Designing Databases with Visio 2013: A Tutorial

APPENDIX A2

Microsoft Visio 2013 includes database design and modeling tools among many other diagramming options. The Visio software has so many features that it is impossible to demonstrate all of them in this short tutorial. However, you will learn how to:

- Select the Crow's Foot entity relationship diagram (ERD) option.
- Create the entities and define their components.
- Create the relationships between the entities and define the nature of those relationships.
- Edit the Crow's Foot ERDs.
- Insert text into the design grid and format the text.

Preview

Once you have learned how to create a Visio Crow's Foot ERD, you will be sufficiently familiar with the basic Visio software features to experiment on your own with other modeling and diagramming options. You will also learn how to insert text into the Visio diagram to document features you consider especially important or to simply provide an explanation of some segment of the ERD.

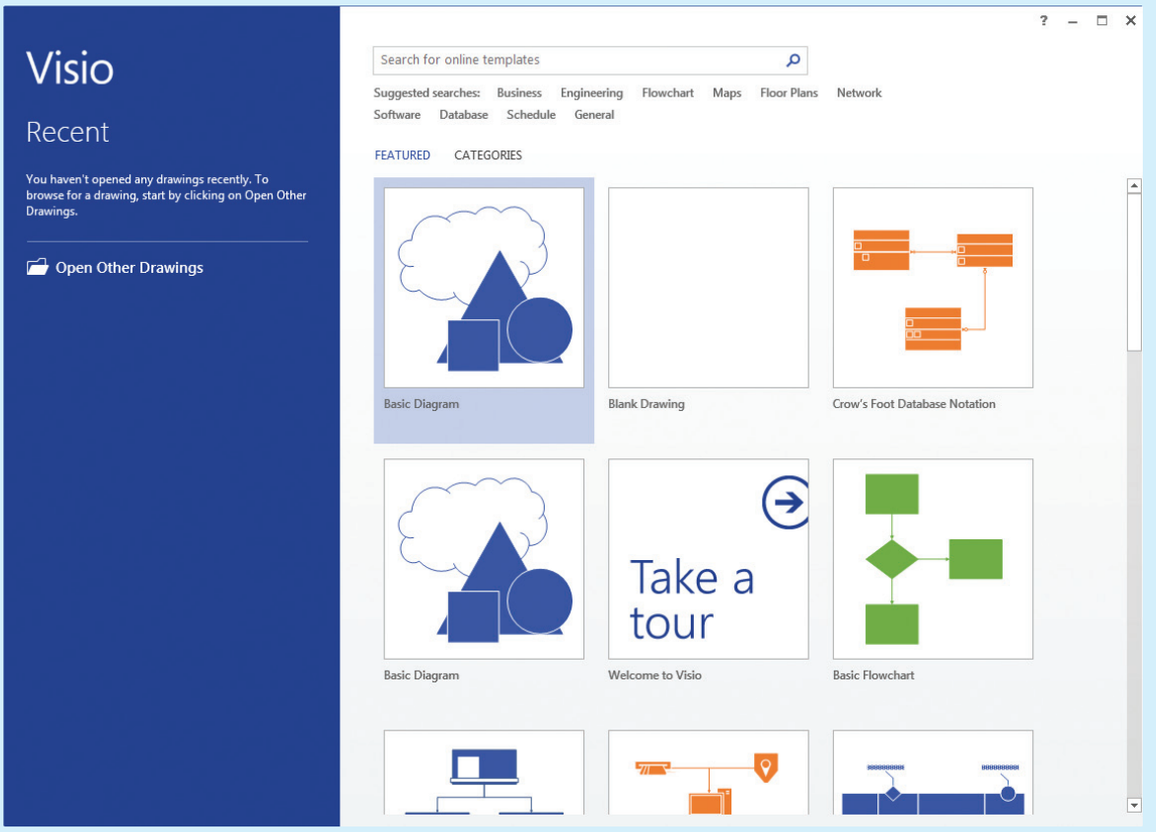
Data Files Available on www.cengagebrain.com:

Appendix	Available formats	Questions and Problems	Available formats
There are no data files for this appendix.			

A2.1 Starting Visio

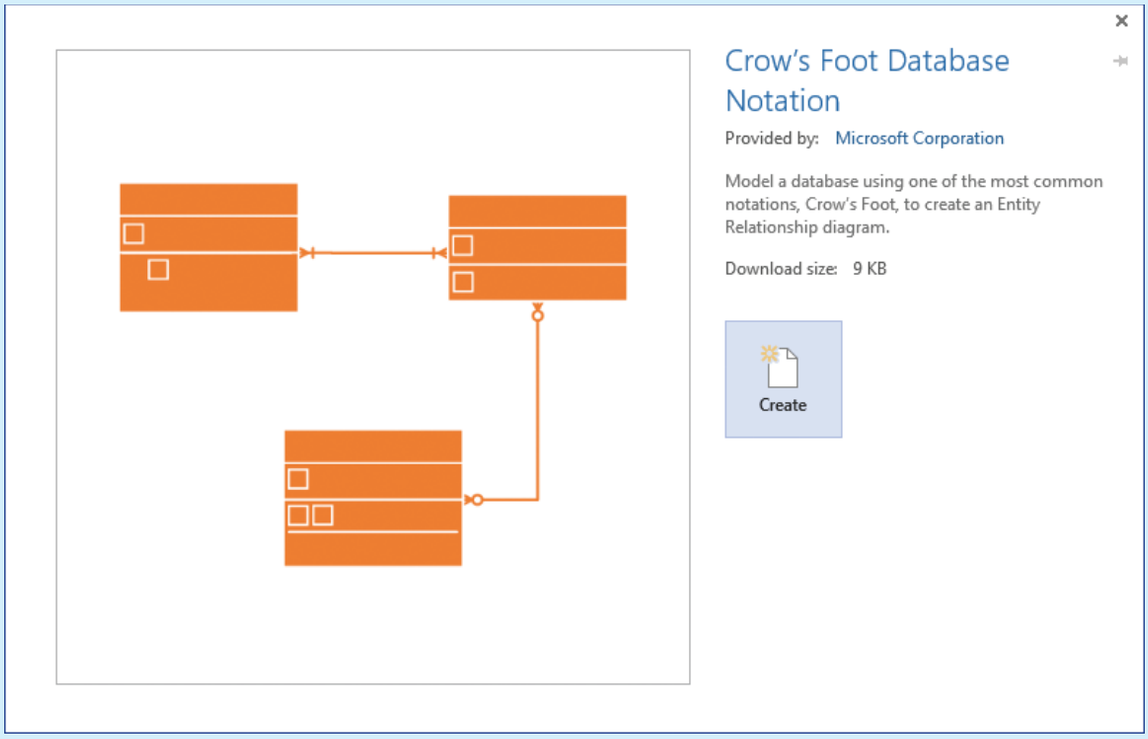
The Visio software on your computer is started in the same fashion as other programs. The exact procedure is dependent on the operating system being used. After the Visio software has been activated, the start screen shown in Figure A2.1 will display. Previously created Visio files show up under the **Recent** header on the left side of the screen.

FIGURE A2.1 The Visio Professional start screen



The option to create a Crow's Foot Database Notation diagram should be presented to you. However, if you do not see this option, you can click the **Database** selection at the top of the screen (visible in Figure A2.1). This will display the set of database modeling options available, and you can select Crow's Foot Database Notation from this window. Once the window shown in Figure A2.2 appears, you can click the large **Create** button to begin a new Crow's Foot diagram.

FIGURE A2.2 **Crow's Foot Database Notation selection**



When you begin a new diagram, the screen shown in Figure A2.3 will appear. Because the preference here is for a larger grid than the one shown in Figure A2.3, start by selecting the **VIEW** tab on the Ribbon at the top of the screen. Click the **Zoom** option to generate the list of size options. Figure A2.4 shows that the **100%** option has been selected. When you choose the **100%** selection and click **OK**, the grid expands to fill the screen.

FIGURE A2.3 The drawing board

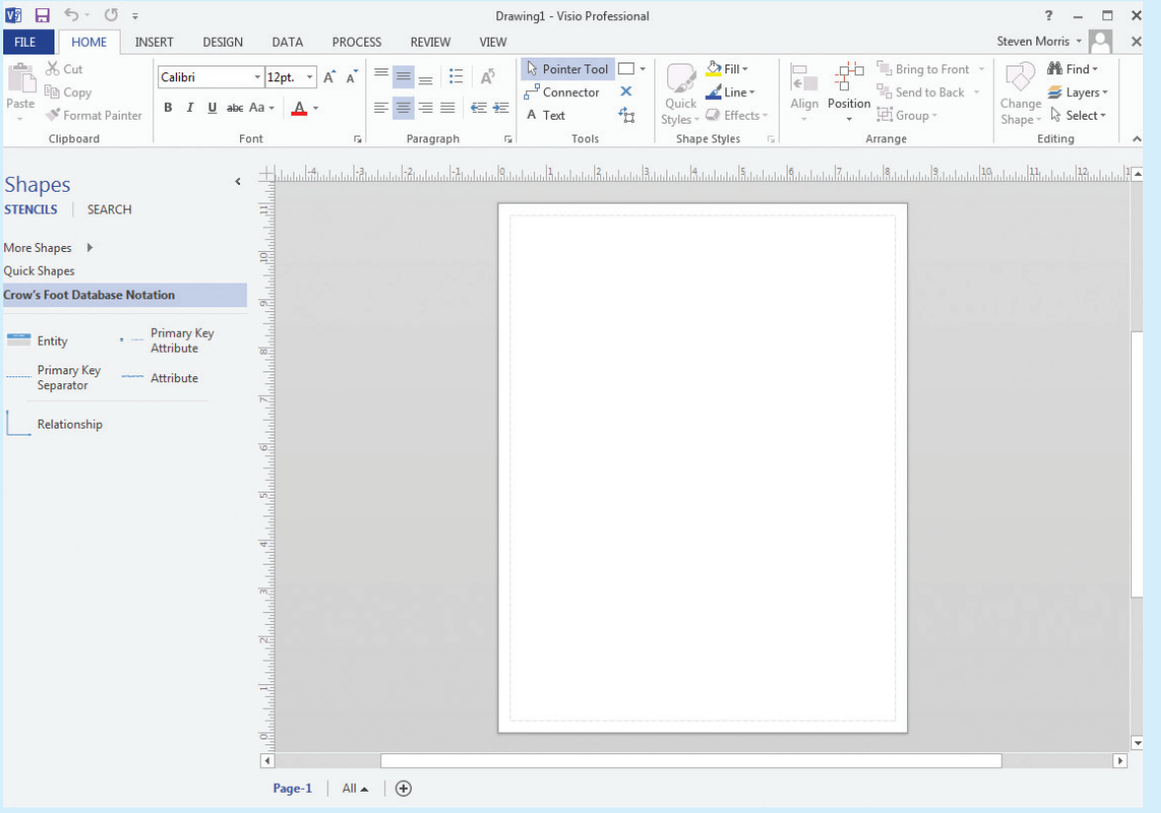
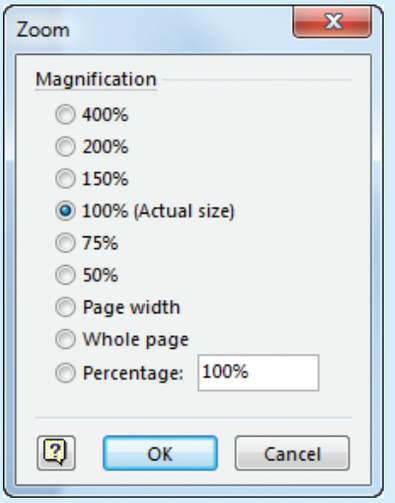


FIGURE A2.4 The drawing board size option



By selecting the Visio Professional database option and its drawing board, you have completed the preliminary work required to create ERDs. You are now ready to draw the ERDs on the drawing board. You will use the Crow's Foot option, the same one used to create all of the ERDs in this text.

