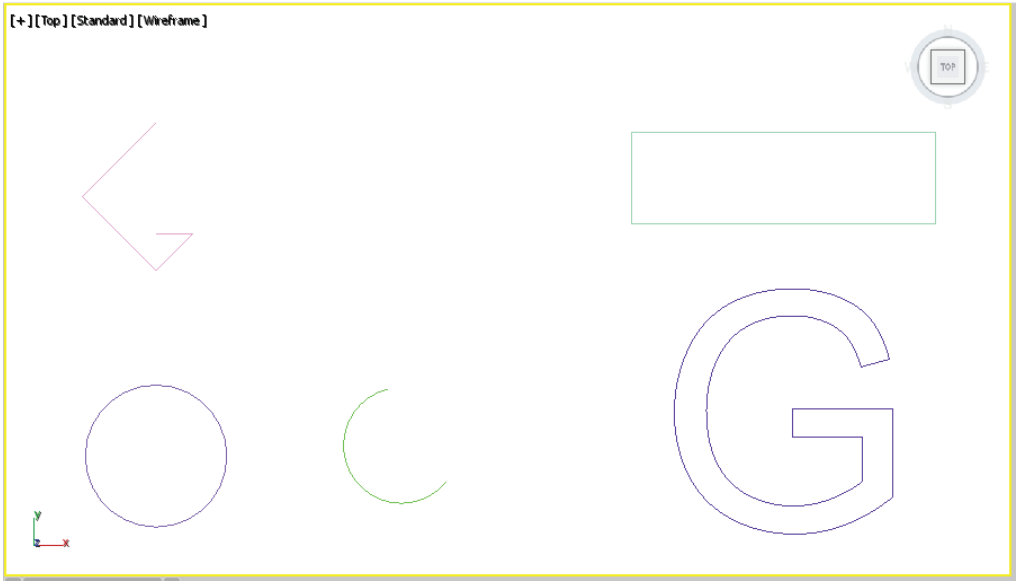

Figure 4-1 *Different spline shapes created in the Top viewport*

10. Invoke the **Text** tool from the **Object Type** rollout. In the **Parameters** rollout, select **Arial** from the drop-down list, if it is not already selected. Next, select **MAX Text** from the **Text** edit box and then enter **G**.

11. Click at a point in the viewport to position the text, refer to Figure 4-1. Invoke the **Select and Move** tool from the **Main Toolbar**. Next, press and hold the left mouse button and drag the cursor to move the text and place it on the screen at a proper position. You can also scale the text as required by using the **Select and Uniform Scale** tool.

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12. Click on the empty area of the viewport to deselect any selected shape.

13. Invoke the **Zoom Extents** tool from the viewport navigation controls to view the text clearly in the viewport. Next, choose **Edit > Hold** from the menu bar to copy the current scene to a buffer. This can be retrieved later using the **Fetch** option.

Modifying Vertices, Segments, and Splines

In this section, you will convert the alignment of vertices from linear to curved and vice versa.

1. Select the text object and then select the circle using the CTRL key.

2. Choose the **Modify** tab in the **Command Panel**. Select **Edit Spline** from the **Modifier List** drop-down list. Next, choose the **Vertex** button in the **Selection** rollout; the **Edit Spline** modifier is applied to the shapes and the **Vertex** sub-object mode is activated. The vertices of both the shapes are displayed in the viewport.

3. Right-click on the vertex on the right side of the circle; a quad menu is displayed. Choose **Corner** from the upper-left quadrant of the quad menu, as shown in Figure 4-2.

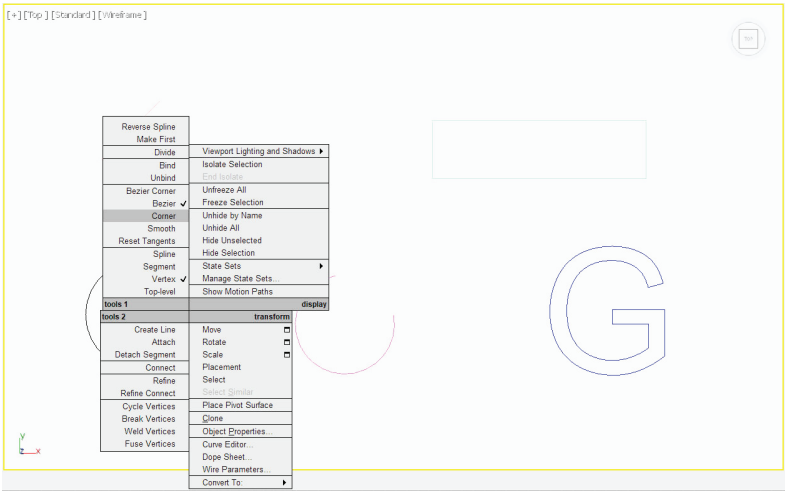

Figure 4-2 *Choosing* ***Corner*** *from the upper-left quadrant of the quad menu*

4. Make sure the text is selected and right-click on the vertex on the left side of the text. Choose **Corner** from the upper-left quadrant of the quad menu displayed; the curved vertices are changed to corner, as shown in Figure 4-3.

5. Right-click on the vertex on the right side of the circle; the quad menu is displayed. Choose **Smooth** from the upper-left quadrant of the quad menu to make the circle smooth. Choose the **Vertex** button to exit the sub-object mode. Now, select the rectangle.

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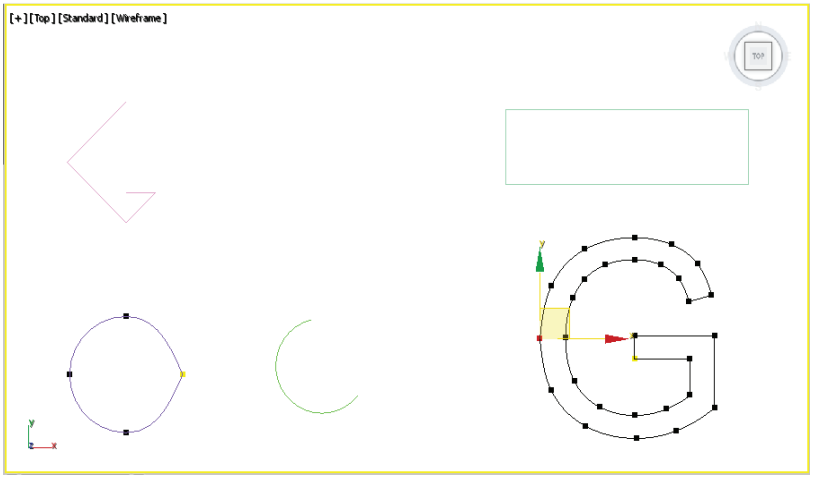

Figure 4-3 *The curved vertices changed to corner*

Note

You cannot select a new shape when you are in the sub-object mode.

6. Select **Edit Spline** from the **OBJECT-SPACE MODIFIERS** section in the **Modifier List** drop-down list. Next, choose the **Vertex** button in the **Selection** rollout; the **Edit Spline** modifier is applied to the rectangle and the **Vertex** sub-object mode is activated. Also, the vertices are displayed in the viewport.

7. Right-click on the lower-left vertex of the rectangle; quad menu is displayed. Choose **Smooth** in the upper-left quadrant of the quad menu. Now, right-click on the upper-right vertex of the rectangle and then choose **Smooth** from the quad menu displayed; the two linear vertices become curved resulting in a curved shape, as shown in Figure 4-4. Similarly, you can convert the linear segments into curved segments and vice versa.

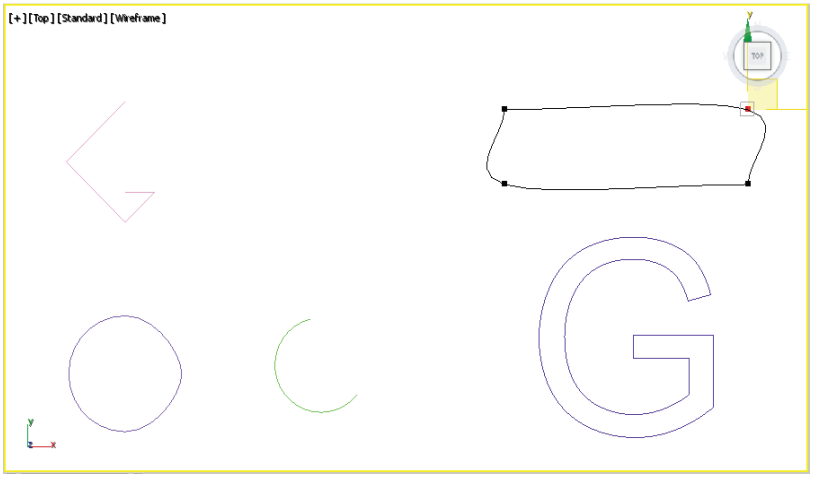

Figure 4-4 *Two corners of the rectangle changed to smooth curves*

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8. Choose the **Segment** button in the **Selection** rollout; the **Segment** sub-object mode of the **Edit Spline** modifier of the rectangle is activated.

9. Drag a selection window around the rectangle to select all segments. The segments turn red. Right-click anywhere on the rectangle to display the quad menu. Choose **Line** from the upper-left quadrant; the curved segments become linear and the rectangle is restored, as shown in Figure 4-5. You can also convert the linear spline into a curved spline and vice versa.

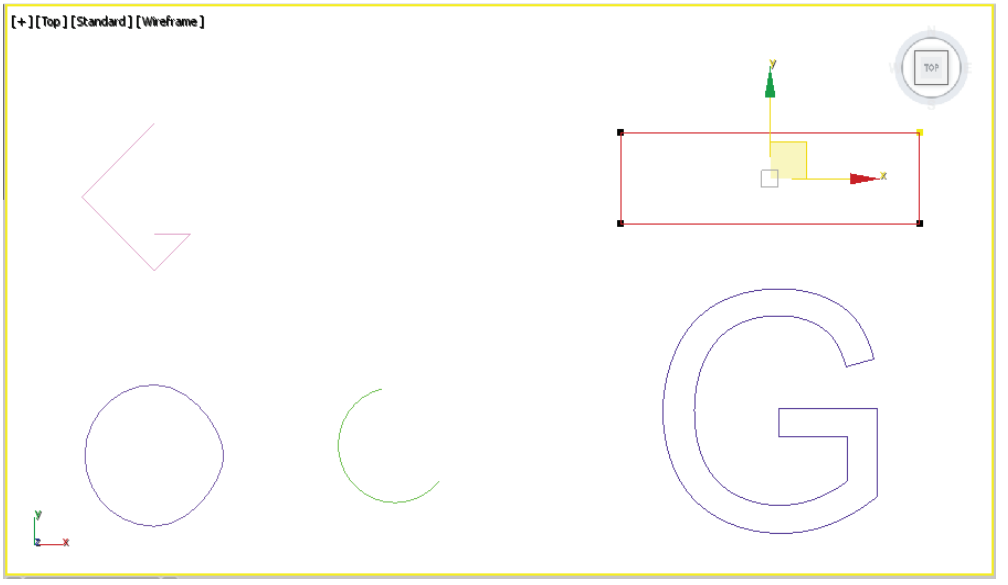

Figure 4-5 *The rectangle restored to its original shape*

10. Choose the **Segment** button in the **Selection** rollout to exit the sub-object mode.

11. Select the object created using the **Line** tool. Next, make sure the **Modify** tab is chosen in the **Command Panel**. In the **Selection** rollout, choose the **Spline** button to enter the **Spline** sub-object mode.

Note

*There is no need to apply the **Edit Spline** modifier to the shapes that were created using the **Line** tool.*

12. Right-click on the spline; the quad menu is displayed. Choose **Curve** from the upper-left quadrant of the quad menu; the whole spline becomes curved, as shown in Figure 4-6.

Changing Bezier Splines

There are two types of bezier vertices: the **Bezier** vertex and the **Bezier Corner** vertex. In this section, you will adjust spline curvature with the help of bezier handles.

1. Choose **Edit > Fetch** from the menu bar; the **About to Fetch. OK?** message box is displayed, as shown in Figure 4-7. Choose the **Yes** button from the message box to restore the scene from buffer.

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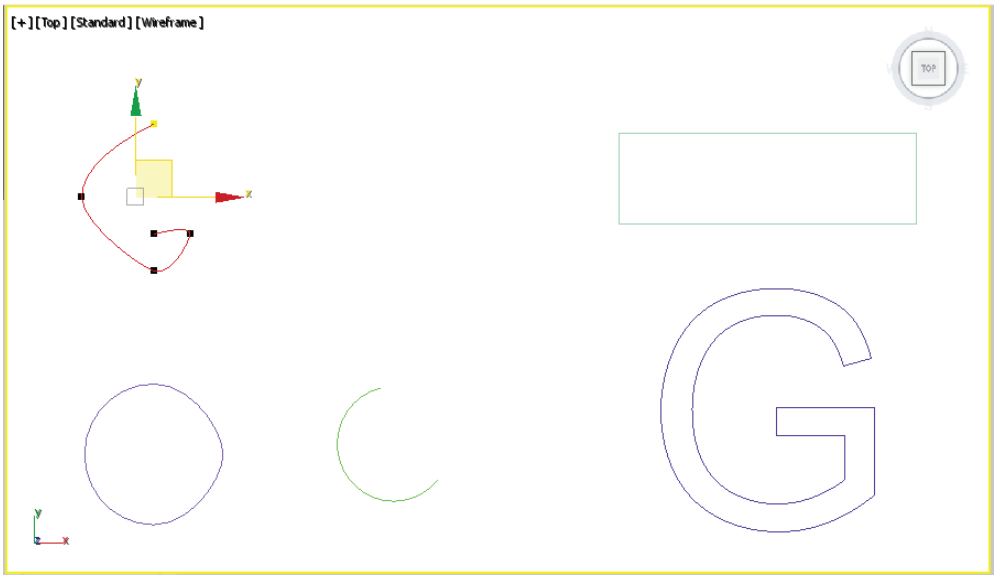

Figure 4-6 *The curved line spline*

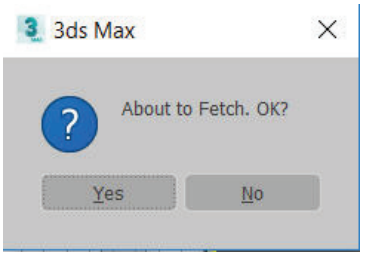

Figure 4-7 *The* ***About to Fetch. OK?*** *message box*

2. Select the rectangle in the viewport and then make sure the **Modify** tab is chosen in the **Command Panel**. Select **Edit Spline** from the **OBJECT-SPACE MODIFIERS** section in the **Modifier-List** drop-down list; the **Edit Spline** modifier is applied. Next, choose the **Vertex** button in the **Selection** rollout to enter into the **Vertex** sub-object mode.

3. Right-click on the top-left vertex of the rectangle; a quad menu is displayed. Choose **Bezier** from the upper-left quadrant of the quad menu; two vector handles are displayed in a straight line forcing the left segment into a curve.

4. Invoke the **Select and Move** tool from the **Main Toolbar**. Next, invoke the **2D Snap** tool again from the **Snaps Toggle** flyout in the **Main Toolbar** to turn it off. Drag one of the handles to form the shape shown in Figure 4-8; both handles move such that the vertex remains tangent to the segments.

