山东科技大学——测绘与空间信息学院

Python程序设计

地理信息科学系　刘洪强

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2021年3月30日星期二

课程安排：

36个学时，其中授课24个学时，实验12个学时

成绩：

出勤5% + 实验报告25% + 考试70%

章节内容

第7章 地图制图与输出

- ✓ 创建布局元素的列表
- ✓ 为布局元素指定名称
- ✓ 获得布局元素
- ✓ 更新布局元素的属性
- ✓ 获取打印机的列表
- ✓ 打印地图
- ✓ 导出地图为PDF文件
- ✓ 导出地图为图像文件
- ✓ 导出报表

7.1 创建布局元素的列表

- ArcMap中有两种视图：data view（数据视图） 和 layout view（布局视图）。无论地图页面的大小和布局如何，Data view都可用于显示地图的地理位置和表格数据、分析数据、符号化地理图层以及管理数据等。Layout view以打印页面的形式显示地图，可通过添加制图元素来创建高质量的地图，这些元素包括数据框、图层、图例、标题、指北针、比例尺和标题栏等。在arcpy.mapping模块中，每个布局元素都用布局元素类来表示，布局列表元素可以是GraphicElement、LegendElement、PictureElement、TextElement或MapSurroundElement等对象实例。

Crime_Ch4.mxd - ArcMap

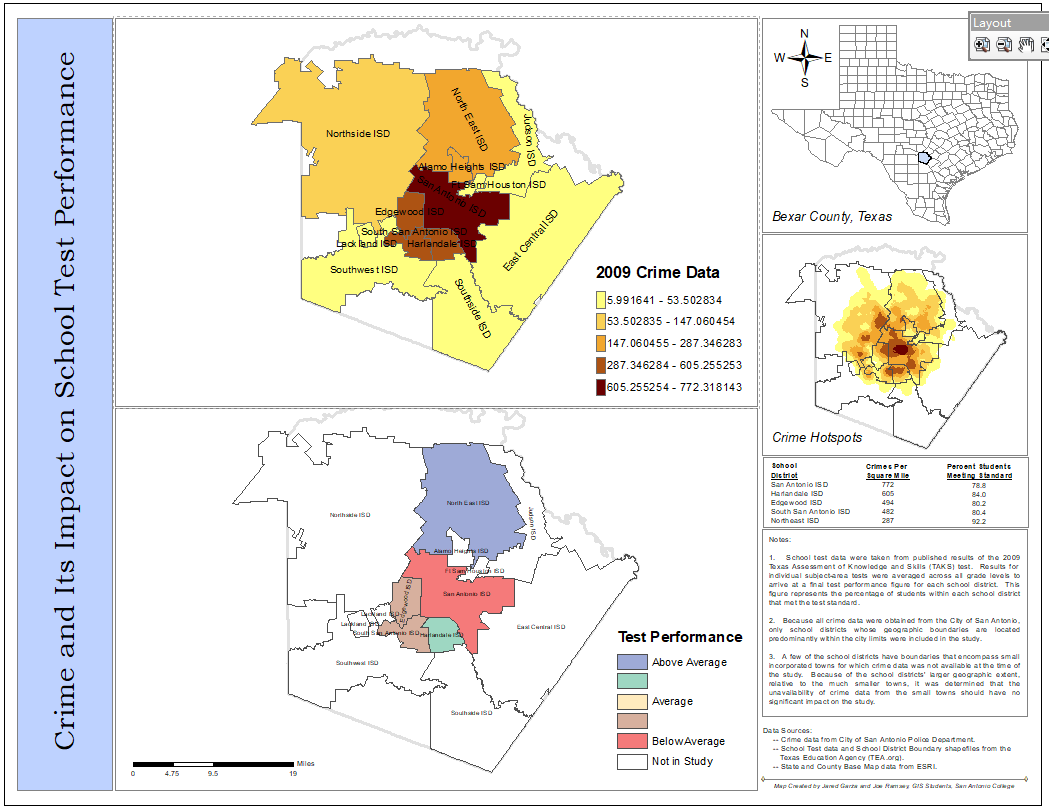
File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:769, 749

Table Of Contents

- Crime
  - C:\ArcpyBook\data\CityOfSanAntonio.gdb
    - Burglaries in 2009
    - Crime Density by School District
      - CrimeDens
      - 5.991641 - 53.502834
      - 53.502835 - 147.060454
      - 147.060455 - 287.346283
      - 287.346284 - 605.255253
      - 605.255254 - 772.318143
    - Bexar County Boundary
    - Crime2009Table
- Test_Performance
  - C:\ArcpyBook\data\CityOfSanAntonio.gdb
    - Test Performance by School District
      - Test_Perf2
      - Above Average
      - Average
      - Below Average
      - Not in Study
    - Bexar County Boundary
- Inset_Map
  - C:\ArcpyBook\data\CityOfSanAntonio.gdb
    - Bexar County Boundary