A2.2 Creating a Crow's Foot ERD

To illustrate the development of the Visio Professional's Crow's Foot ERD, you will create a simple design based on the following business rules:

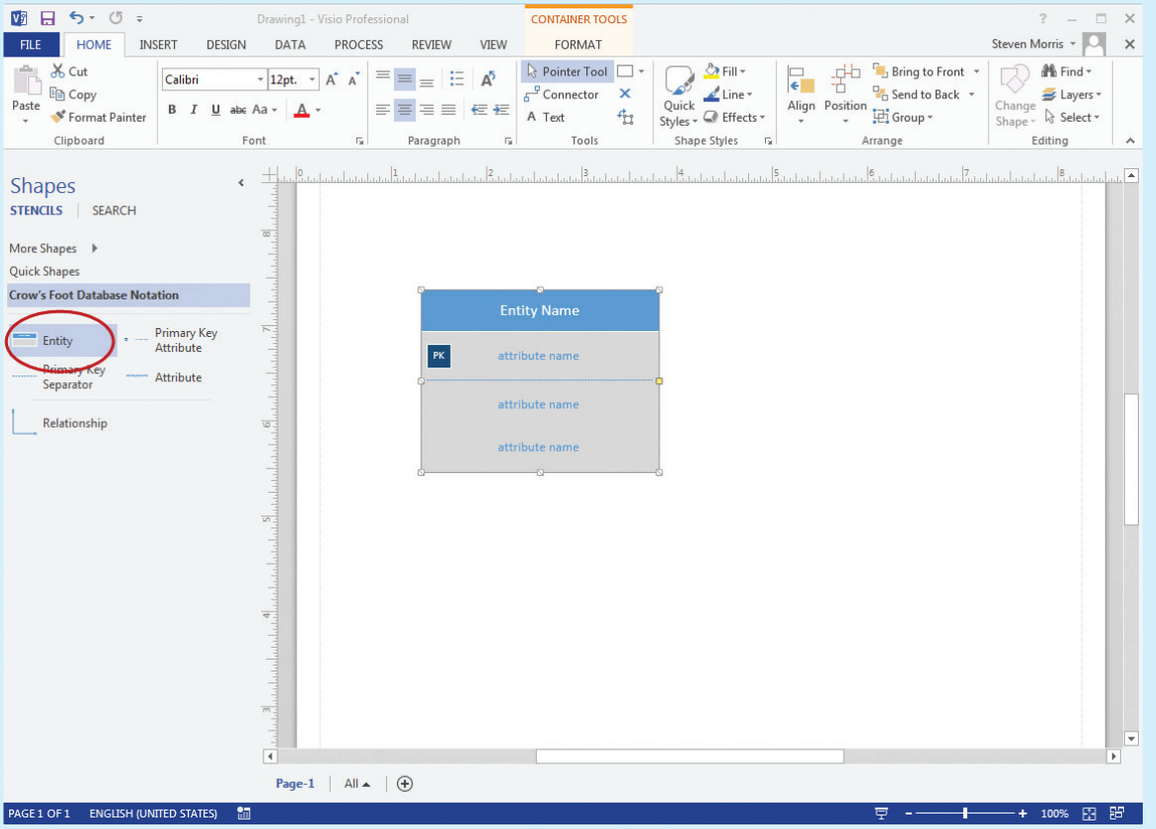
- A course can generate many classes.
- Each class is generated by a course.
- A course may or may not generate a class.
- A student can enroll in many classes.
- A student may or may not have enrolled in any class.
- A class can have many students in it.
- A class may or may not have had any students enroll in it.

Note that a class has been defined as a section of a course. That definition reflects the real world's use of the labels *class* and *course*. Students have a *class* schedule rather than a section schedule. The catalog that lists all of the courses offered by a department is called a *course* catalog. Some courses are not taught each semester, so they may not generate a class during any given semester.

A2.2.1 Creating an Entity

Now that you have some idea of the proposed design components, let's create the first entity for the design. Click the **Entity** object shown in Figure A2.5. (It is circled in red in the figure.) Drag the **Entity** object to the grid and then drop it. That action will produce the **Entity Name** object shown in the grid in Figure A2.5.

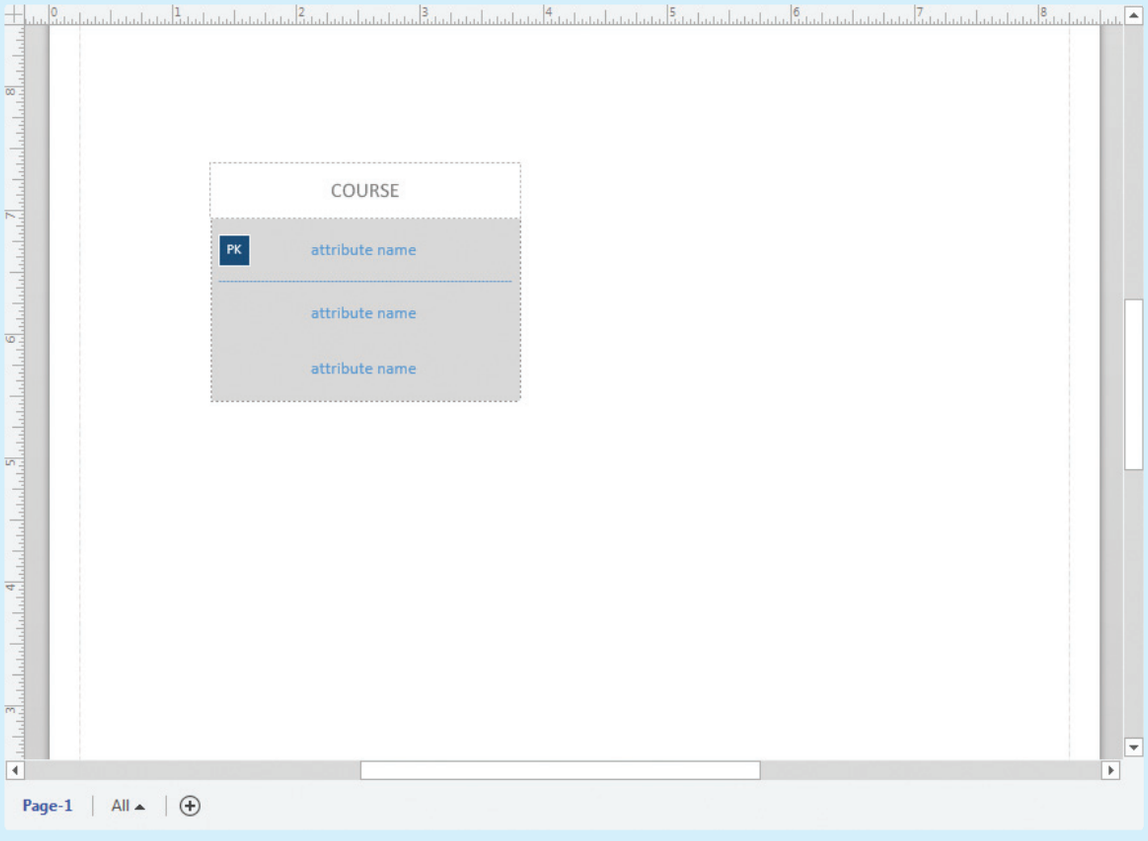
FIGURE A2.5 **Placing the entity object in the grid**



As you examine Figure A2.5, note that the small "squares" or handles around the entity object perimeter indicate that the object has been selected. You can deselect the object by clicking an empty portion of the grid. If the entity object has not been selected, click it to select it.

First, create a COURSE entity by double-clicking the text "Entity Name" to make the text editable and replacing it with **COURSE**, as shown in Figure A2.6.

FIGURE A2.6 Typing the COURSE entity name



When you have finished typing the **COURSE** label as shown in Figure A2.6, you are ready to start defining the table columns. Visio places three undefined attributes in the entity by default to get you started.

A2.2.2 Defining the Entity Attributes (Columns)

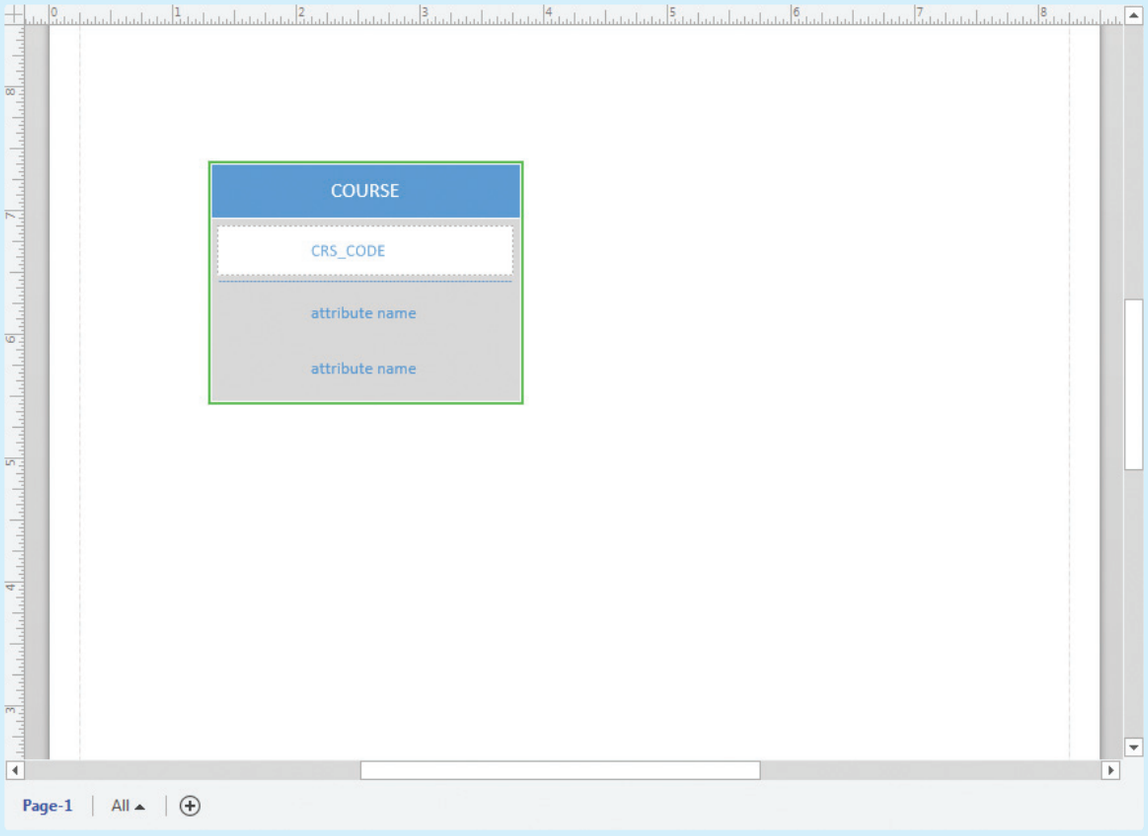
Each table column represents one of the characteristics (attributes or fields) of the entity. For example, if the COURSE entity, represented by the COURSE table, is described by the course code, the course description, and the course credits, you can expect to define three columns in the COURSE table. Table A2.1 provides a preview of the expected COURSE table structure. (A few sample records are entered to give you an idea of the COURSE table contents.)