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Note

On choosing the transform gizmo button, an axis constraint is set. Therefore, it is often difficult to move the handles as desired while the transform gizmo is active. You may need to turn off the transform gizmo while working with bezier handles. To turn off the transform gizmo, choose ***Views > Show Transform Gizmo*** *from the menu bar. On choosing* ***Show Transform Gizmo*** *again, the transform gizmo will be restored in the viewport.*

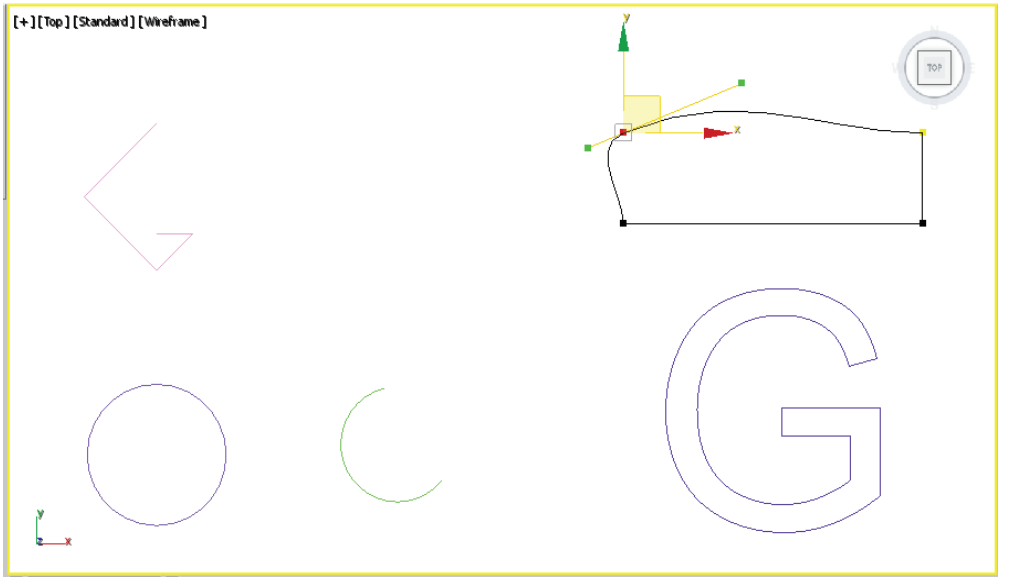

Figure 4-8 *Shape of the rectangle after dragging one of the handles*

5. Press and hold the SHIFT key and move the left handle up toward the left direction; the SHIFT key breaks the tangent by allowing you to move the selected handle converting the bezier vertex into a bezier corner vertex; only the segment associated with this handle is affected whereas the other handle remains unchanged, as shown in Figure 4-9.

6. Right-click on the same vertex again to display the quad menu and choose **Bezier** from it; the changed segment automatically assumes its previous shape forcing the moved handle to be in a straight line with the unchanged handle.

Locking Handles

For any vertex, there are two bezier handles that are used to set the tangency. By selecting the **Lock Handles** check box in the **Selection** rollout and selecting the **Alike** radio button, you can simultaneously transform all similar bezier handles (all lead-in handles or all lead-out handles) for the selected vertices. When the **All** radio button is active, you can simultaneously move both handles for all the selected vertices. In this section, you will explore the use of the **Lock Handles** check box and the radio buttons discussed above.

1. Choose **Edit > Fetch** from the menu bar; the **About to Fetch. OK?** message box is displayed.

2. Choose the **Yes** button in this message box; the original shape of the rectangle is restored.

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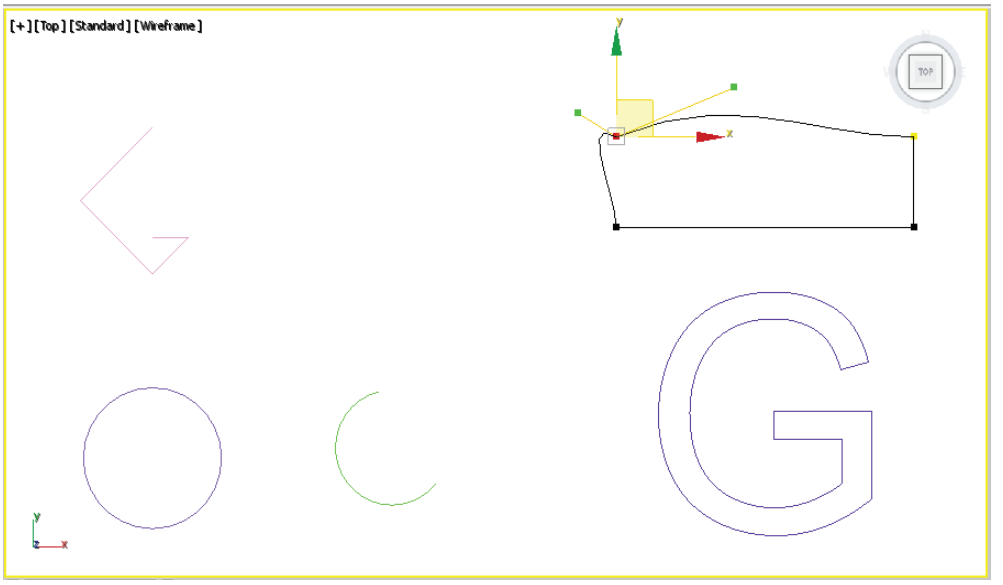

Figure 4-9 *Curved line segments of the spline*

3. Select the rectangle and apply the **Edit Spline** modifier, as discussed earlier.

4. Choose the **Vertex** button in the **Selection** rollout and select all the vertices in the shape by dragging a selection window around the rectangle; the bezier handles are displayed on all the vertices.

5. In the **Selection** rollout, clear the **Lock Handles** check box if it is selected.

6. Invoke the **Select and Move** tool. Next, select the lower handle of the top-left vertex. Now, drag it to left; only the selected handle is affected and only the segment connected to it changes, as shown in Figure 4-10.

7. Choose the **Undo** button to reverse the changes. In the **Selection** rollout, select the **Lock Handles** check box. Also, make sure the **Alike** radio button is selected. Select all vertices in the rectangle in the viewport.

8. Select the lower handle of the top-left corner vertex and drag it to left; the selected handle and all other lead-in handles for the selected vertices are affected, and all segments connected to them are changed, as shown in Figure 4-11.

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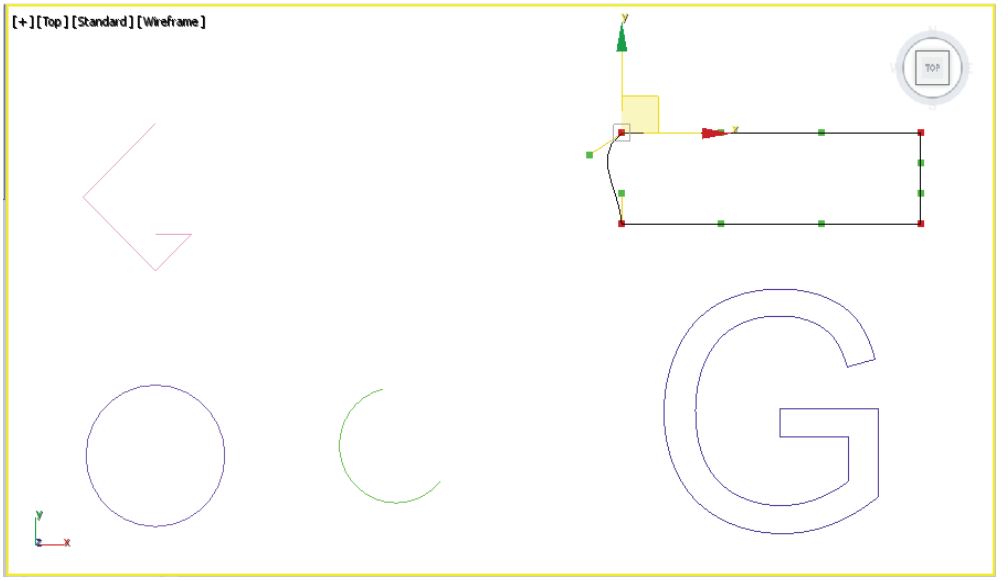

Figure 4-10 *Adjusting the bezier handles*

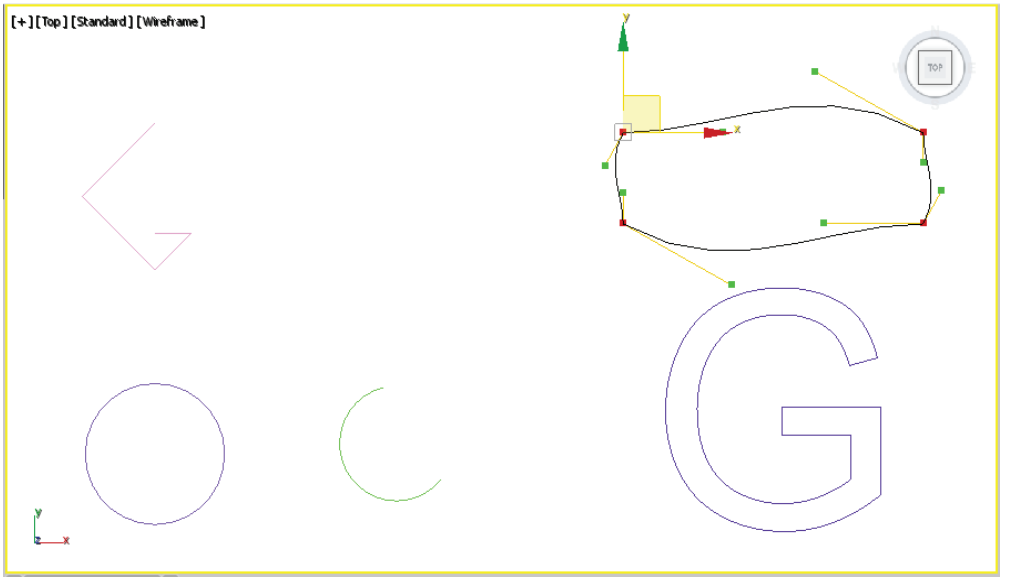

Figure 4-11 *All similar bezier handles affected by the* ***Lock Handles*** *check box and the* ***Alike*** *radio button*

9. Press CTRL + Z to reverse the changes. In the **Selection** rollout, select the **All** radio button.

10. Select the lower handle of the top-left corner vertex and drag it to left. Release the left mouse button; all the handles are affected and all the segments are changed, refer to Figure 4-12.

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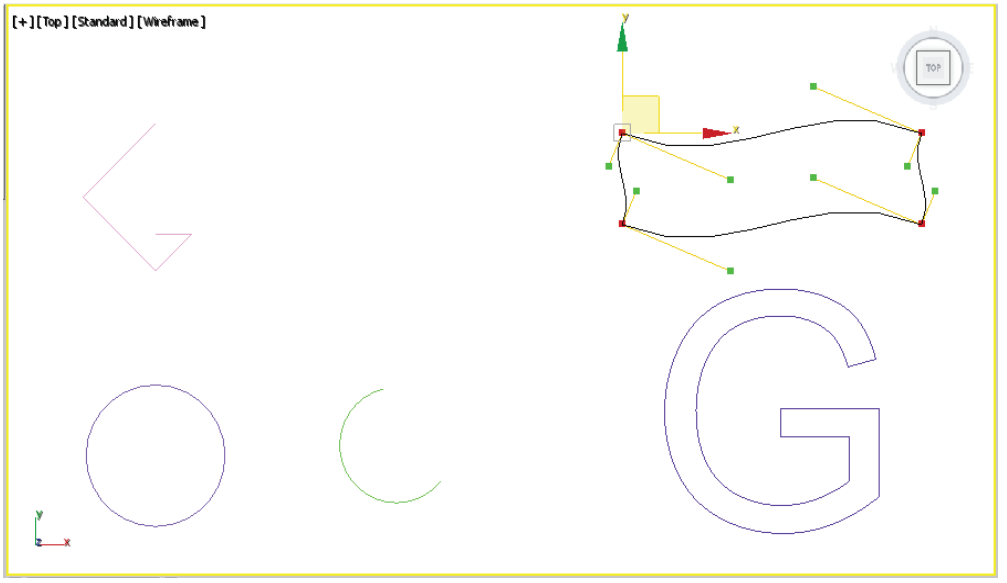

*Figure 4-12 All bezier handles affected on selecting the **All** radio button*

Creating and Modifying Splines

In this section, you will create some more splines and modify them using options in the rollouts.

1. Choose **File > New > New All** from the **File** menu; the **Autodesk 3ds Max 2021** message box is displayed, as shown in Figure 4-13. Choose the **Don't Save** button; all shapes are removed and a blank screen is displayed. But the viewport layout, which contains maximized Top viewport, is retained.

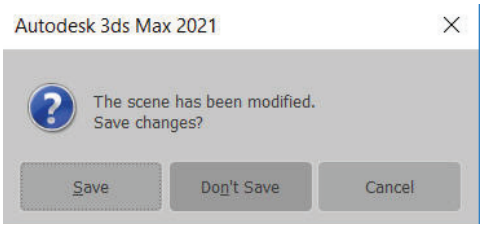

*Figure 4-13 The **Autodesk 3ds Max 2021** message box*

2. Choose **Create > Shapes** in the **Command Panel**. Next, invoke the **Ellipse** tool from the **Object Type** rollout. Create an ellipse in the Top viewport.

3. Invoke the **Rectangle** tool from the **Object Type** rollout. Press and hold the CTRL key and draw a square, as shown in Figure 4-14.

4. Invoke the **Select Object** tool, press and hold the CTRL key, and select the ellipse and square.

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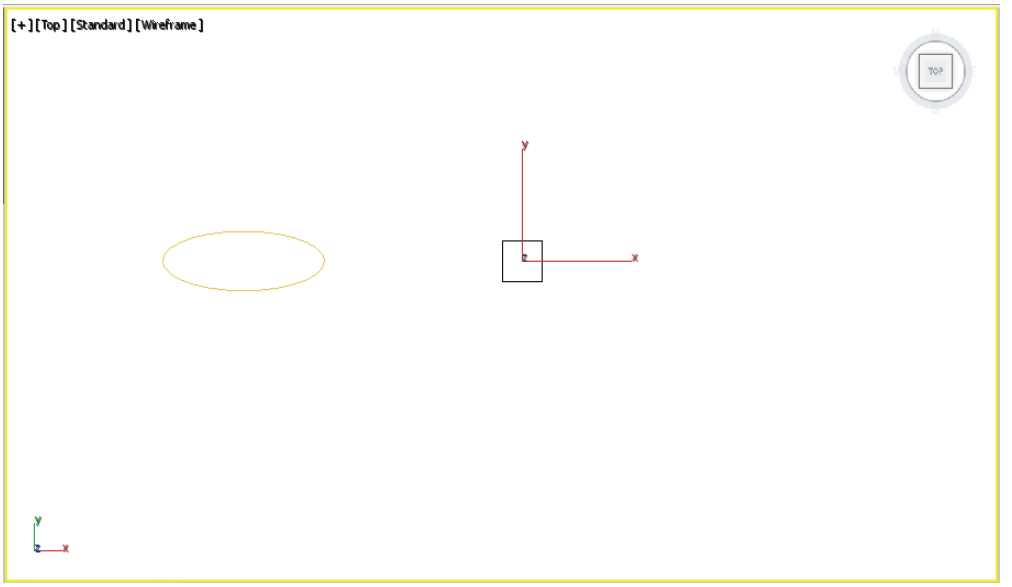

Figure 4-14 *The ellipse and square created in the Top viewport*

5. Choose the **Modify** tab in the **Command Panel**. Select **Edit Spline** from the **OBJECT-SPACE MODIFIERS** section in the **Modifier List** drop-down list; the **Edit Spline** modifier is applied to both shapes.