Layout 66%

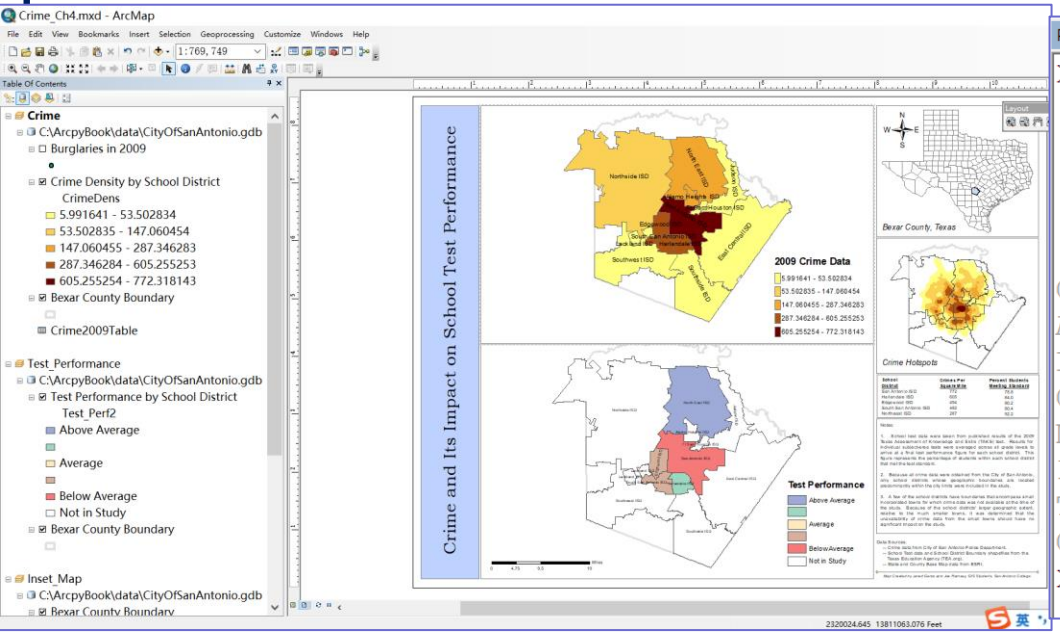


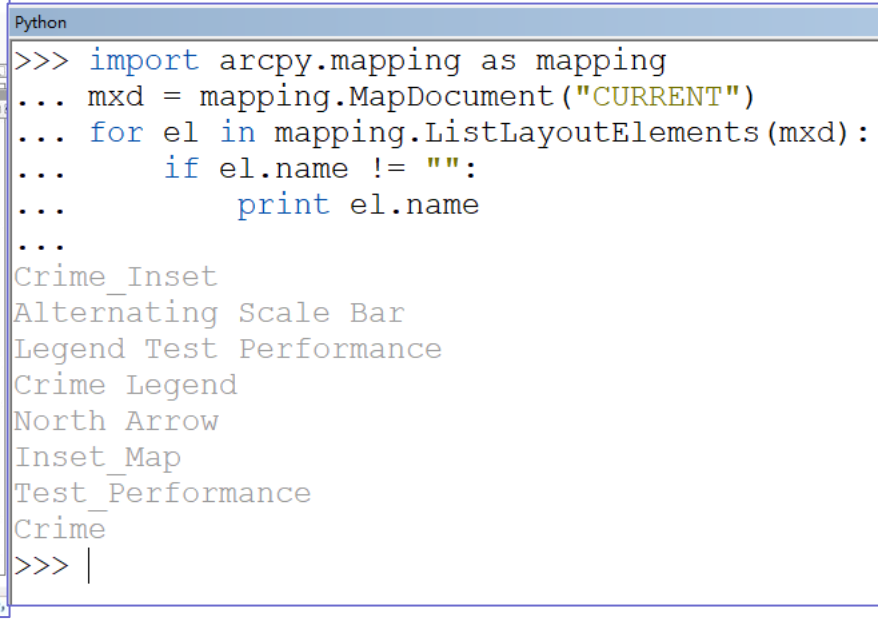
2320024.645 13811063.076 Feet

7

7.1 创建布局元素的列表

- ListLayoutElements()