TABLE A2.1 Some Sample COURSE Records

CRS_CODE	CRS_TITLE	CRS_DESCRIPTION	CRS_CREDITS
ACCT-345	Managerial Accounting	Accounting as a management tool. Prerequisites: Junior standing and ACCT-234 and 245.	3
CIS-456	Database Systems Design	Creation of conceptual models, logical models, and design implementation. Includes basic database applications development and the role of the database administrator. Prerequisites: Senior standing and at least 12 credit hours in computer information systems, including CIS-234 and CIS-345.	4
ECON-101	Introduction to Economics	An introduction to economic history and basic economic principles. Not available for credit to economics and finance majors.	3

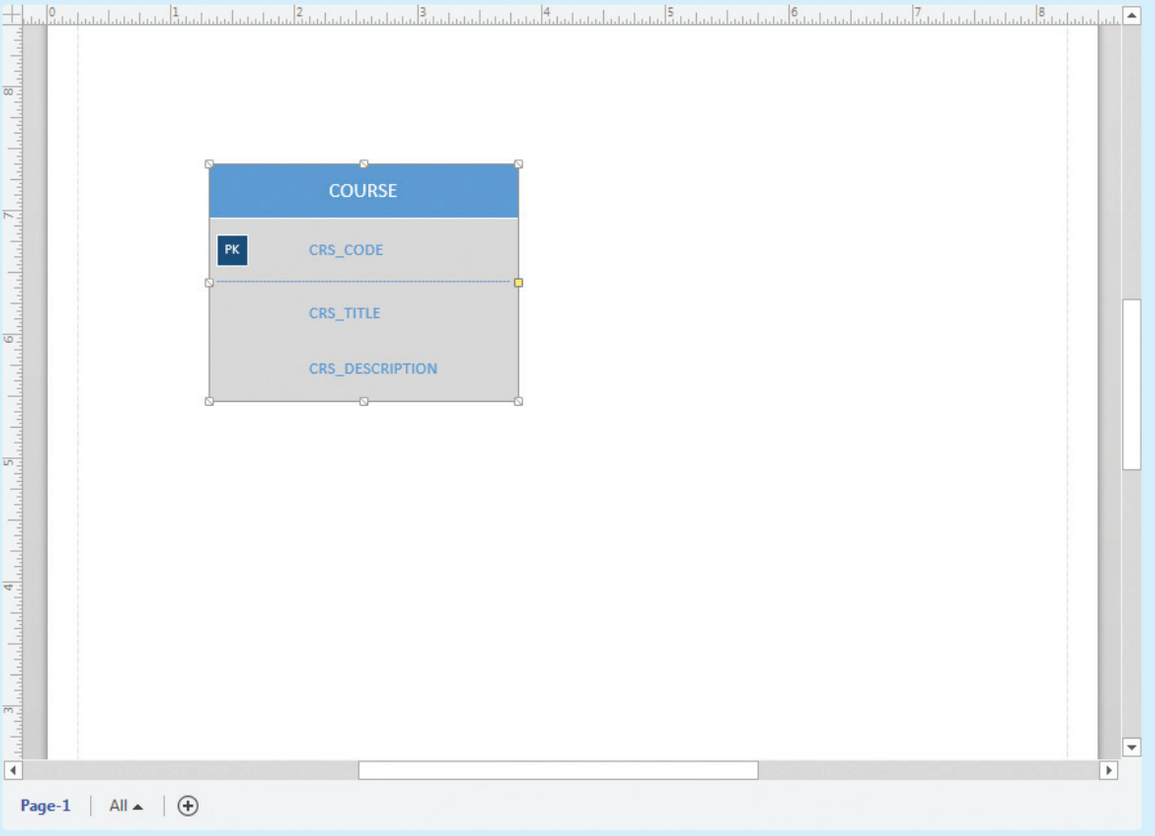
To define the columns of the COURSE table, you must assign column names and characteristics. The first column in the COURSE table will be the CRS_CODE, which serves as the table's primary key (PK). Visio assumes that every entity will have a primary key, as it should, and begins the entity with the first attribute already labeled PK. If a composite primary key is needed, another primary key attribute can be added to the entity by dragging the **Primary Key Attribute** symbol from the left side of the screen and dropping it in the entity. In the current business rules, a single attribute primary key is appropriate. Double-click the first attribute in the entity to make it editable, and type **CRS_CODE** as the attribute name to match Figure A2.7.

FIGURE A2.7 **Selecting the PK**



You are now ready to make the entries for the second and third COURSE attributes. Name these attributes **CRS_TITLE** and **CRS_DESCRIPTION**, respectively (Figure A2.8).

FIGURE A2.8 Entering the remaining columns



While Visio starts the entity with three attributes, more attributes can be added as needed. One way to add attributes to the entity is to drag the **Attribute** symbol from the left side of the screen and drop it on the entity. Attributes in the entity can be dragged and dropped within the entity to change their order so it is easy to adjust the order of the attributes. An attribute can also be added to an entity by hovering the mouse over the entity border for about two seconds. At this time, a red line will appear in the entity indicating that an attribute can be inserted at that location in the entity, as shown in Figure A2.9. Left-click when the red line is positioned at the bottom of the attribute list in the COURSE entity to insert a new attribute symbol. Change the name of this attribute to **CRS_CREDITS** to match Figure A2.10

FIGURE A2.9 Inserting a new attribute

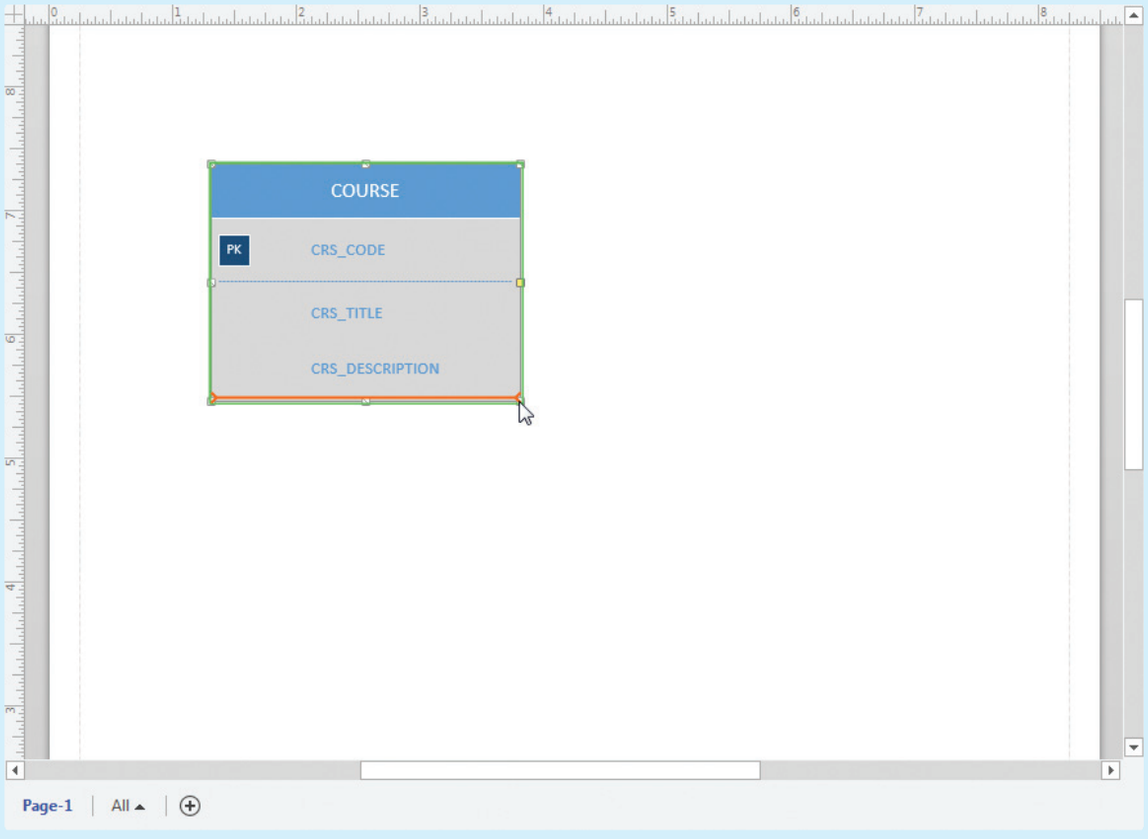
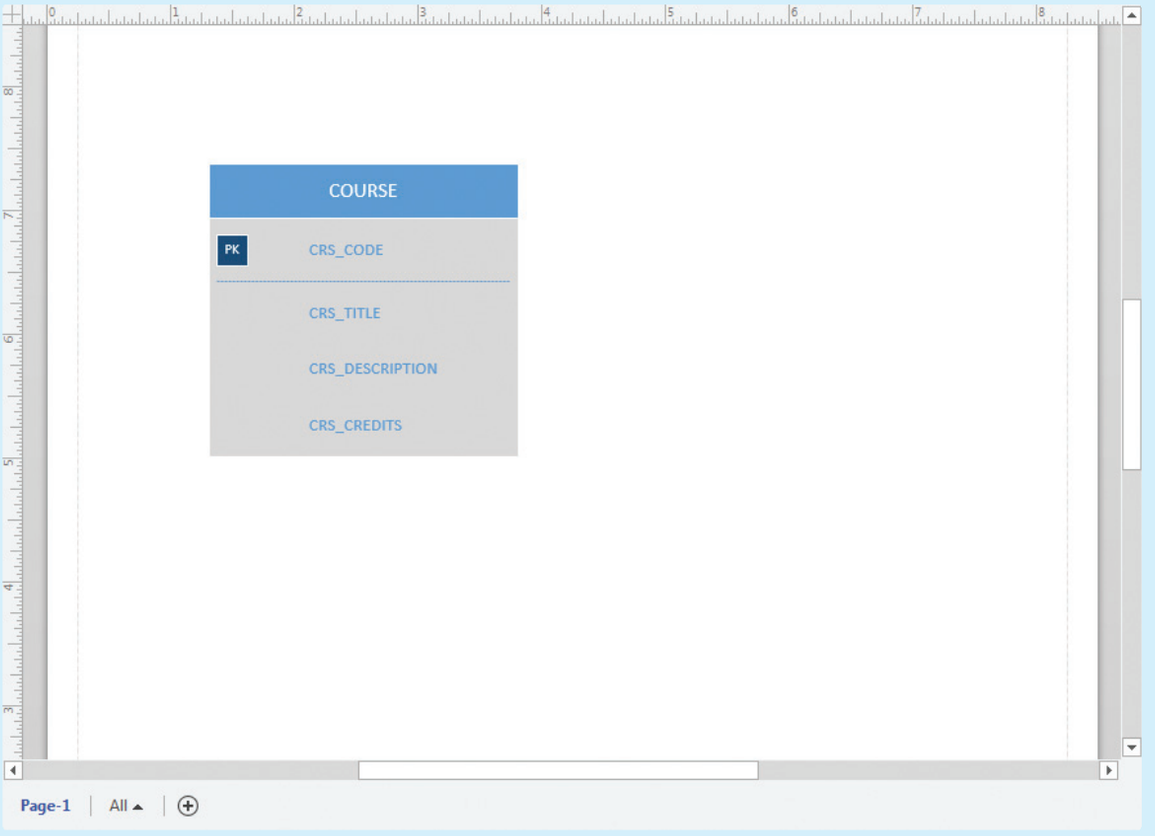