6. Choose the **Segment** button in the **Selection** rollout.

7. Select the lower-right segment of the ellipse. Press and hold the CTRL key and select the left and lower side of the square as well; all three segments turn red indicating that they are selected.

8. Choose the **Delete** button in the **Geometry** rollout or press the DELETE key; the selected segments are deleted from the shapes and the ellipse and the square become two open splines, as shown in Figure 4-15.

9. Choose the **Spline** button in the **Selection** rollout.

10. Click anywhere on the remaining portion of the square; the spline turns red indicating selection. Notice that the ellipse is not selected.

11. Choose the **Close** button in the **Geometry** rollout; the end vertices of the two remaining segments are joined by a curved segment and the spline is closed, as shown in Figure 4-16.

12. Choose the **Undo** button to reverse the changes. Next, choose the **Vertex** button in the **Selection** rollout.

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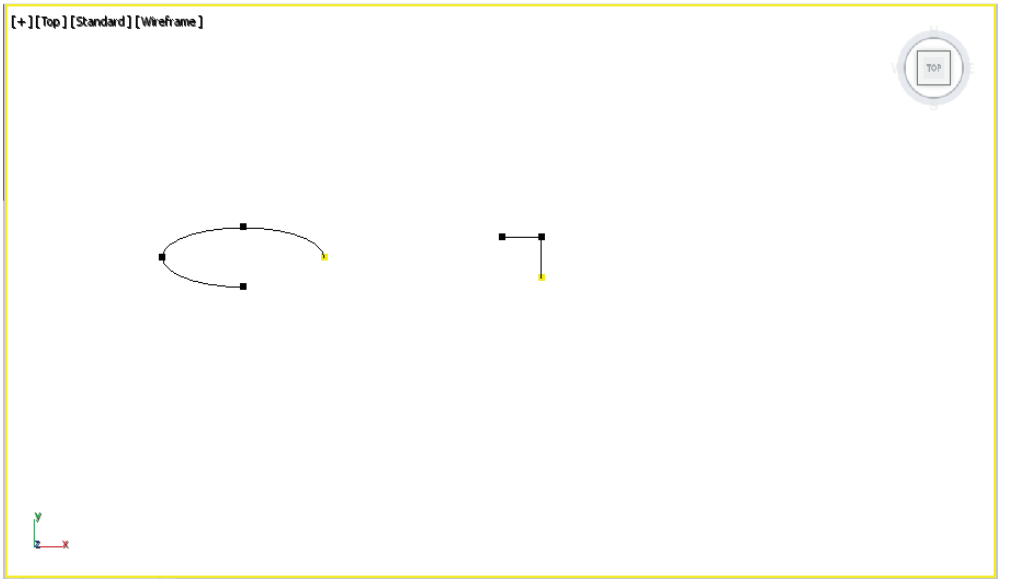

Figure 4-15 *Selected segments deleted from the shapes*

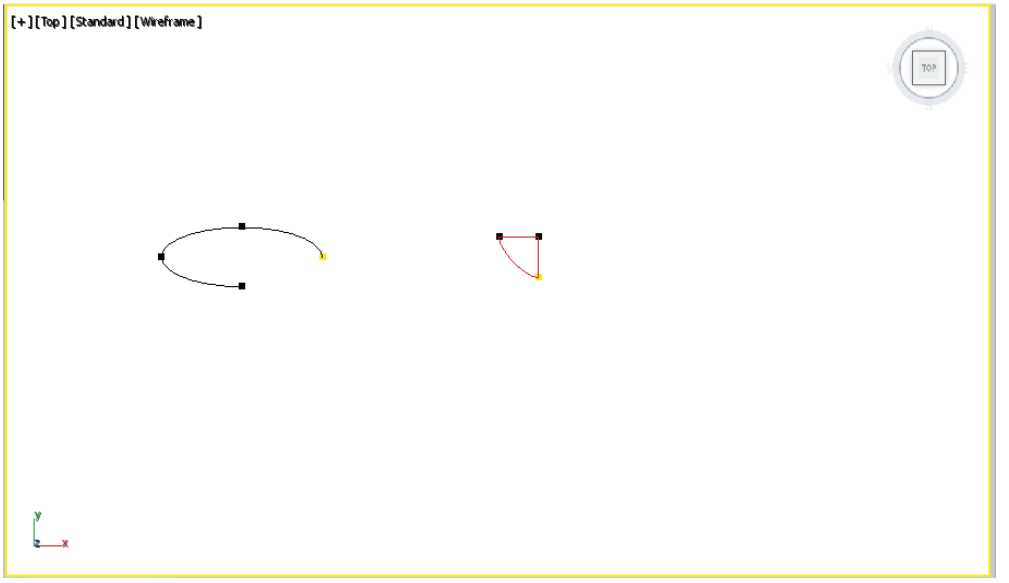

Figure 4-16 *The closed spline*

13. Choose the **Connect** button in the **Geometry** rollout. Next, select the end vertex of the square segment and then drag the cursor toward the other end vertex. When you move the cursor over the other end vertex, the cursor icon gets changed. Also, a dashed line is attached to the cursor while dragging, as shown in Figure 4-17.

14. Release the mouse button; the two vertices are joined by a straight segment, as shown in Figure 4-18.

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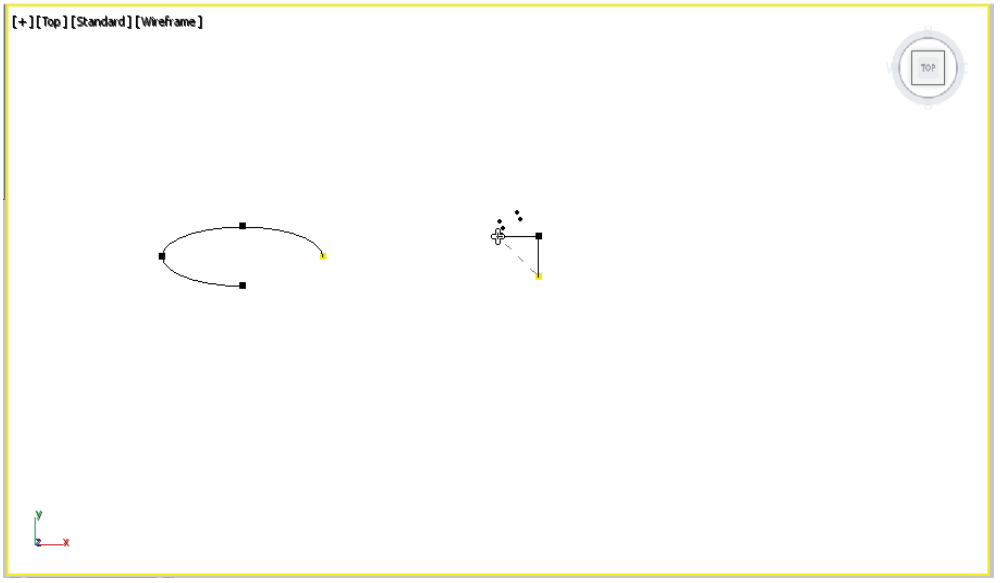

Figure 4-17 *A dashed line attached to the end vertices*

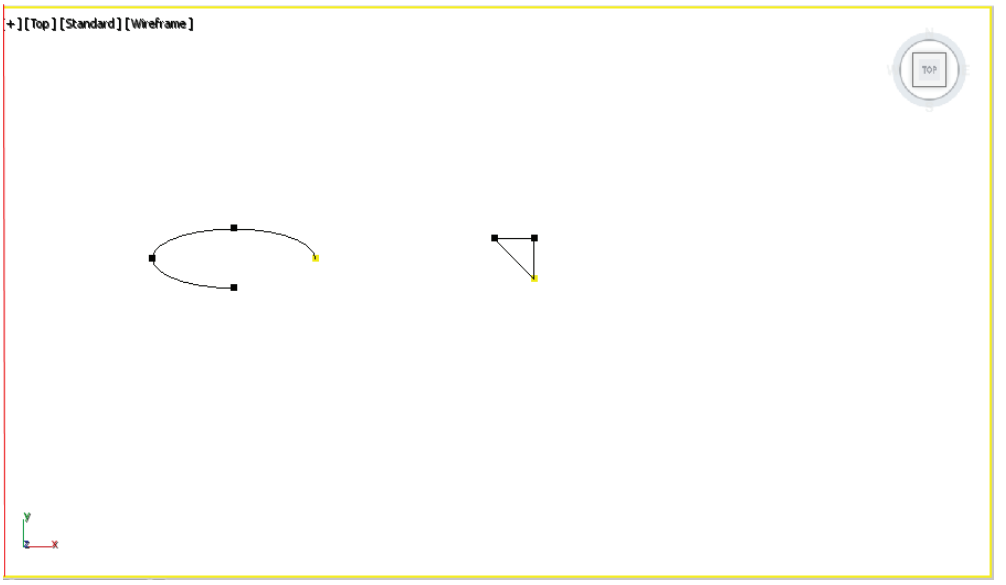

Figure 4-18 *The two vertices joined by a straight segment*

15. Choose the **Undo** button to reverse the changes. Next, choose the **Insert** button in the **Geometry** rollout.

16. Move the cursor and place it near the middle of the top segment of the remaining square; the cursor icon changes.

17. Click anywhere in the top segment to insert the vertex and then move the cursor down. Click again to position the vertex.

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18. Move the cursor to the left and click to place another vertex, refer to Figure 4-19. Right-click to complete the command.

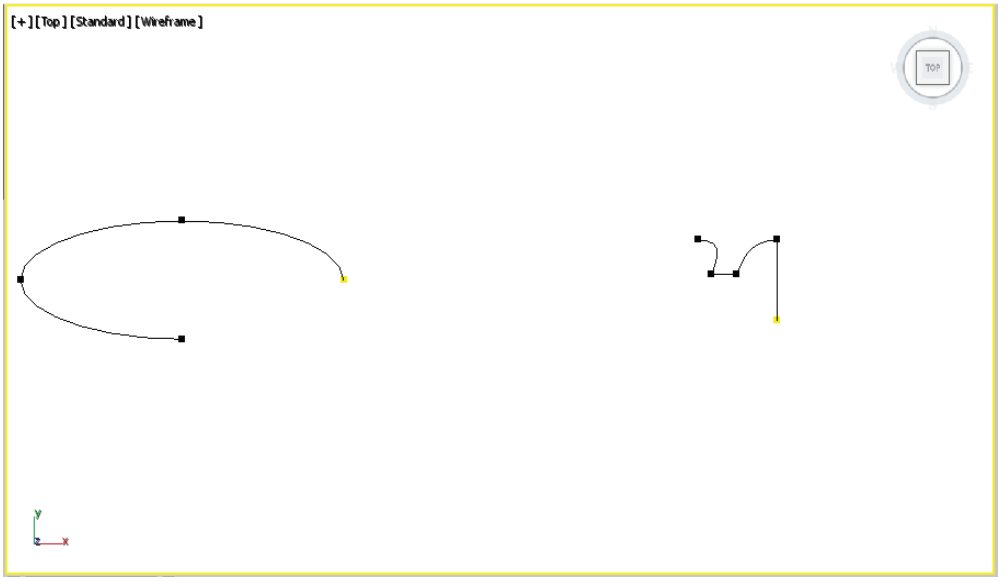

Figure 4-19 *New vertices added to the segment*

19. Choose the **Undo** button to reverse the changes. Next, invoke the **Select Object** tool and select the white colored end vertex. The direction of the spline runs from the first vertex to the last vertex. The first vertex is yellow in color.

20. Choose the **Make First** button in the **Geometry** rollout; the selected vertex becomes yellow in color indicating that now it is the first vertex. Since the vertex is selected, it is red in color.

21. Choose the **Insert** button in the **Geometry** rollout. Next, move the cursor and place it near the middle of the top segment of the remaining portion of the square; the cursor icon changes.

22. Click to place the vertex and then move it down. Click again to position the vertex.

23. Move the cursor to the right and click again to place another vertex. Right-click to complete the command.

    As the direction of the spline has changed, the resulting shape is different from the one created previously by adding vertices, refer to Figure 4-20.

    Next, you will work with transform centers. There are three types of transform centers: pivot point, selection, and transform coordinate. The effect on objects due to rotation and scale transforms differs depending on the type of transform center selected.

24. Choose **File > New > New All** from the **File** menu; the **Autodesk 3ds Max 2021** message box is displayed. Choose the **Don't Save** button; all shapes are removed.

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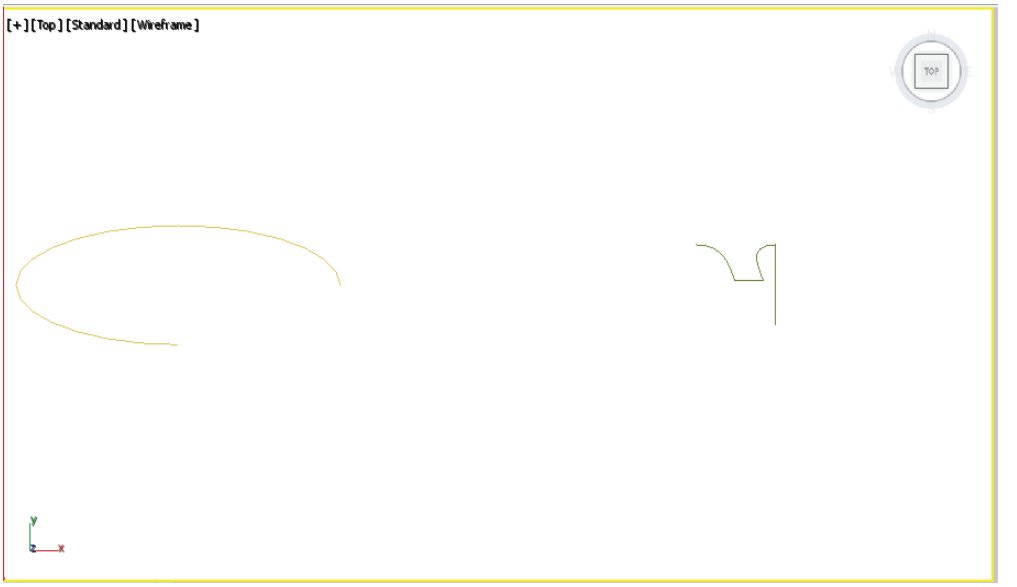

Figure 4-20 *The resulting shape created after changing the direction of the spline*

25. Invoke the **Zoom Extents** tool. Next, choose **Create > Shapes** in the **Command Panel**. Next, invoke the **Rectangle** tool. Draw a small rectangle near the upper-left corner of the Top viewport.

26. Invoke the **Ellipse** tool and draw a small ellipse close to the rectangle, as shown in Figure 4-21.

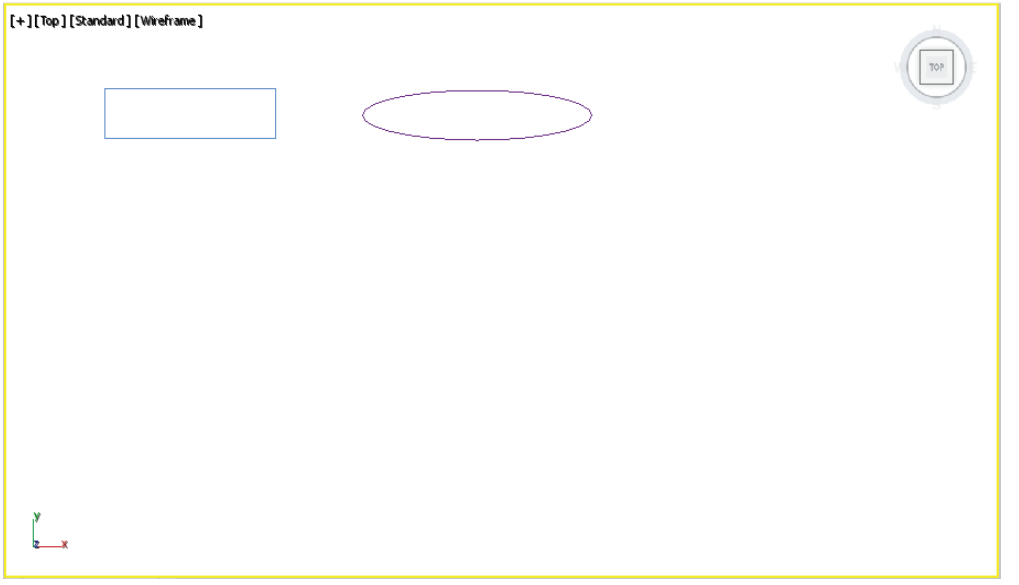

Figure 4-21 *A rectangle and an ellipse created*

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27. Choose **Edit > Hold** from the menu bar to copy the current state to a buffer. This can be retrieved later using the **Fetch** option.

28. Make sure the **Snaps Toggle** tool is turned off. Next, invoke the **Select and Rotate** tool and make sure the **Transform Gizmo Z Constraint** button is chosen.

29. Make sure the ellipse is selected and then invoke the **Angle Snap Toggle** tool to turn the angle snap on.

    The **Use Pivot Point Center** tool in the **Main Toolbar** is invoked by default.

30. Rotate the ellipse until 0.00, 0.00, 90.0 is displayed in the coordinate display; the ellipse is rotated about its pivot point which is at the center of the ellipse, as shown in Figure 4-22.

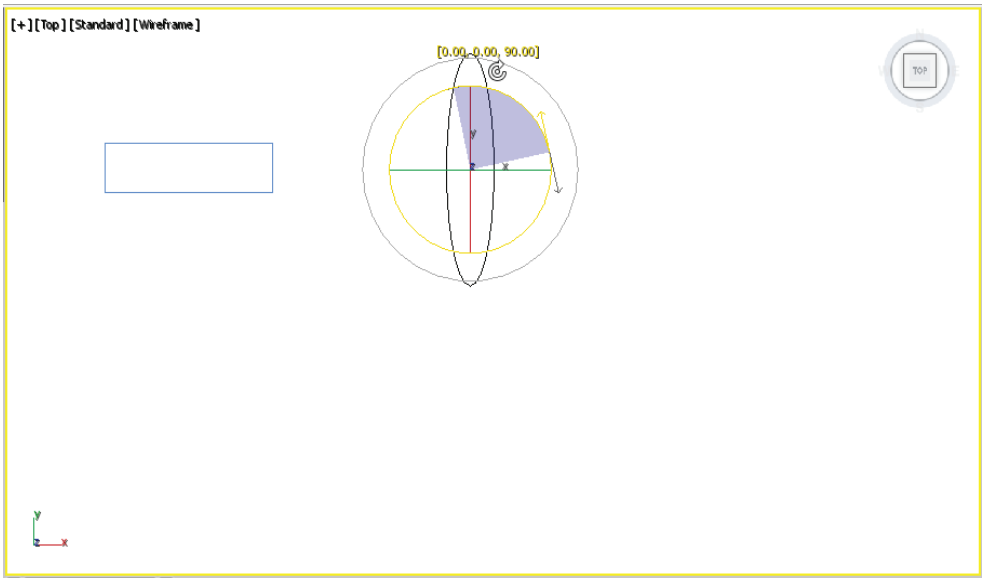

Figure 4-22 *The ellipse rotated to 90 degrees*

31. Invoke the **Select and Uniform Scale** tool from the **Main Toolbar** and make sure the **Transform Gizmo XY Plane Constraint** button is chosen in the **Axis Constraints** toolbar. Select the rectangle and scale it until 50, 50, 50 is shown in the coordinate display; the rectangle is scaled about its pivot point which is at the center of the rectangle, as shown in Figure 4-23.

32. Choose **Edit > Fetch** from the menu bar to retrieve the original drawing; the **About to Fetch. OK** message box is displayed. Choose the **Yes** button in this dialog box; the original shape of the rectangle and the ellipse is restored.

33. Invoke the **Select and Rotate** tool and make sure the **Transform Gizmo Z Constraint** button is chosen. Make sure the **Snaps Toggle** tool is deactivated and the **Angle Snap Toggle** tool is invoked.

Evaluation Copy. Do not reproduce. For information visit www.cadcim.com

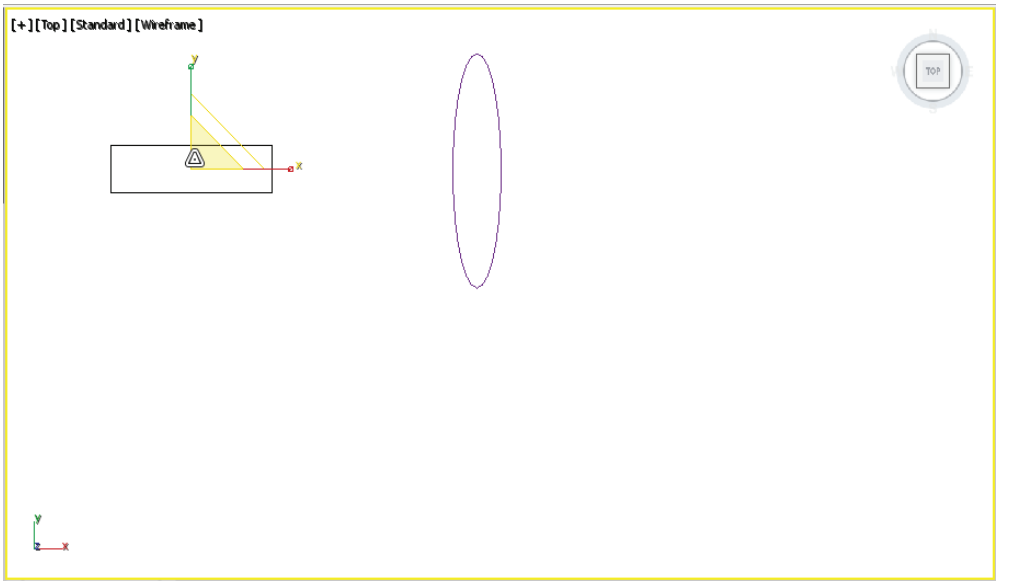

Figure 4-23 *The rectangle scaled to its pivot point*

34. Use the CTRL key to select both the ellipse and the rectangle. Make sure the **Use selection Center** tool is invoked in the **Use Pivot Point Center** flyout of the **Main Toolbar** which shows the transform gizmo at the center point of the combined selection.

35. Rotate both objects until 0.00, 0.00, 40.00 is shown in the coordinate display and in the viewport display; the objects are rotated about their combined center point, as shown in Figure 4-24.

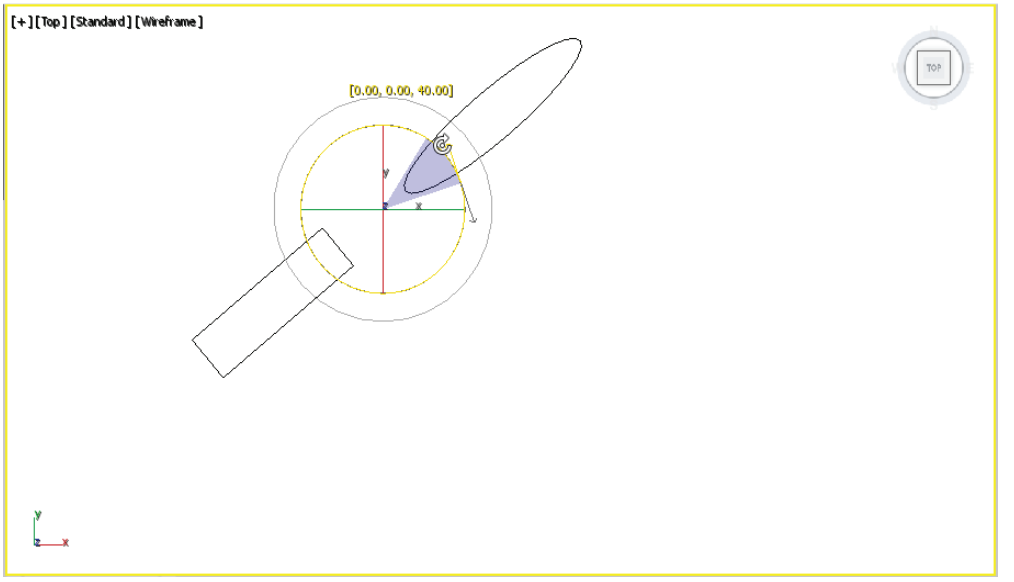

Figure 4-24 *Both objects rotated around the center of their combined center point*

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36. Restore the original drawing by choosing the **Undo** button. Make sure the **Select and Rotate** tool is invoked in the **Main Toolbar**.

37. Select only the ellipse. Next, invoke the **Use Transform Coordinate Center** tool from the **Use Selection Center** flyout. Also, select **World** from the **Reference Coordinate System** drop-down list located next to the **Select and Place** tool. Note that the axis tripod moves to the world origin, which is probably near the center of the viewport.

38. Make sure that the **Angle Snap Toggle** tool is invoked in the **Main Toolbar** and then rotate the ellipse until 0.00, 0.00, -90.00 is shown in the coordinate display; the ellipse is rotated with respect to the origin of the world space, as shown in Figure 4-25.

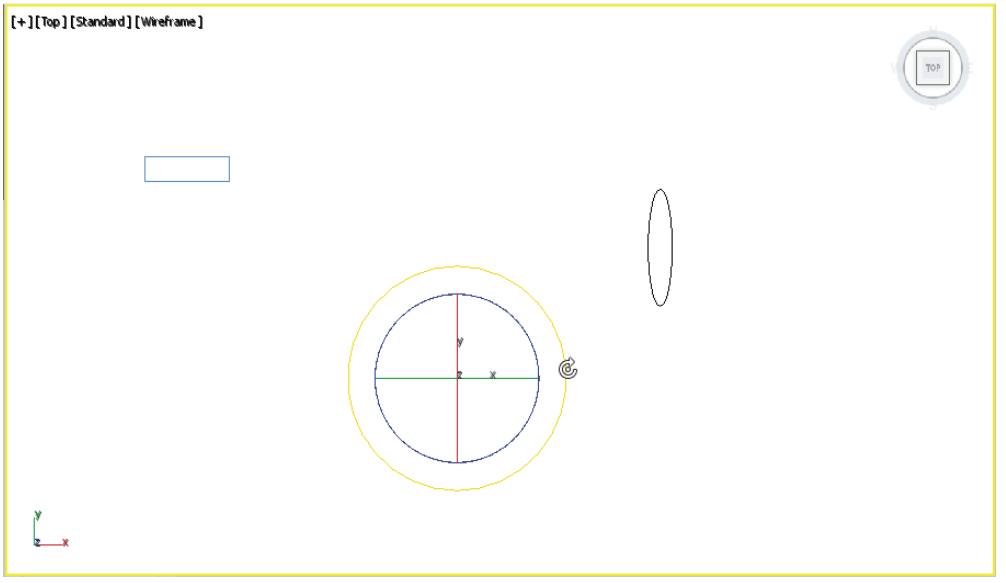

Figure 4-25 *The rotated ellipse after selecting* ***World*** *from the* ***Reference Coordinate System*** *drop-down list*

Copying an Object

In this section, you will use the SHIFT key with the transform commands to make a copy of the original object.

1. Choose **File > New > New All** from the **File** menu; the **Autodesk 3ds Max 2021** message box is displayed. Choose the **Don't Save** button; all the shapes are removed and a blank Top viewport is displayed.

2. Choose **Create > Shapes** in the **Command Panel**. Next, invoke the **Rectangle** tool from the **Object Type** rollout. Expand the **Keyboard Entry** rollout and set the values as given next:

   Length: **100** Width: **100**

   Choose the **Create** button; a square is created in the center of the Top viewport.

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3. Invoke the **Select and Rotate** tool and make sure the **Transform Gizmo Z Constraint** button is chosen. Select **View** from the **Reference Coordinate System** drop-down list if it is not already selected. Make sure the **Use Pivot Point Center** tool is also invoked. Also, ensure that the snap is turned off and the **Angle Snap Toggle** tool is invoked.

4. Press and hold the SHIFT key and make sure the square is selected and then rotate it, as shown in Figure 4-26. Next, release the mouse button and the SHIFT key when the square is rotated about 45 degrees; the **Clone Options** dialog box is displayed. Notice that the original square remains at its position, while its copy is rotated about its pivot point.

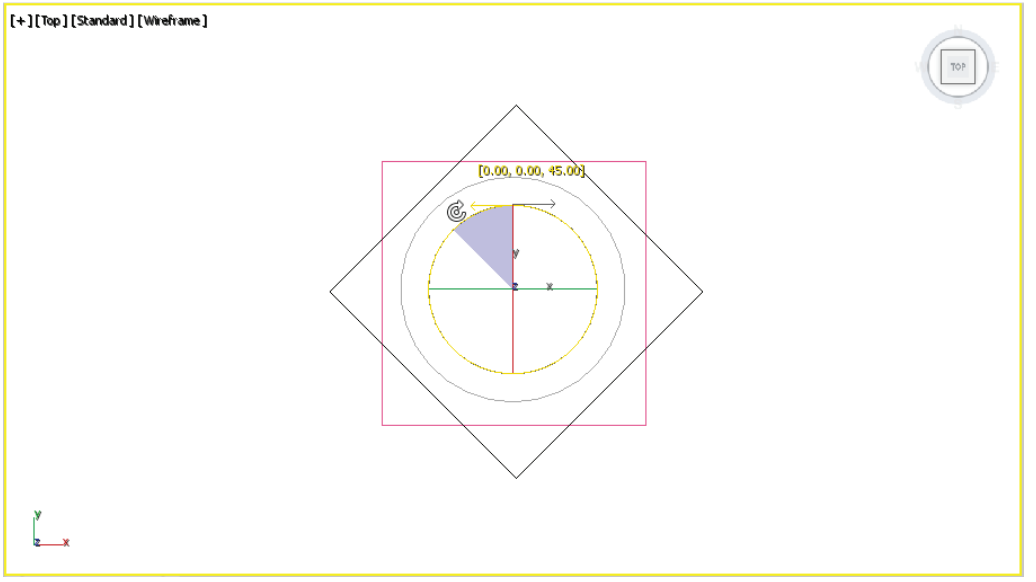

Figure 4-26 *Rotating the square at an angle of 45 degrees*

5. Make sure that the **Copy** radio button is selected in the **Object** area of the **Clone Options** dialog box. Choose the **OK** button in the dialog box; a copy of the square rotated at an angle of 45 degrees is created, as shown in Figure 4-27.

6. Invoke the **Select and Uniform Scale** tool from the **Main Toolbar**. Next, press and hold the left mouse button and the SHIFT key. Now, select the original square and scale it up to 50 percent of its original size and release the left mouse button and the SHIFT key; the **Clone Options** dialog box is displayed.

7. Choose the **OK** button in the **Clone Options** dialog box; a copy of the square scaled down to half of its original size is created inside the two overlapping squares.

8. Select the first square that you cloned, press and hold the SHIFT key, and scale the square to 50 percent of its original size. Choose **OK** in the **Clone Options** dialog box; a copy of the rotated square, scaled down to half its size, is created, as shown in Figure 4-28.