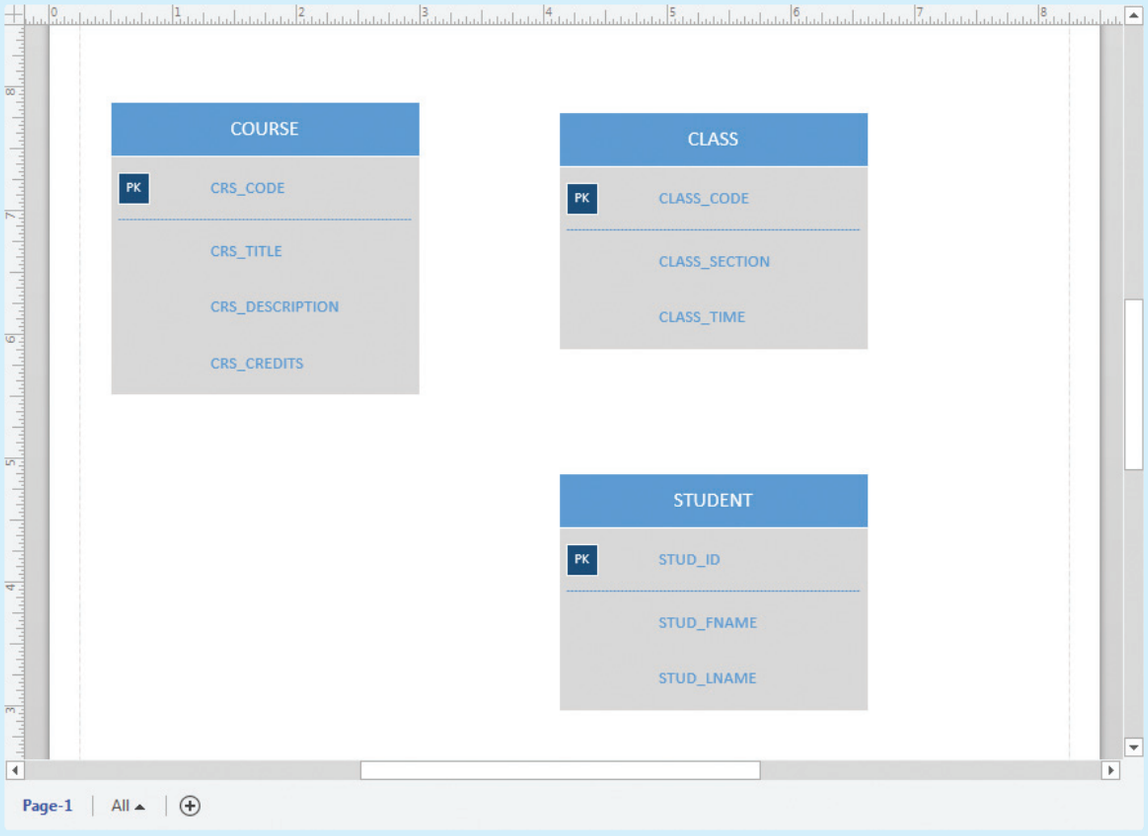
FIGURE A2.10 Final COURSE entity



A2.2.3 Defining the CLASS and STUDENT Entities

You are now ready to define the CLASS and STUDENT entities, using the same techniques you used to create the COURSE entity. When you are done, the screen will look like Figure A2.11.

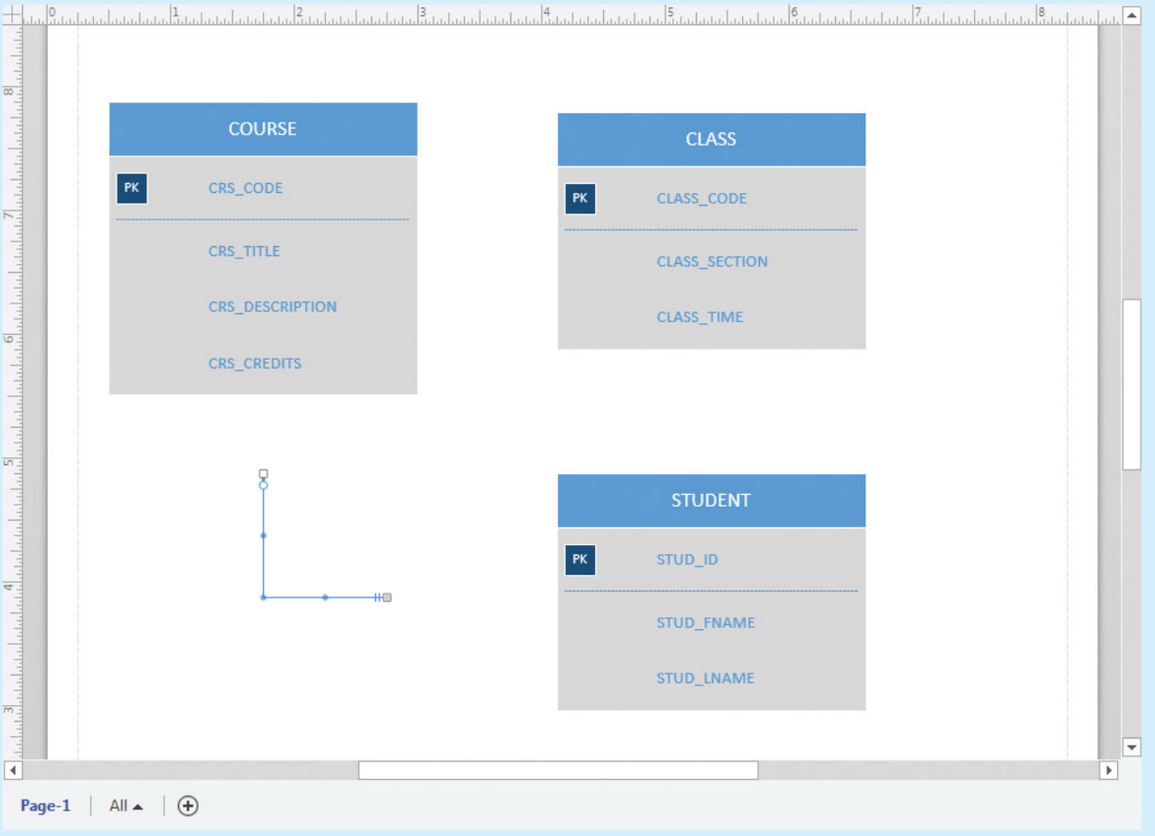
FIGURE A2.11 Adding the CLASS and STUDENT entities



A2.3 Defining Relationships

To create a relationship between the entities, click the **Relationship** object, drag it to the grid, and drop it on the drawing board to produce the results shown in Figure A2.12.

FIGURE A2.12 Adding the relationship object



Dropping the relationship object on the grid produces the relationship line. Further note that the symbols at the two ends of the relationship line reflect default cardinalities of (1,1) and (0,N). By default, relationship lines and the Crow's Foot symbols are small and can be difficult to see. To enlarge the relationship line and the symbols, right-click the relationship object and select **Format Shape** as shown in Figure A2.13. The Format Shape window will open on the right side of the screen. From this window, the format of the relationship object can be adjusted. If the **Line** section is collapsed, click the pointer next to it to expand the line options. Set the **Width** to **1.5 pt**, and the **Begin Arrow size** and **End Arrow size** options to **Jumbo** to match Figure A2.14. When you have finished with the format options, close the Format Shape window by clicking the **Close** button at the top right corner of that window.

FIGURE A2.13 Formatting the relationship line object

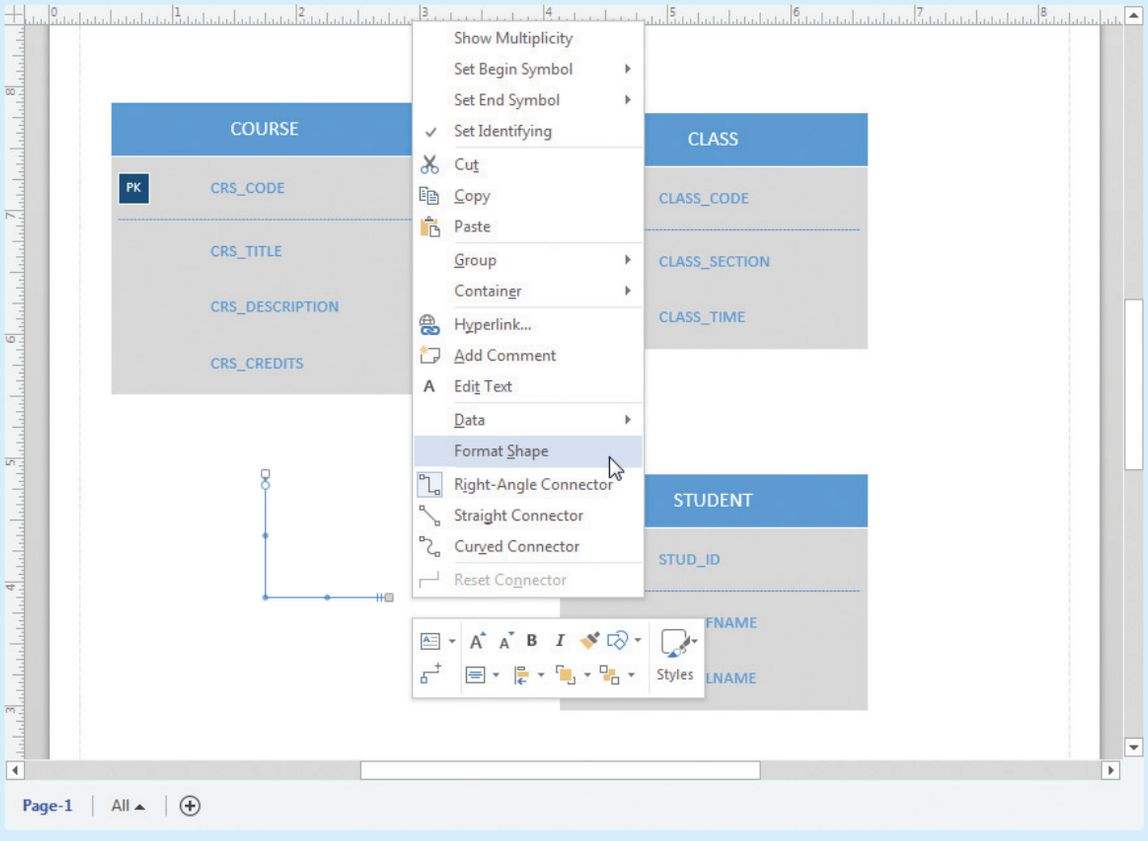
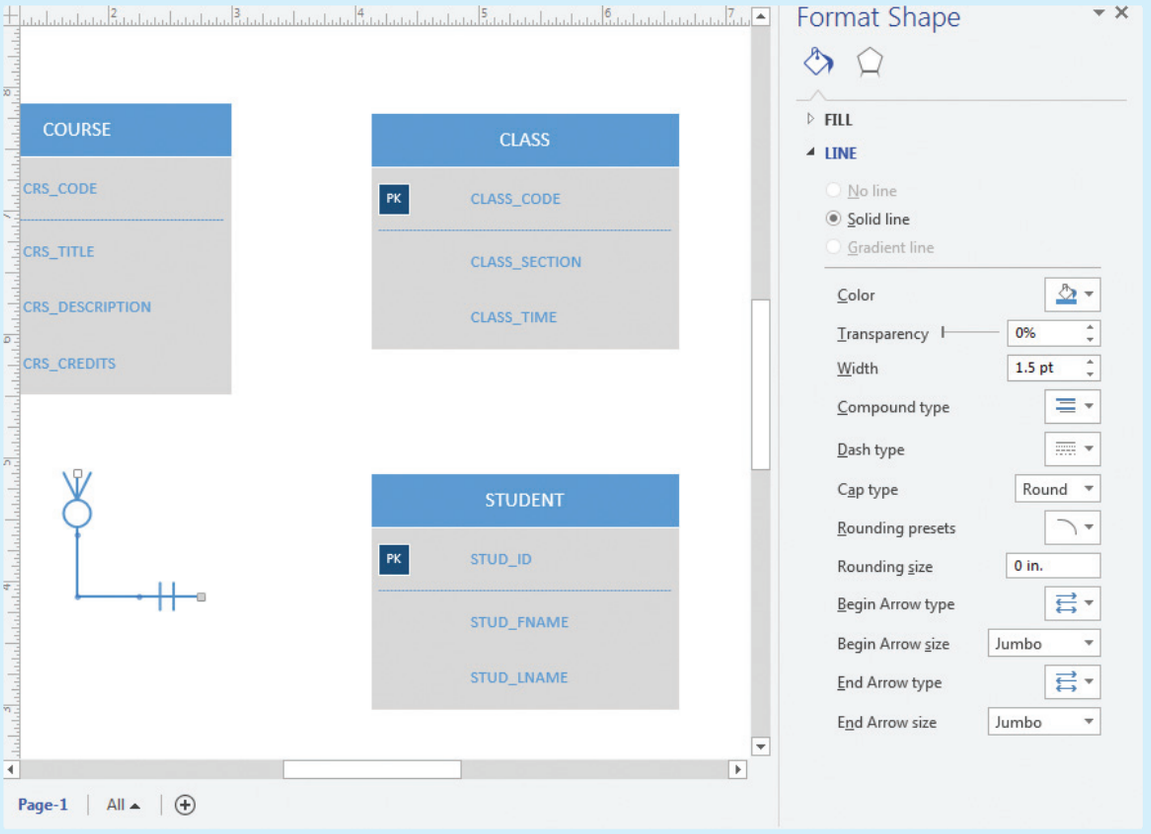


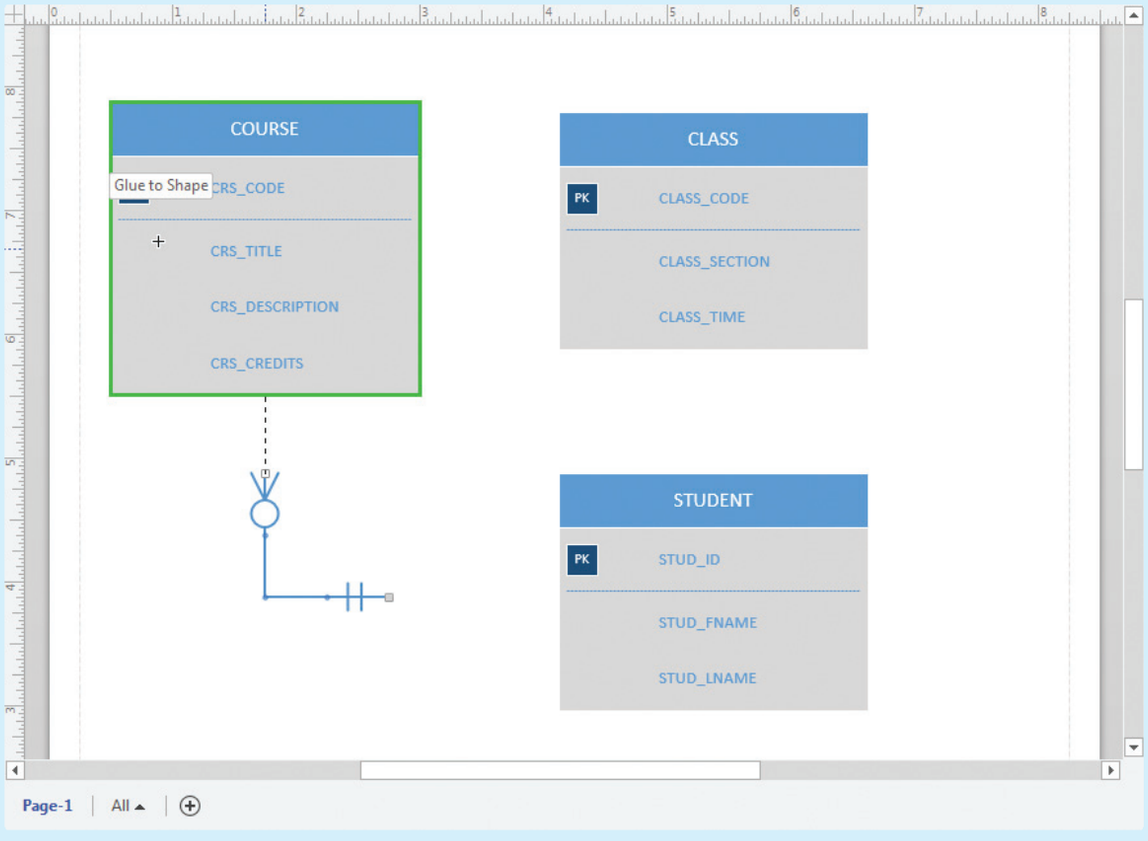
FIGURE A2.14 **Format Shape options**



Remember that the relationship to be established between COURSE and CLASS reflects the business rule "One COURSE may generate many CLASSes." Therefore, the COURSE represents the "1" side of the relationship and the CLASS represents the "many" side of the relationship.

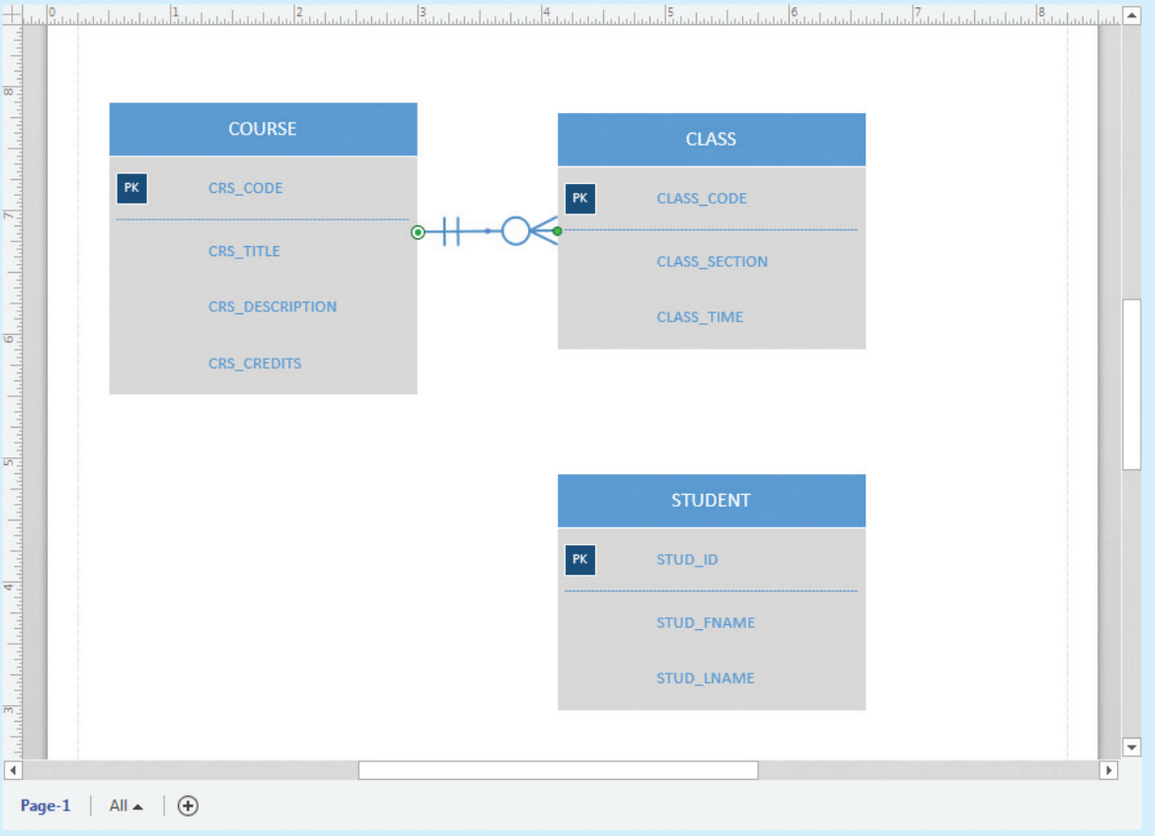
Attach the "1" side of the relationship line to the COURSE entity by dragging the "1" end of the relationship line to the COURSE entity, as shown in Figure A2.15. Visio will allow you to attach the relationship to several points in the entity. The relationship can be attached to a particular location on the border of the entity, a particular attribute box, the entity name box, or to the entity as a whole. Wherever you attach the relationship object, Visio will always anchor the relationship line to that location. We recommend attaching to the entity as a whole so that Visio can more effectively move the relationship object as needed to cleanly route relationships on the diagram. The relationship is attached to the entity as a whole when the entire entity perimeter is highlighted in green, as shown in Figure A2.15.