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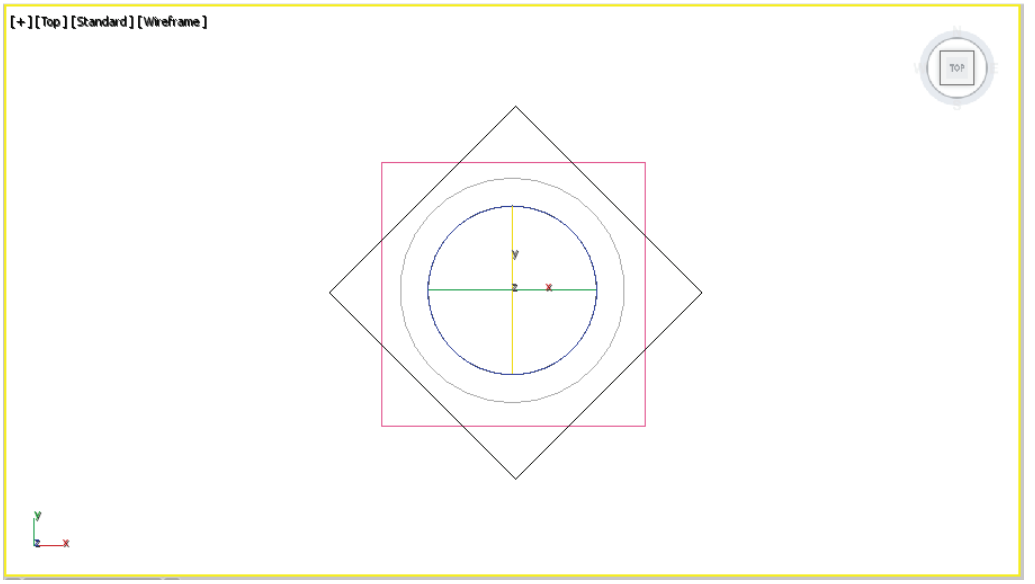

Figure 4-27 *A copy of the square created by rotating it at 45 degrees*

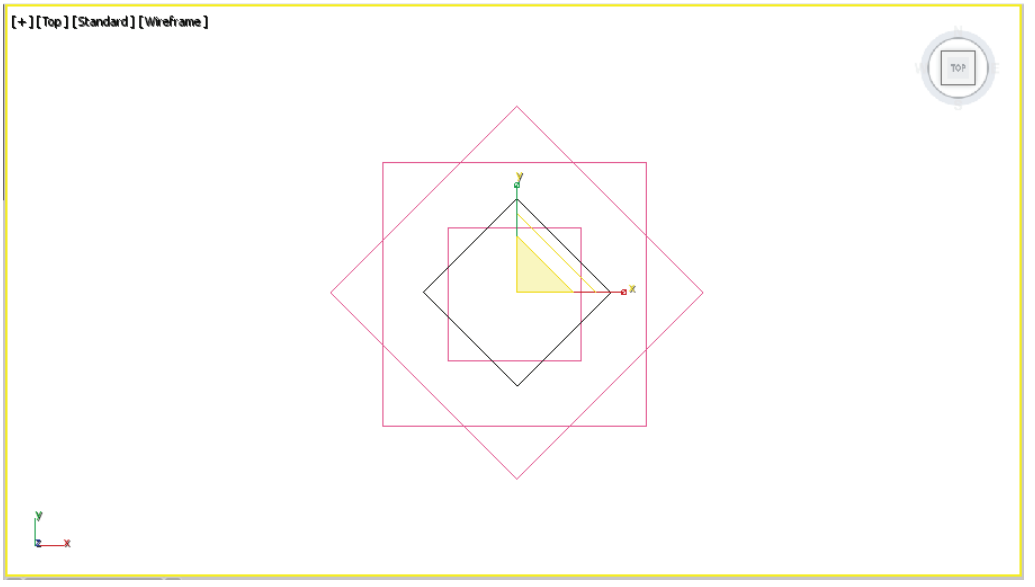

Figure 4-28 *Both squares copied and scaled down to 50 percent of their original size*

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Tutorial 2

In this tutorial, you will create model of a table lamp using splines, as shown in Figure 4-29.

(Expected time: 25 min)

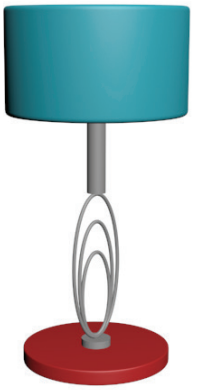

Figure 4-29 *The model of a lamp*

The following steps are required to complete this tutorial:

a. Create the project folder.
b. Create base of the table lamp.
c. Create body of the table lamp.
d. Create shade and wire of the table lamp.
e. Save and render the scene.

Creating the Project Folder

Create a project folder with the name *c04_tut2* in the *3dsmax 2021* folder as discussed in Tutorial 1 of Chapter 2.

Creating Base of the Table Lamp

In this section, you will create base of the table lamp using the **Circle** tool and the **Chamfer** modifier.

1. Activate the Top viewport and then choose **Create > Shapes** in the **Command Panel**; the **Splines** option is displayed in the drop-down list located below it. Next, invoke the **Circle** tool from the **Object Type** rollout.

2. Expand the **Keyboard Entry** rollout and set the value **10** in the **Radius** spinner. Next, expand the **Interpolation** rollout and set the value **16** in the **Steps** spinner. Now, choose the **Create** button in the **Keyboard Entry** rollout; a circle is created in all viewports.

3. Enter **base** in the **Name and Color** rollout. Invoke the **Zoom Extents All** tool; *base* is zoomed in all viewports, as shown in Figure 4-30.

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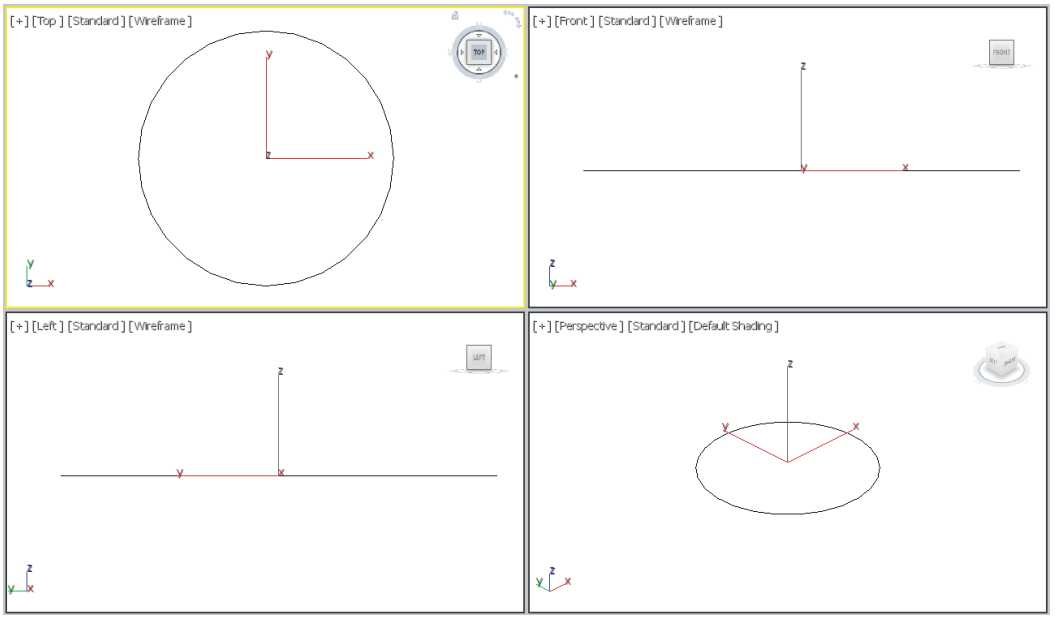

Figure 4-30 *The base zoomed in all viewports*

4. Choose the **Modify** tab in the **Command Panel**. Next, select the **Extrude** option from the **OBJECT-SPACE MODIFIERS** section in the **Modifier List** drop-down list; the **Extrude** modifier is applied to *base* and displayed in the modifier stack. Also, various rollouts of this modifier are displayed in the **Command Panel**.

5. In the **Parameters** rollout, set the value **2** in the **Amount** spinner and **4** in the **Segments** spinner. Next, press the ENTER key; *base* is extruded, as shown in Figure 4-31.

6. Activate the Perspective viewport and press F4. Notice that edges of *base* are now visible in the Perspective viewport.

7. Make sure the **Modify** tab is chosen and then select the **Chamfer** modifier from the **OBJECT-SPACE MODIFIERS** section in the **Modifier List** drop-down list; the **Chamfer** modifier is displayed in the modifier stack and the **Parameters** rollout is displayed in the **Command Panel**.

8. In the **Chamfer Options** area of the **Parameters** rollout, set **0.2** in the **Amounts** spinner and **2** in the **Segments** spinner; *base* is smoothened, as shown in Figure 4-32.

Creating Body of the Table Lamp

In this section, you will create body of the table lamp using the **Ellipse** and **Circle** tools.

1. Activate the Top viewport and then choose **Create > Shapes** in the **Command Panel**; the **Splines** option is displayed in the drop-down list located below it. Next, invoke the **Circle** tool from the **Object Type** rollout.

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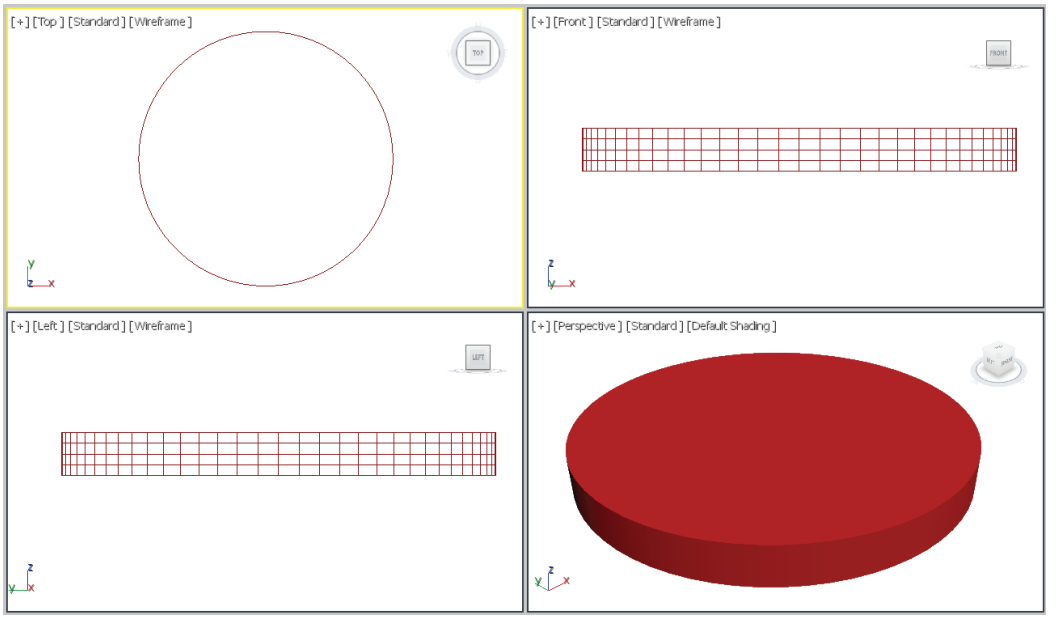

Figure 4-31 *The base zoomed in all viewports*

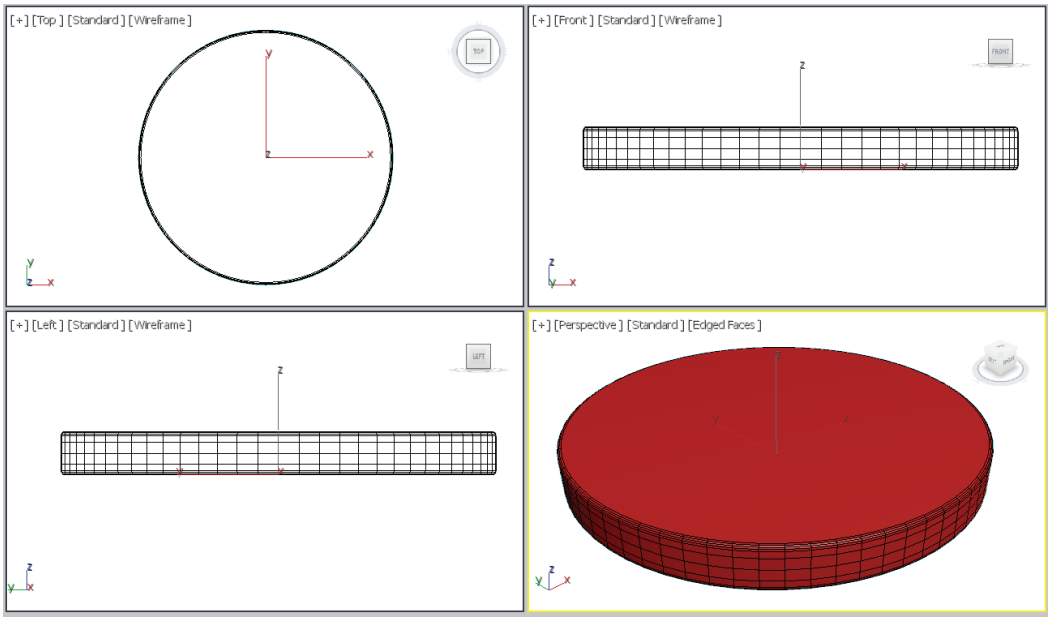

Figure 4-32 *The base smoothened*

2. Expand the **Keyboard Entry** rollout and set the value **2** in the **Radius** spinner. Next, expand the **Interpolation** rollout and make sure **16** is displayed in the **Steps** spinner. Now, choose the **Create** button in the **Keyboard Entry** rollout; a circle is created in all viewports with the name *Circle001*.

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3. Choose the **Modify** tab in the **Command Panel**. Next, select the **Extrude** option from the **OBJECT-SPACE-MODIFIERS** section in the **Modifier List** drop-down list; the **Extrude** modifier is applied to *Circle001* and displayed in the modifier stack. Also, various rollouts of this modifier are displayed in the **Command Panel**.

4. In the **Parameters** rollout, set the value **1** in the **Amount** spinner and make sure **4** is displayed in the **Segments** spinner. Next, press the ENTER key; *Circle001* is extruded.

5. Activate the Front viewport. Next, choose the **Select and Move** tool from the **Main Toolbar** and move *Circle001*, as shown in Figure 4-33.

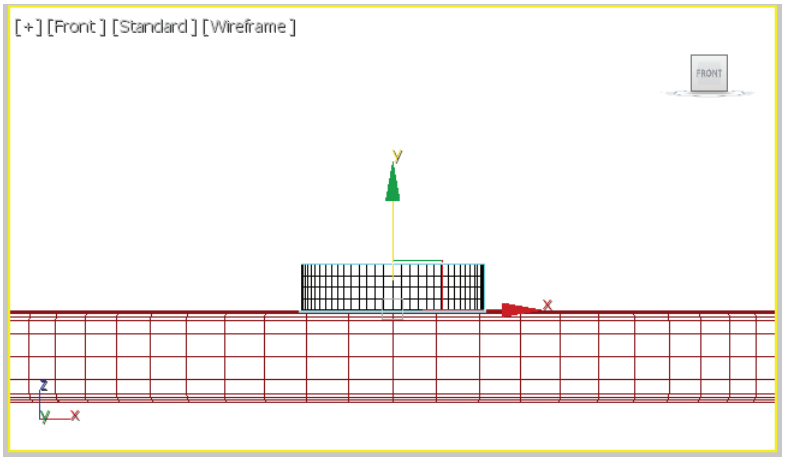

Figure 4-33 *The Circle001 object moved*

6. Make sure the Front viewport is activated. Next, choose **Create > Shapes** in the **Command Panel**; the **Splines** option is displayed in the drop-down list located below it. Next, invoke the **Ellipse** tool from the **Object Type** rollout.