FIGURE A2.15 Attaching the "1" side of the relationship line



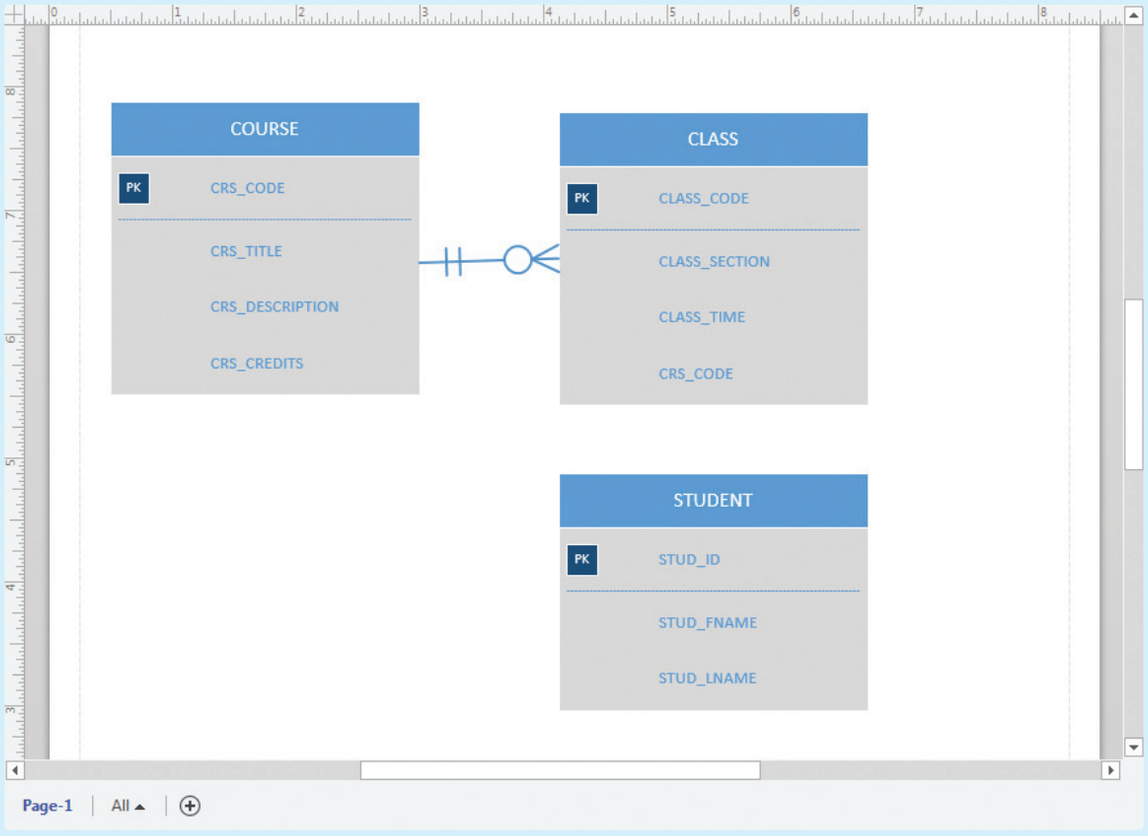
Using the same technique that was used to attach the "1" side of the relationship, drag the "M" side of the relationship line to the CLASS entity to produce Figure A2.16. You can use the handles in the relationship line to adjust the layout, if needed.

FIGURE A2.16 Attaching the "M" side of the relationship line



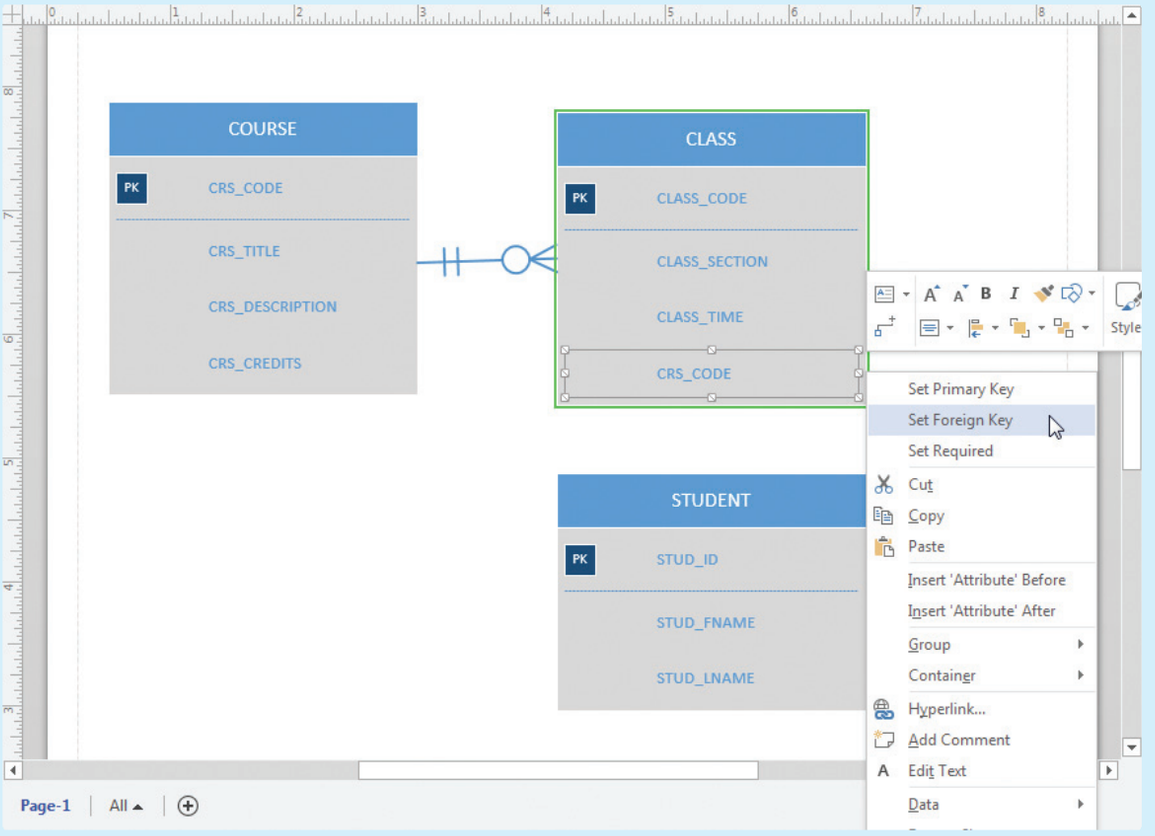
As you examine Figure A2.16, note that the model does not include a foreign key attribute in the CLASS table to implement the relationship that we just created. This foreign key attribute will have to added manually and set as a foreign key. To do this, add an attribute to the CLASS entity using the same technique you used to add the CRS_CREDITS attribute to the COURSE entity earlier, as shown in Figure A2.17. Since the foreign key is always the primary key of the related table, the next step is to specify CRS_CODE as a foreign key in the CLASS table.

FIGURE A2.17 Adding CRS_CODE to CLASS



Visio allows database designers to indicate that an attribute is a foreign key by placing a small "FK" box next to the attribute, similar to the "PK" box used to identify primary keys. To mark CRS_CODE in the CLASS entity as a foreign key, click to select **CRS_CODE**, then right-click the CRS_CODE attribute and choose **Set Foreign Key** from the context menu, as shown in Figure A2.18.

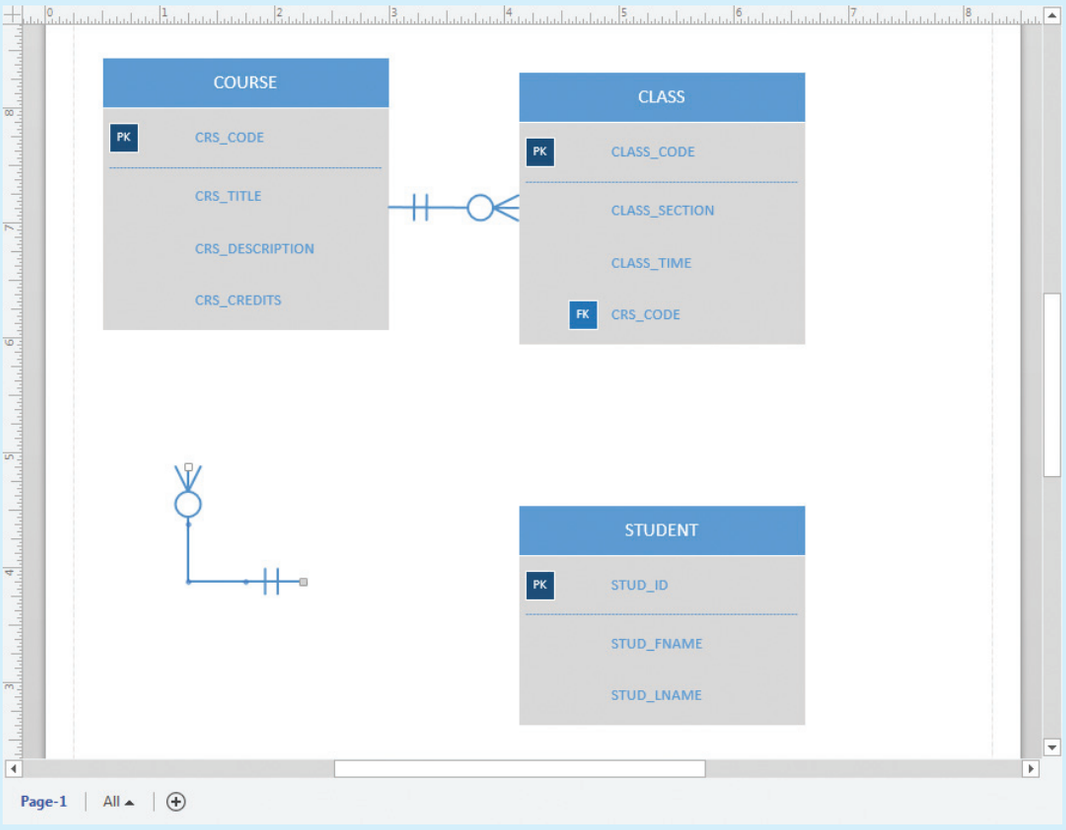
FIGURE A2.18 Setting CRS_CODE as a foreign key