7. Expand the **Keyboard Entry** rollout and set the value **12** in the **Length** spinner and **5** in the **Width** spinner. Next, expand the **Interpolation** rollout and make sure **16** is displayed in the **Steps** spinner. Now, choose the **Create** button in the **Keyboard Entry** rollout; an ellipse is created in all viewports with the name *Ellipse001*.

8. Expand the **Rendering** rollout and select the **Enable in Renderer** and **Enable in Viewport** check boxes. Also, make sure that the **Radial** radio button is selected and set the value **0.5** in the **Thickness** spinner.

9. Align *Ellipse001* on the top of *Circle001*, as shown in Figure 4-34.

10. Make sure *Ellipse001* is selected. Next, press and hold the SHIFT key and drag the cursor in the Y direction. Now, release the left mouse button; the **Clone Options** dialog box is displayed. In this dialog box, make sure the **Copy** radio button is selected. Also, set the value in the **Number of Copies** spinner to **2** and then choose the **OK** button; the copies of *Ellipse001* are created with the names *Ellipse002* and *Ellipse003*.

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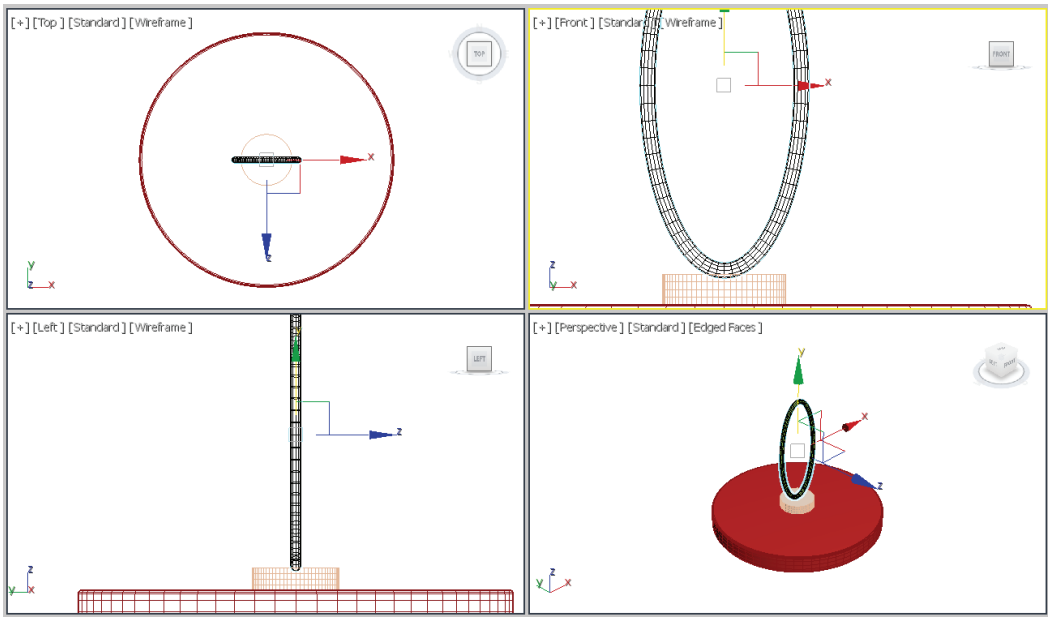

Figure 4-34 *Ellipse001 aligned*

11. Select *Ellipse002*. Make sure the **Modify** tab is chosen in the **Command Panel**. In the **Parameters** rollout, set the value **16** in the **Length** spinner and **6** in the **Width** spinner.

12. Select *Ellipse003*. Make sure the **Modify** tab is chosen in the **Command Panel**. In the **Parameters** rollout, set the value **20** in the **Length** spinner and **8** in the **Width** spinner.

13. Align *Ellipse002* and *Ellipse003* in all viewports, as shown in Figure 4-35.

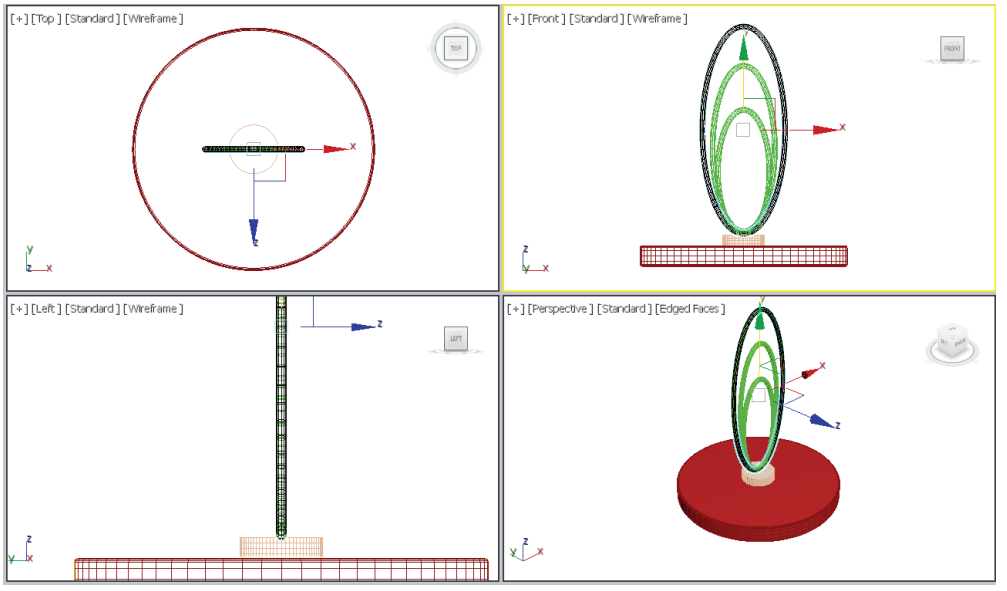

Figure 4-35 *Ellipse002 and Ellipse003 aligned*

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14. Activate the Top viewport and then choose **Create > Shapes** in the **Command Panel**; the **Splines** option is displayed in the drop-down list located below it. Next, invoke the **Circle** tool from the **Object Type** rollout.

15. Expand the **Keyboard Entry** rollout and set the value **1.25** in the **Radius** spinner. Next, expand the **Interpolation** rollout and make sure **16** is displayed in the **Steps** spinner. Now, choose the **Create** button in the **Keyboard Entry** rollout; a circle is created in all viewports. with the name *Circle002*.

16. Choose the **Modify** tab in the **Command Panel**. Next, select the **Extrude** option from the **OBJECT-SPACE MODIFIERS** section in the **Modifier List** drop-down list; the **Extrude** modifier is applied to *Circle002* and displayed in the modifier stack. Also, various rollouts of this modifier are displayed in the **Command Panel**.

17. In the **Parameters** rollout, set the value **12** in the **Amount** spinner and make sure **4** is displayed in the **Segments** spinner. Next, press the ENTER key; *Circle002* is extruded.

18. Activate the Front viewport. Next, choose the **Select and Move** tool from the **Main Toolbar** and align *Circle002*, as shown in Figure 4-36.

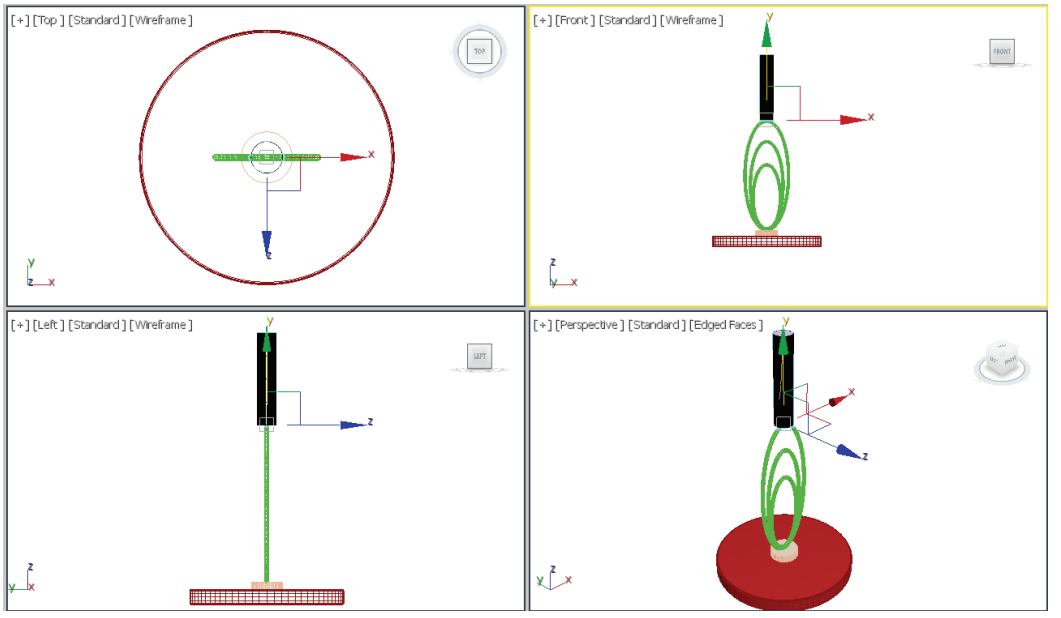

Figure 4-36 *Circle002 aligned*

Next, you need to select all the objects excluding *base* and create a group.

19. Select *Circle001, Circle002, Ellipse001, Ellipse002, and Ellipse003* using the CTRL key. Next, choose **Group > Group** from the menu bar; the **Group** dialog box is displayed. Enter **body** in the **Group name** edit box and choose the **OK** button to close the dialog box.

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20. Make sure that the group *body* is selected. Change the color of *body* to grey or black by using the color swatch in the **Name and Color** rollout of the **Command Panel**.

Creating Shade of the Table Lamp

In this section, you will create shade using the **Circle** tool.

1. Activate the Top viewport and then choose **Create > Shapes** in the **Command Panel**; the **Splines** option is displayed in the drop-down list located below it. Next, invoke the **Circle** tool from the **Object Type** rollout.

2. Expand the **Keyboard Entry** rollout and set the value **12** in the **Radius** spinner. Next, expand the **Interpolation** rollout and make sure **16** is displayed in the **Steps** spinner. Now, choose the **Create** button in the **Keyboard Entry** rollout; a circle is created in all viewports. with the name *Circle003*.

3. Enter **shade** in the **Name and Color** rollout to rename it.

4. Choose the **Modify** tab in the **Command Panel**. Next, select the **Extrude** option from the **OBJECT-SPACE MODIFIERS** section in the **Modifier List** drop-down list; the **Extrude** modifier is applied to *shade* and displayed in the modifier stack. Also, various rollouts of this modifier are displayed in the **Command Panel**.

5. In the **Parameters** rollout, set the value **14** in the **Amount** spinner and **4** in the **Segments** spinner. Next, press the ENTER key; *shade* is extruded.

6. Activate the Front viewport. Next, choose the **Select and Move** tool from the **Main Toolbar** and align *shade*, as shown in Figure 4-37.

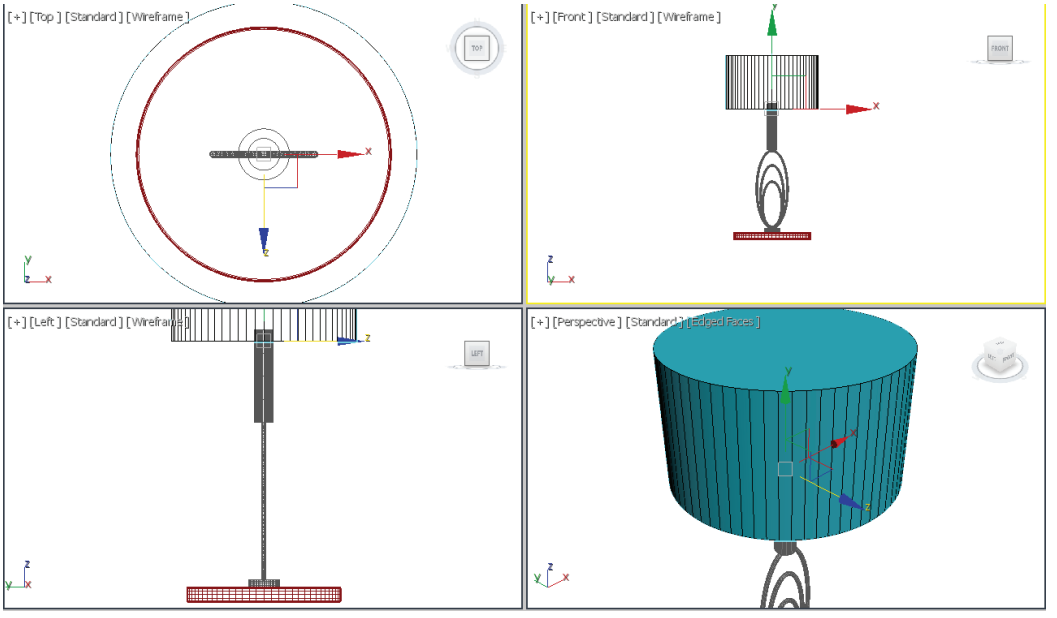

Figure 4-37 *The shade object aligned*

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7. Make sure the **Modify** tab is chosen and then select the **Chamfer** modifier from the **OBJECT-SPACE MODIFIERS** section in the **Modifier List** drop-down list; the **Chamfer** modifier is displayed in the modifier stack and the **Parameters** rollout is displayed in the **Command Panel**.

8. In the **Chamfer Options** area of the **Parameters** rollout, set **0.65** in the **Amounts** spinner and **2** in the **Segments** spinner; *shade* is smoothened, as shown in Figure 4-38.

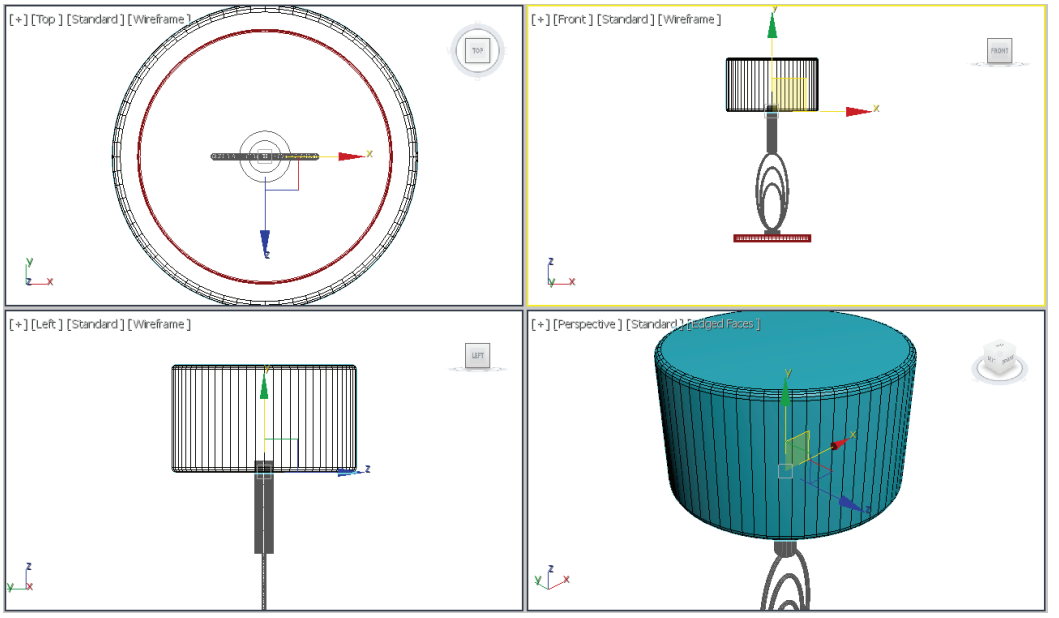

Figure 4-38 *The shade object smoothened*

9. Make sure the **Modify** tab is chosen and then select the **Edit Poly** modifier from the **OBJECT-SPACE MODIFIERS** section in the **Modifier List** drop-down list; the **Edit Poly** modifier is displayed in the modifier stack and various rollouts are displayed in the **Command Panel**.

10. In the modifier stack, click on the arrow sign on the left of the **Edit Poly** modifier to view all the sub-object levels and then select the **Polygon** sub-object level.

    Next, you will activate the Bottom viewport.

11. Click on the POV viewport label in the Top viewport; a flyout is displayed. Choose the **Bottom** option; the Top viewport is switched to the Bottom viewport. Now, select the polygon in the Bottom viewport and delete it, refer to Figure 4-39.

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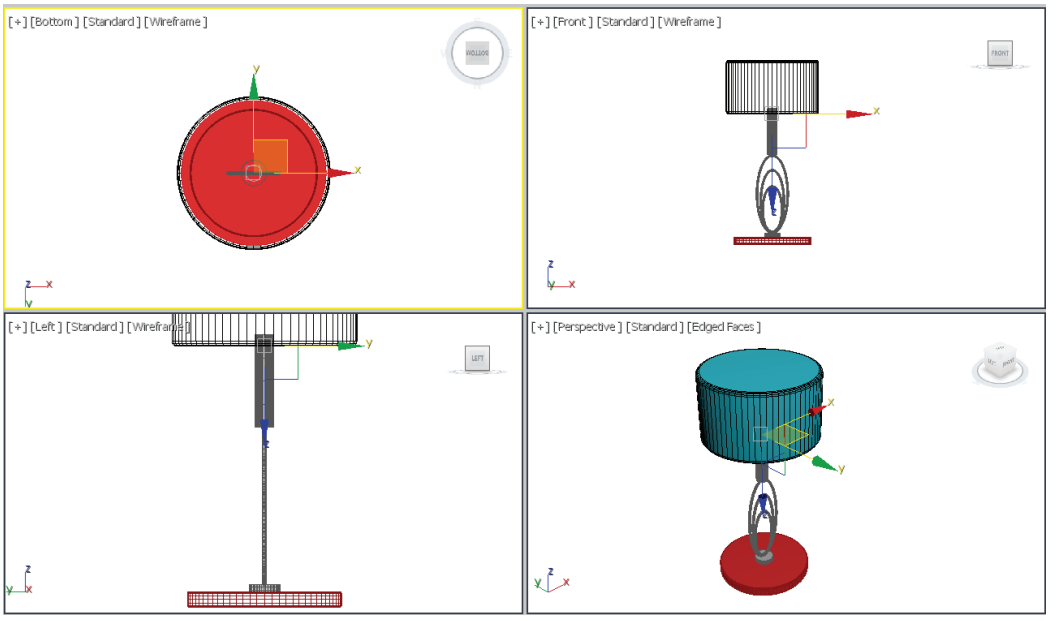

Figure 4-39 *The selected polygon*

Saving and Rendering the Scene

In this section, you will save the scene that you have created and then render it. You can also view the final rendered image of this model by downloading the *c04_3dsmax_2021_rndr.zip* file from *www.cadcim.com*. The path of the file is as follows: *Textbooks > Animation and Visual Effects > 3ds Max > Autodesk 3ds Max 2021 for Beginners: A Tutorial Approach*

1. Change the background color of the scene to white by following the steps as given in Tutorial 1 of Chapter 2.

2. Choose **Save** from the **File** menu.

3. Activate the Perspective viewport. Next, invoke the **Render Production** tool from the **Main Toolbar**; the rendered image is displayed, refer to Figure 4-40.

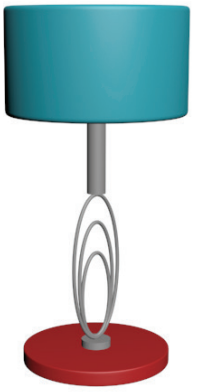

Figure 4-40 *The rendered image*

Tutorial 3

In this tutorial, you will create the model of a vase by converting a 2D spline into a 3D mesh object and then place a flower plant in it, as shown in Figure 4-41.

(Expected time: 25 min)

The following steps are required to complete this tutorial:

a. Create the project folder.
b. Create a line spline for the vase.

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c. Apply the **Lathe** modifier.
d. Assign the material to the vase.
e. Create a stand for the vase.
f. Save and render the scene.

Figure 4-41 *The model of a vase with flower plant*

Creating the Project Folder

Create a project folder with the name *c04_tut3* in the *3dsmax 2021* folder as discussed in Tutorial 1 of Chapter 2.

Creating a Line Spline for the Vase

In this section, you will create a profile similar to one-half of the vase using the **Line** tool.

1. Activate the Front viewport and choose **Create > Shapes** in the **Command Panel**; the **Splines** option is selected by default in the drop-down list below the **Shapes** button. Now, choose the **Line** tool from the **Object Type** rollout.

2. In the **Creation Method** rollout, select the **Corner** radio button in both the **Initial Type** and **Drag Type** areas.

3. Create a line spline as discussed in Tutorial 1. This spline should be similar to one-half of the vase, refer to Figure 4-42.

4. Choose the **Modify** tab and select the **Vertex** sub-object level in the modifier stack; all vertices of the line spline are displayed in the viewport. Next, select the vertices one by one in the viewport and modify the shape by moving them to get a perfect shape.

Applying the Lathe Modifier

In this section, you will apply the **Lathe** modifier to convert the 2D spline into the 3D mesh object.

1. Select the first vertex of the spline in the Front viewport, as shown in Figure 4-43.

2. Choose **Modifiers > Patch/Spline Editing > Lathe** from the menu bar; the 2D line spline is converted into a 3D mesh object.

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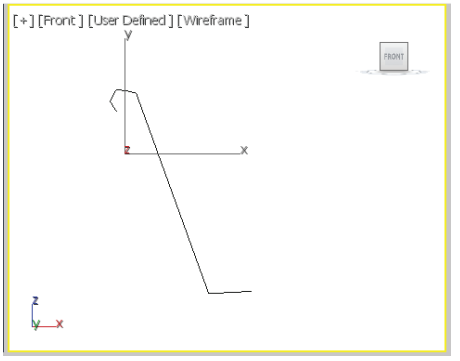

Figure 4-42 A line spline created for the vase

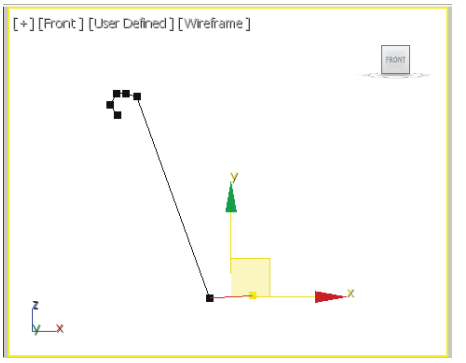

Figure 4-43 The first vertex of the line spline selected in the Front viewport

3. Name the new 3D mesh object as *vase*. Also, click anywhere in the viewport to deselect the *vase*.

4. Choose the **Zoom Extents All** tool; the entire *vase* is displayed in the viewports, as shown in Figure 4-44.

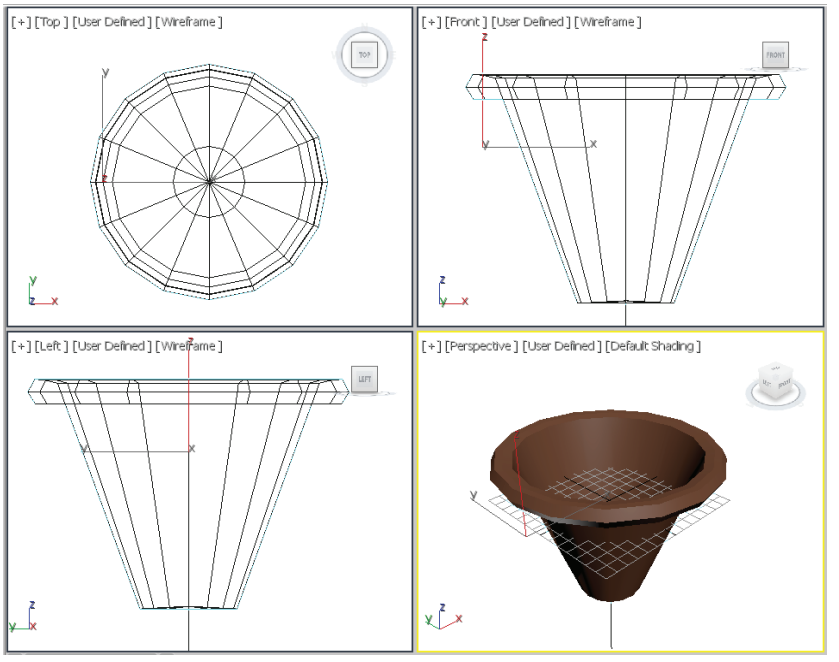

Figure 4-44 The vase geometry after applying the ***Lathe*** *modifier*

Assigning Material to Vase

In this section, you will assign the material to *vase* using the **Material Editor** tool as discussed in Tutorial 1 of this chapter.

1. Choose **Rendering > Material Editor > Compact Material Editor** from the menu bar; the **Material Editor** dialog box is displayed.

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2. Select the **2-Sided** check box in the **Shader Basic Parameters** rollout of the **Material Editor** dialog box. This enables you to view both sides of *vase* in the final output. Also, in the **Blinn Basic Parameters** rollout, choose the **Diffuse** color swatch; the **Color Selector: Diffuse Color** dialog box is displayed. In this dialog box, enter the values as follows:

   Red: **177** Green: **88** Blue: **27**

   Choose the **OK** button in the **Color Selector: Diffuse Color** dialog box; the selected color is displayed in the **Diffuse** color swatch.

3. Make sure that *vase* is selected in the viewports. Next, choose the **Assign Material to Selection** button in the **Material Editor** dialog box; the selected material is assigned to *vase* in the viewport. Next, choose the **Show Shaded Material in Viewport** button in the same dialog box to view the material in viewport. Next, close the **Material Editor** dialog box.

   Next, you need to use the **Foliage** tool to place a plant in *vase*.

4. Activate the Top viewport. Choose **Create > Geometry** in the **Command Panel**; a drop-down list is displayed below the **Geometry** button. Select **AEC Extended** from the drop-down list and then choose the **Foliage** tool from the **Object Type** rollout.

5. In the **Favorite Plants** rollout, double-click on the **Society Garlic** foliage; the foliage is displayed in the viewports.

6. In the **Name and Color** rollout, change the name of foliage to *plant* and press ENTER.

7. Make sure that *plant* is still selected. Choose the **Modify** tab in the **Command Panel**; the **Parameters** rollout is displayed.

8. In the **Parameters** rollout, set a value in the **Height** spinner to adjust the height of *plant* according to *vase*.

9. Choose the **Select and Move** tool and align *plant* with *vase* in the viewports, refer to Figure 4-45.

10. Select *plant* and *vase* in the viewports and group them as *flower vase*.

    Next, you need to create a stand for *flower vase*.

Creating a Stand for the Flower Vase

In this section, you will create a stand for the *flower vase*.

1. Select *flower vase* and right-click on it; a quad menu is displayed. Choose the **Hide Selection** option from it; *flower vase* disappears temporarily from the viewports. Now, you can work easily in the viewports.

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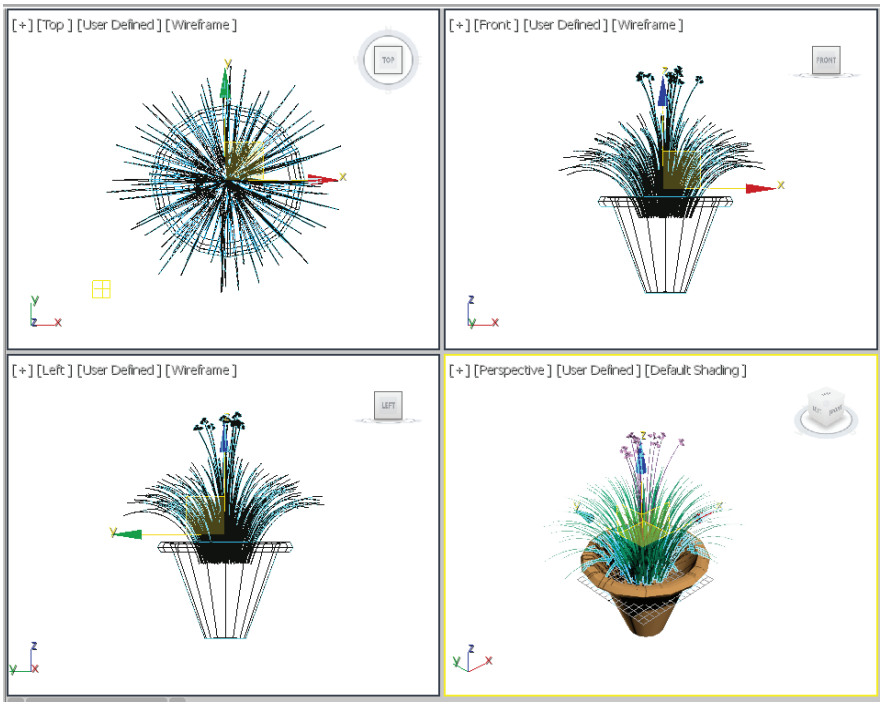

Figure 4-45 *Alignment of plant with vase in viewports*

2. Activate the Top viewport. Choose **Create > Shapes** in the **Command Panel**; the **Splines** option is selected by default in the drop-down list below the **Shapes** button. Now, choose the **Circle** tool from the **Object Type** rollout and create a circular spline.

3. In the **Parameters** rollout, set the radius of the circle to **11.662** in the **Radius** spinner.

   You may need to modify the radius according to the scene in the later section.

4. Expand the **Rendering** rollout and select the **Enable In Renderer** and **Enable In Viewport** check boxes. Select the **Radial** radio button, if it is not already selected. Also, make sure that the **Auto Smooth** check box is selected. Now, enter the values as follows:

   Thickness: **2.0** Sides: **15** Angle: **0.99**

5. The circular spline is automatically named as *Circle001*. Now, change its color by entering the values as follows:

   Red: **193** Green: **193** Blue: **193**

6. Create another circle in the Top viewport. It is automatically named as *Circle002*.

7. In the **Parameters** rollout, set the radius value of *Circle002*. This radius should be double the size of radius of *Circle001*.

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8. Change the color of *Circle002* to black.

9. Choose the **Zoom Extents All** tool and align both the circles using the **Select and Move** tool, as shown in Figure 4-46.