A2.3.1 EDITING THE CARDINALITIES

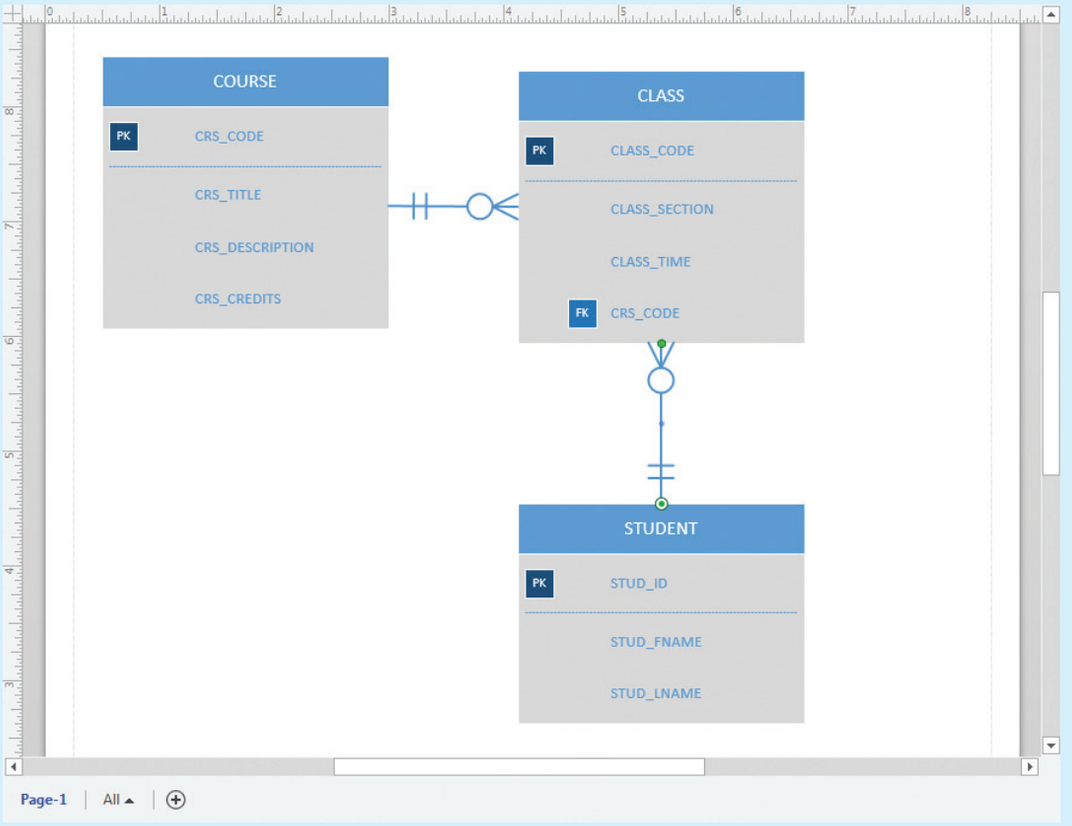
Using the same technique as above, add another relationship object to the drawing board, and set the format options the same as for the previous relationship. If you examine Figure A2.19, you'll notice that the default cardinalities of (1,1) and (0,N) are again presented. However, our business rules state that a student can enroll in many classes, and a class can have many students enrolled in it. Clearly, this will call for a M:N relationship, not a 1:M relationship; therefore, we will have to adjust the cardinalities of the relationship object.

FIGURE A2.19 Adding a second relationship object



Attach the relationship object to the CLASS and STUDENT entities, attaching the one-side of the relationship to STUDENT and attaching the many-side of the relationship to CLASS. Again, we prefer to attach the relationship object to the entity as a whole. The attached relationship object is shown in Figure A2.20.

FIGURE A2.20 Attaching the second relationship



To adjust the cardinalities, right-click the relationship object to open the context menu. From the context menu, the Crow's Foot symbols can be changed to match the cardinality of the business rules. Based on the business rules, we know that the relationship should be optional in both directions with a connectivity of "many" in both directions. The **Set Begin Symbol** option is already set to **Zero or more**, which corresponds to our desired cardinality. On the context menu, move the cursor to **Set End Symbol** and choose **Zero or more** to change the current (1,1) cardinality to (0,N) to match our business rules as shown in Figure A2.21. Your result should match Figure A2.22.

FIGURE A2.21 Setting the cardinalities

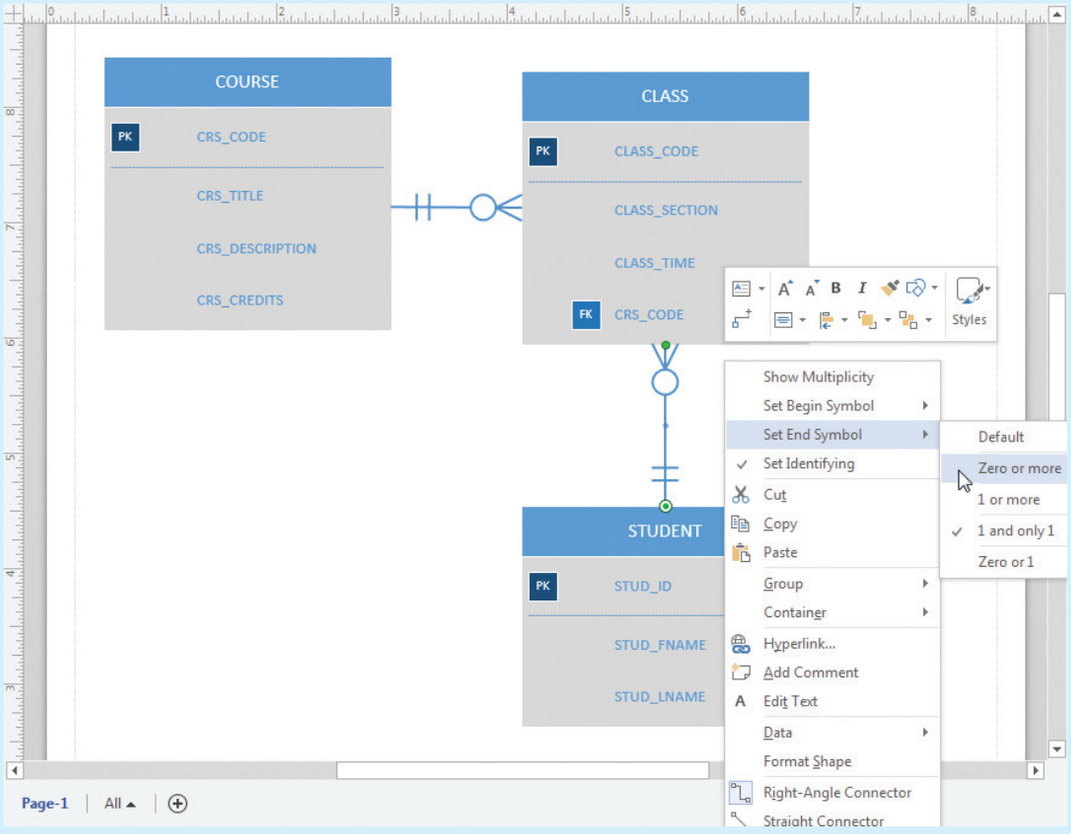
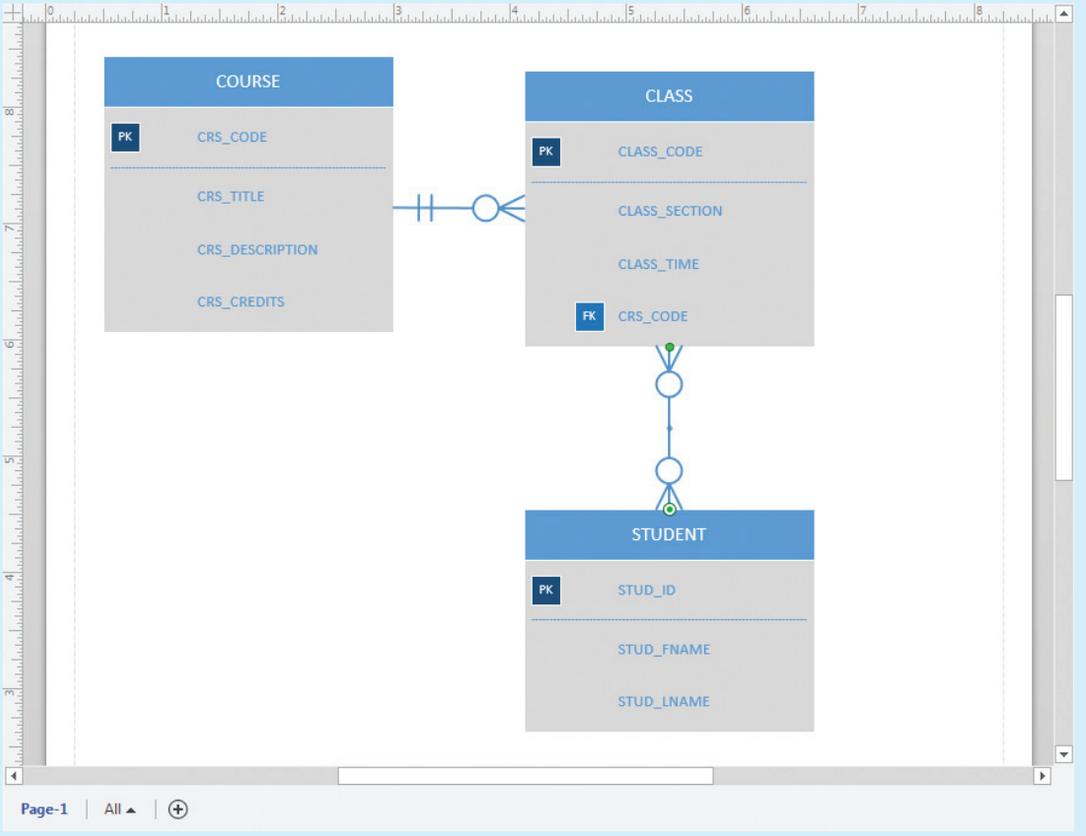
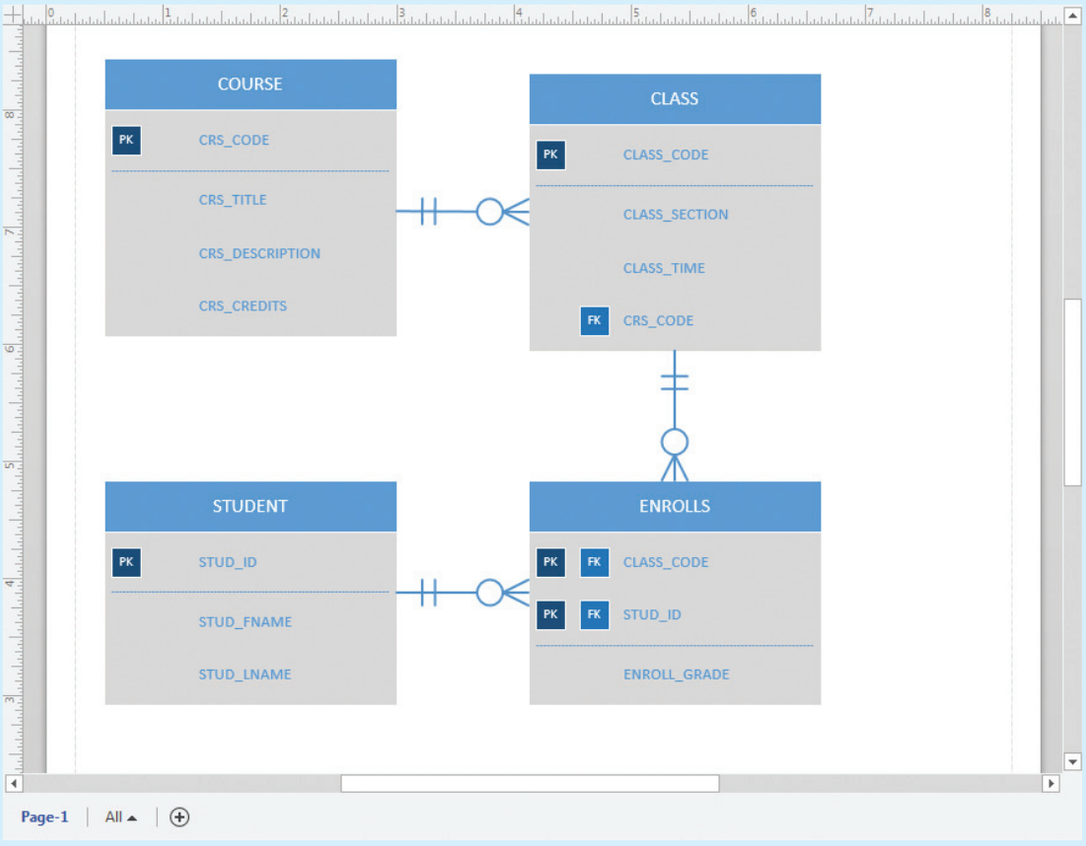