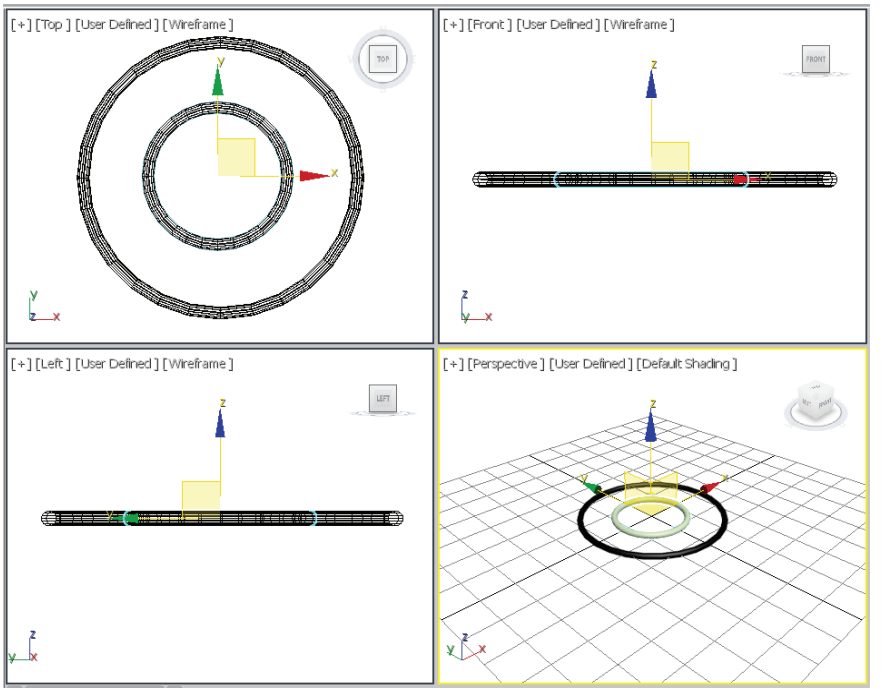

Figure 4-46 *Alignment of the circles in viewports*

10. Choose the **Line** tool from **Create > Shapes > Splines > Object Type** rollout.

11. In the **Creation Method** rollout, select the **Corner** radio button in the **Initial Type** and **Drag Type** areas.

12. Activate the Top viewport. Next, create four line splines to join both the circles, as shown in Figure 4-47.

13. Assign black color to all line splines.

14. Select the line splines and both the circles in any viewport by dragging a selection box around them, and then group them as *upper portion*.

15. Select *upper portion* and hide it temporarily as described earlier.

    Next, you need to create the legs for the stand using the **Line** tool.

16. Activate the Front viewport. Next, choose the **Line** tool from **Create > Shapes > Splines > Object Type** rollout.

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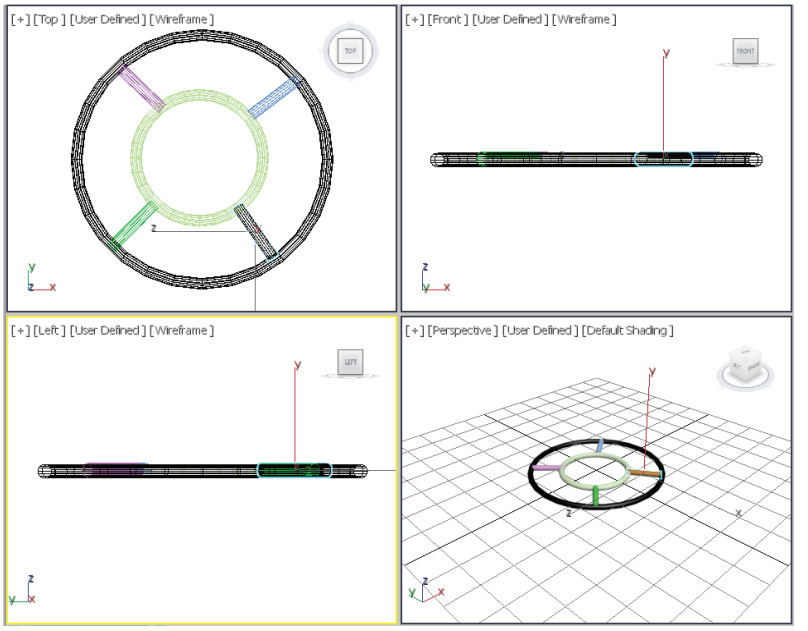

Figure 4-47 *The line splines created to join both the circles*

17. In the **Creation Method** rollout, select the **Smooth** radio button in both the **Initial Type** and **Drag Type** areas.

18. Create a line spline in the Front viewport, as shown in Figure 4-48. It uses the same parameters from the **Rendering** rollout that you had set earlier.

Figure 4-48 *The line spline for the leg of stand*

19. In the **Rendering** rollout, make sure that the **Enable In Renderer** and **Enable In Viewport** check boxes are selected. Select the **Rectangular** radio button and enter the values as follows:

    Length: **2.0** Width: **1.5** Angle: **0.0**

20. Name the line spline as *leg01* and change its color to black.

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21. Right-click in any of the viewports; a quad menu is displayed. Choose the **Unhide by Name** option; the **Unhide Objects** dialog box is displayed. Select *upper portion* from the list given in this dialog box and choose the **Unhide** button; *upper portion* is now displayed in the viewport. Choose the **Zoom Extents All** tool.

Note

You can resize leg01 according to the size of the upper portion using the ***Select and Uniform Scale*** *tool.*

22. Align *upper portion* and *leg01* in viewports, as shown in Figure 4-49.

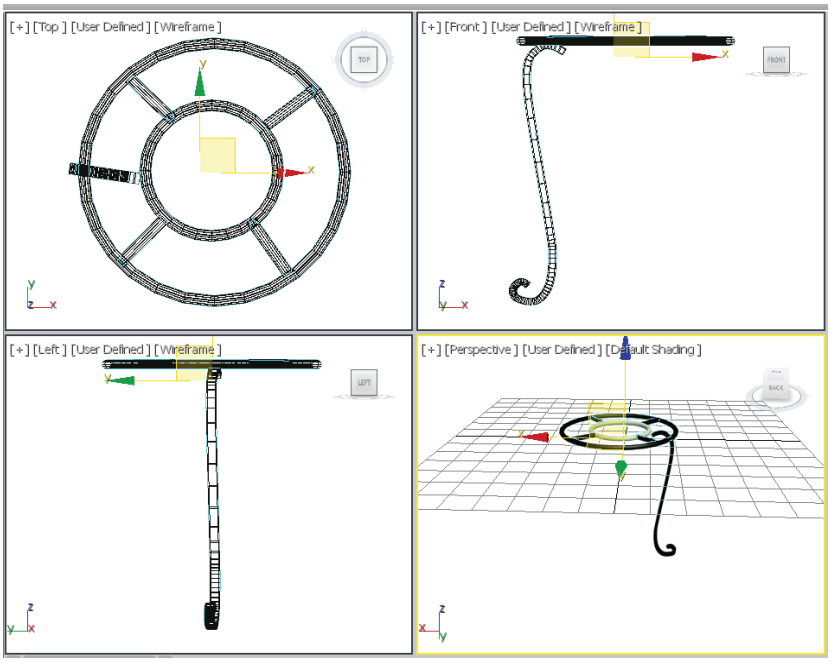

Figure 4-49 *Alignment of upper portion and leg01 in viewports*

Next, you need to copy the *leg01* to create other legs.

23. Create three copies of *leg01*; they are automatically named as *leg002*, *leg003*, and *leg004*.

24. Align *leg01*, *leg002*, *leg003*, and *leg004* using the **Select and Move** and **Select and Rotate** tools, as shown in Figure 4-50.

25. Select all the objects in the viewport and group them as *vase stand*.

26. Right-click on the viewport; a quad menu is displayed. Choose the **Unhide All** option; all the hidden objects are displayed in the viewports.

27. Align *flower vase* and *vase stand* and choose the **Zoom Extents All** tool, refer to Figure 4-51.

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Note

You can adjust the size of the flower vase according to the size of the vase stand using the ***Select and Uniform Scale*** *tool.*

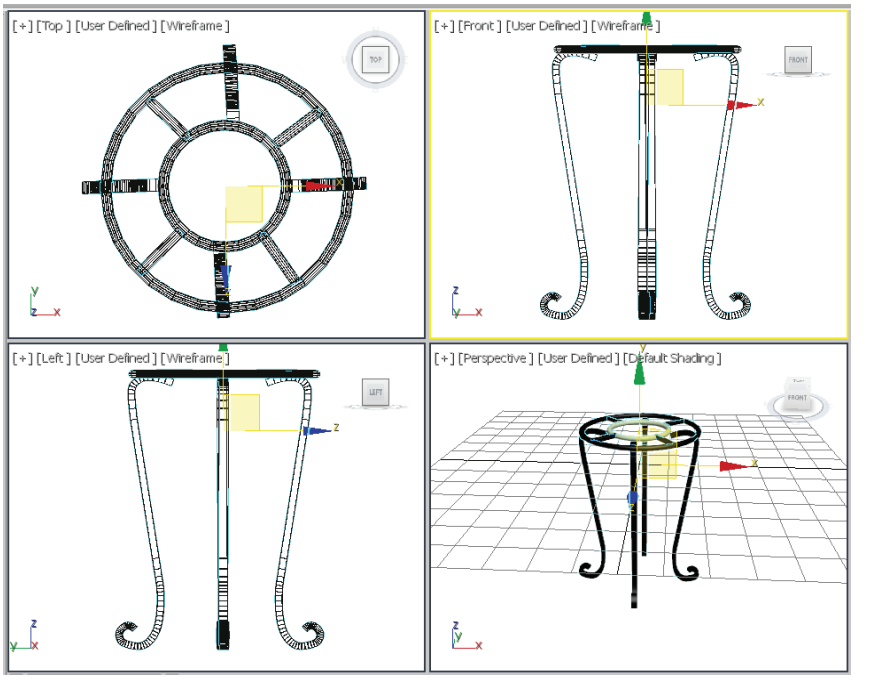

Figure 4-50 *Alignment of leg01, leg002, leg003, and leg004 in viewports*

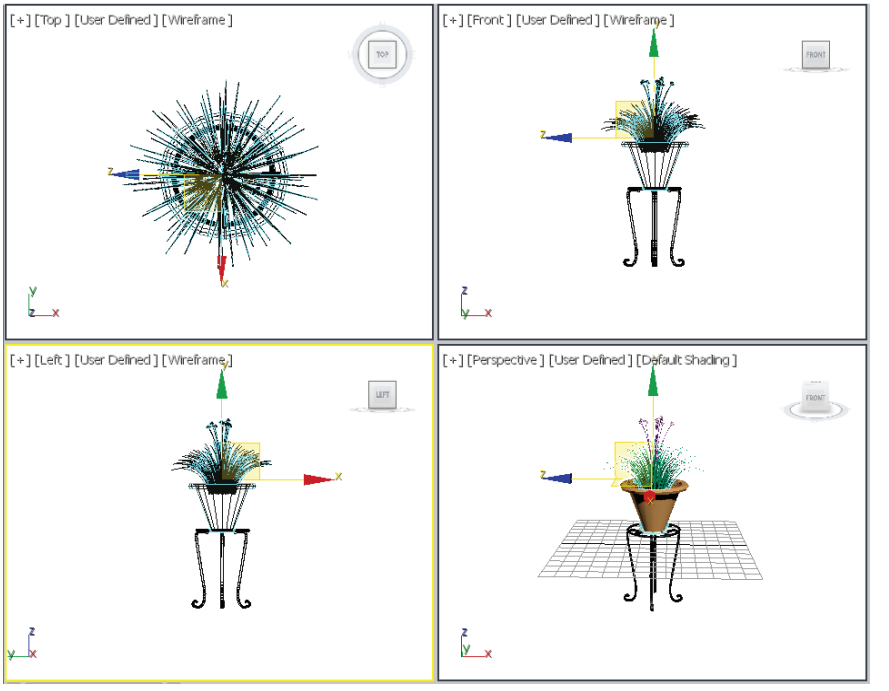

Figure 4-51 *Alignment of flower vase and vase stand in viewports*

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Saving and Rendering the Scene

In this section, you will save the scene that you have created and then render it. You can also view the final rendered image of this model by downloading the *c04_3dsmax_2021_rndr.zip* file from *www.cadcim.com*. The path of the file is as follows: *Textbooks > Animation and Visual Effects > 3ds Max > Autodesk 3ds Max 2021 for Beginners: A Tutorial Approach*

1. Change the background color of the scene to white by following the steps as given in Tutorial 1 of Chapter 2.

2. Choose **Save** from the **File** menu.

3. Activate the Perspective viewport. Next, invoke the **Render Production** tool from the **Main Toolbar**; the rendered image is displayed, refer to Figure 4-41.

Self-Evaluation Test

Answer the following questions and then compare them to those given at the end of this chapter:

1. Which of the following options is used to convert a curved spline into a linear spline?

   (a) **Bezier** (b) **Bezier Corner**
   (c) **Corner** (d) **Smooth**

2. Which of the following buttons is chosen to enter the spline sub-object mode?

   (a) **Spline** (b) **Line**
   (c) **Vertex** (d) None

3. You need to choose _____ from the **Edit** menu to copy the existing state on the screen to a buffer.

4. When you choose the **Vertex** button in the **Selection** rollout to turn it on, the _____ of the selected shape are displayed.

5. You can change the curvature through a vertex by manipulating the _____ of the vertex.

6. There are two types of bezier vertices, **Bezier** and _____.

7. The two bezier handles at any vertex are used to move the lead in and out of the vertex. (T/F)

8. When the **Connect** button in the **Geometry** rollout (in the **Vertex** sub-object mode) is used, the two vertices of a spline are joined by a curved segment. (T/F)

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9. The first vertex in a spline has white color. (T/F)

10. The **Edit Spline** modifier need not to be applied to the shapes created using the **Line** tool. (T/F)

Review Questions

Answer the following questions:

1. Which of the following tools is used to bring the transform gizmo to the center point of the selected object?

   (a) **Use Transform Coordinate Center** (b) **Use Pivot Point Center**
   (c) **Use Selection Center** (d) **Select and Uniform Scale**

2. Which modifier is used to modify the shape of the splines?

   (a) **Edit Poly** (b) **Edit Spline**
   (c) **Edit Mesh** (d) None of these

3. The _____ option is used to convert a linear spline into a curved spline.

4. The _____ option is used to restore the previously saved state from the buffer.

5. To turn the transform gizmo on and off, choose _____ from the **Views** menu.

6. The _____ button is used to bring the transform gizmo to the center point of the selected object.

7. The **Edit Spline** modifier helps you to modify the shape of splines. (T/F)

8. When the **Use Selection Center** tool becomes active on using the **Rotate** command, the selected objects are rotated along their individual pivot points. (T/F)

9. The first vertex of the spline is always yellow colored. (T/F)

10. You cannot select a new shape when you are in the sub-object mode. (T/F)

EXERCISES

The rendered output of the model used in the following exercises can be accessed by downloading the *c04_3dsmax_2021_exr.zip* from *www.cadcim.com*. The path of the file is as follows: *Textbooks > Animation and Visual Effects > 3ds Max > Autodesk 3ds Max 2021 for Beginners: A Tutorial Approach*

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Exercise 1

Draw the following shapes by using the dimensions of your choice, refer to Figure 4-52. Create their copies and transform them as required. **(Expected time: 20 min)**

Figure 4-52 *Drawing different shapes*

Exercise 2

Create the model of a street lamp, as shown in Figure 4-53, by applying dimensions of your choice. **(Expected time: 30 min)**

Figure 4-53 *The model of a street lamp*

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Answers to Self-Evaluation Test

1. c, **2.** a, **3. Hold**, **4.** vertices, **5.** bezier handles, **6. Bezier Corner**, **7.** T, **8.** F, **9.** F, **10.** T

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