FIGURE A2.22 Completed second relationship



Notice in Figure A2.22 that there is not a foreign key to implement the many-to-many relationship between CLASS and STUDENT. As discussed in Chapter 4, Entity Relationship Modeling, many-to-many relationships are appropriate in conceptual data models. Recall that M:M relationships cannot be directly implemented in a relational database without the use of an associative or composite entity, and part of the process of converting a conceptual model to a logical model is the decomposition of M:M relationships into 1:M relationships. For practice, create the ENROLLS composite entity shown in Figure A2.23. Use **CLASS_CODE** and **STUD_ID** as a composite primary key in the ENROLLS entity, and be certain to mark them both as foreign keys as well.

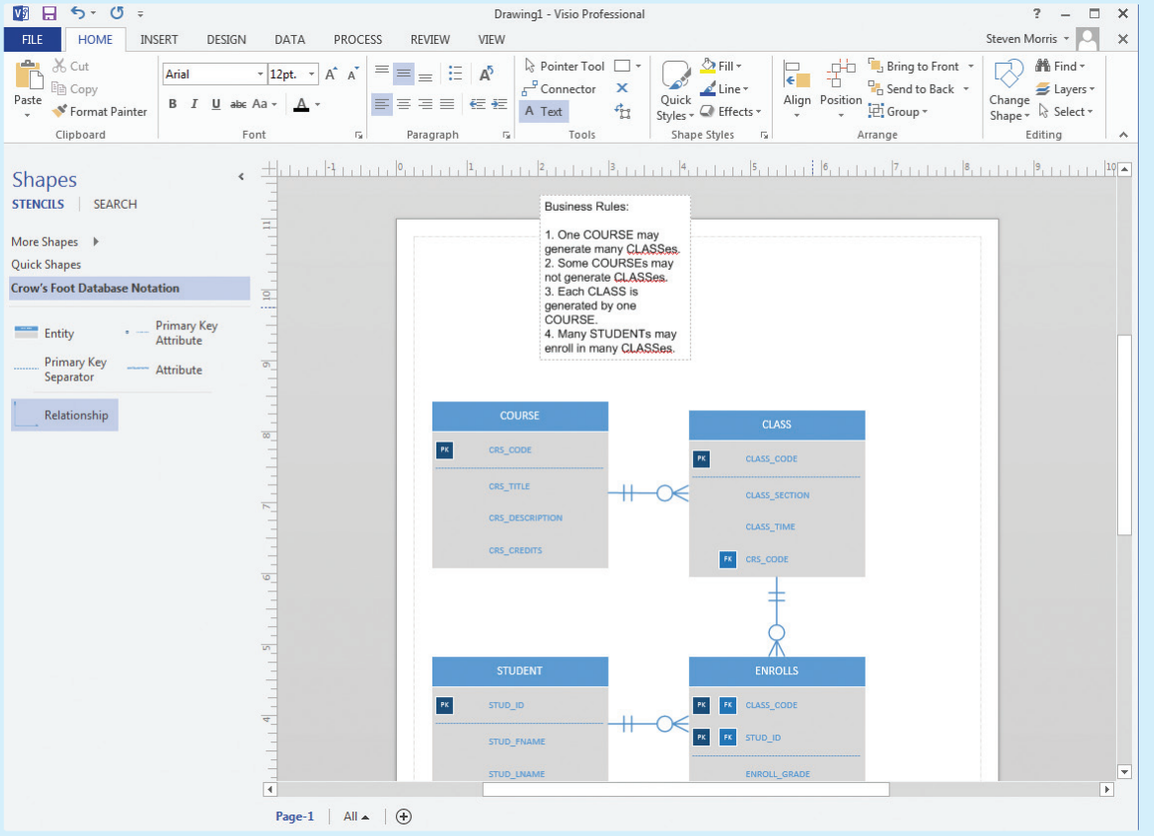
FIGURE A2.23 Final data model with composite entity



A2.4 Placing Text on the Grid

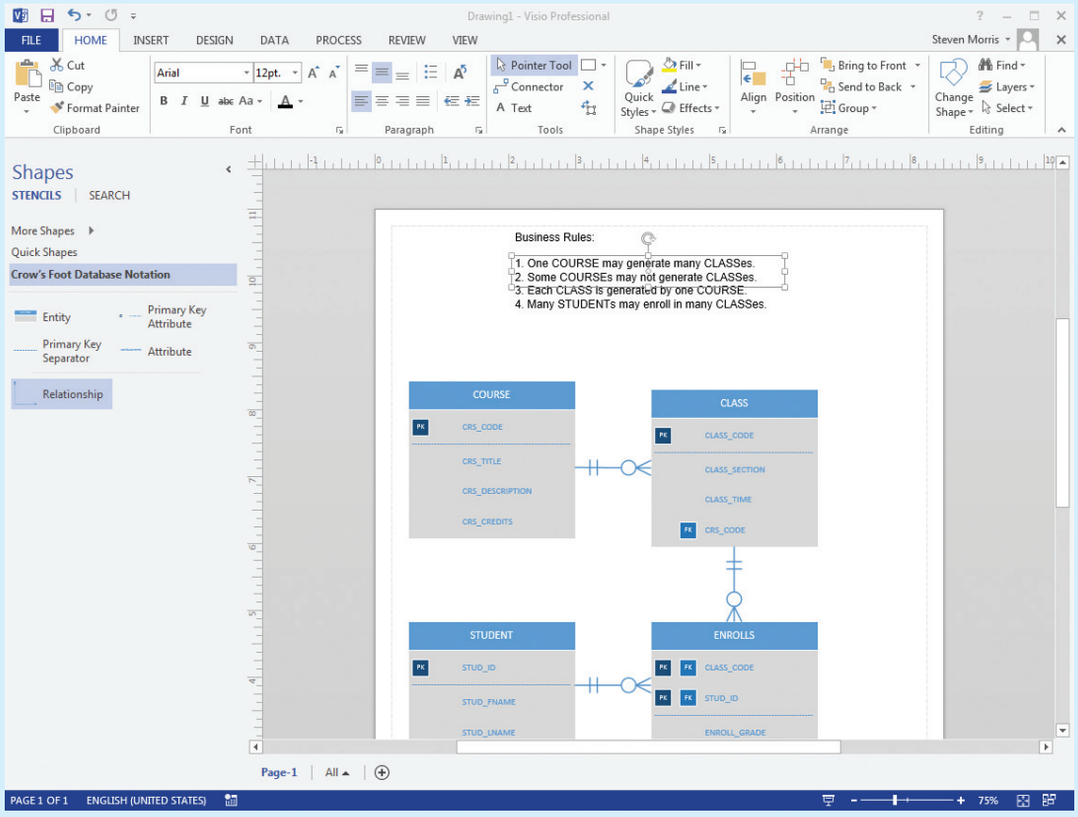
To help document the ERD, it may be helpful to place explanatory notes on the grid. Make sure that you have not selected any object by clicking a blank area of the screen. Change the **Zoom** to **75%** on the **VIEW** tab on the Ribbon; then select the **Text tool** (marked **A Text**) shown at the top of the screen in the Tools group on the **HOME** tab. You will see the effect of your selection when you note the cursor's new look. Select the text format to suit your needs—left alignment, black font color, and a font face and size of Arial 12pt have been selected in Figure A2.24. After making these selections, enter the text as shown. (You can modify any text format such as the font, size, color, and justification later.)

FIGURE A2.24 The initial text



To move the text box, you must first make sure that the Text tool has been deselected, and the **Pointer Tool** is selected. Clicking the text box produces a set of small squares (handles) shown on the text box perimeter. After the text box has been selected, you can drag and drop it as you would any other object on the screen. In fact, the text box behaves like any other Windows object. For example, you can change the size of the text box by dragging its perimeter in or out. Resize the text box so that the text format matches Figure A2.25.

FIGURE A2.25 The completed text box



Don't forget to save your Visio file before you exit. As with all Windows applications, you will be reminded to save the file if you try to close it without first saving it.