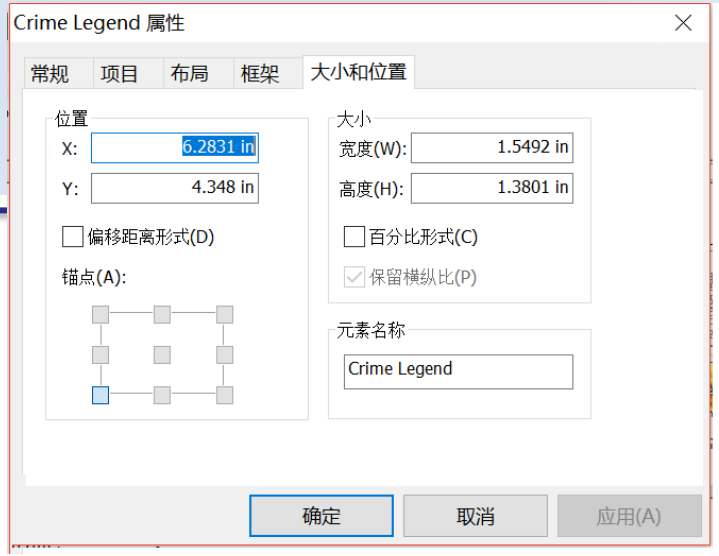
7.2 为布局元素指定名称

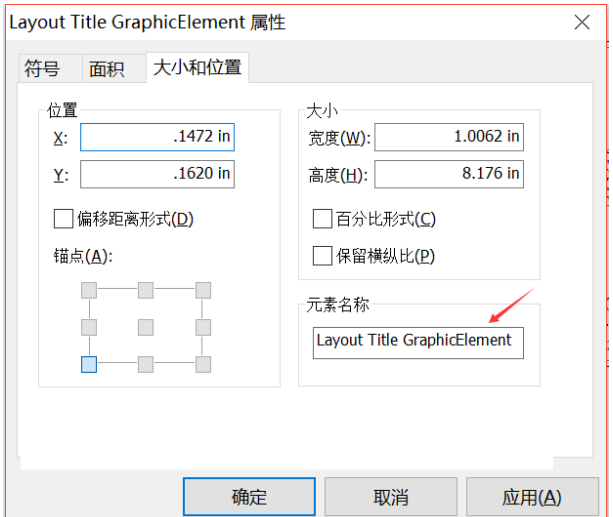
当需要用地理处理脚本访问并更改一个特定的元素时，使用ArcMap为所有的布局元素指定**唯一的名称**就显得尤为重要。

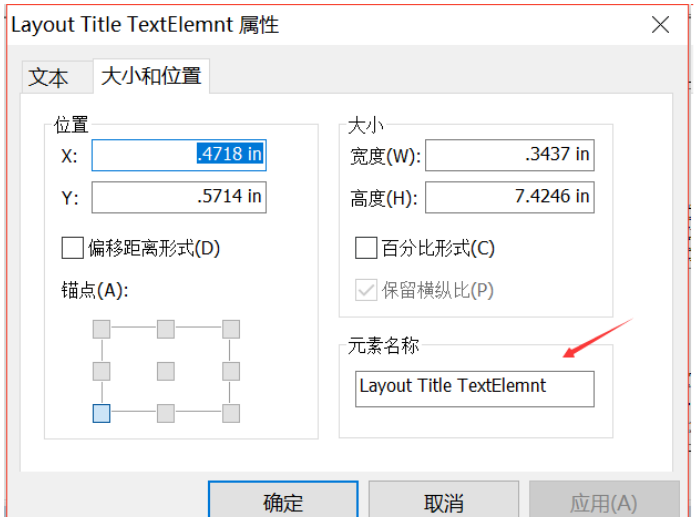
每个布局元素都属于一种元素类型，且都可以指定一个唯一的名称，这样才可以单独访问该布局元素。

7.2


数据框 属性
常规
数据框
坐标系
照明度
格网
要素缓存
注记组
范围指示器
框架
大小和位置
位置
X: 1.1814 in
Y: 4.229 in
偏移距离形式(D)
锚点(A):
大小
宽度(W): 6.8063 in
高度(H): 4.1103 in
百分比形式(C)
保留横纵比(P)
元素名称
Crime
确定
取消
应用(A)


Crime Legend 属性
常规
项目
布局
框架
大小和位置
位置
X: 6.2831 in
Y: 4.348 in
偏移距离形式(D)
锚点(A):
大小
宽度(W): 1.5492 in
高度(H): 1.3801 in
百分比形式(C)
保留横纵比(P)
元素名称
Crime Legend
确定
取消
应用(A)


Layout Title GraphicElement 属性
符号
面积
大小和位置
位置
X: .1472 in
Y: .1620 in
偏移距离形式(D)
锚点(A):
大小
宽度(W): 1.0062 in
高度(H): 8.176 in
百分比形式(C)
保留横纵比(P)
元素名称
Layout Title GraphicElement
确定
取消
应用(A)


Layout Title TextElemnt 属性
文本
大小和位置
位置
X: .4718 in
Y: .5714 in
偏移距离形式(D)
锚点(A):
大小
宽度(W): .3437 in
高度(H): 7.4246 in
百分比形式(C)
保留横纵比(P)
元素名称
Layout Title TextElemnt
确定
取消
应用(A)

7.3 获得布局元素

布局视图中包含大量的制图元素，但是对于一个特定的地理处理脚本而言，很多元素都是多余的。通过向ListLayoutElements()函数中传入元素类型参数和通配符参数，可以限制返回的布局元素。元素类型参数用于定义要返回的布局元素类型，**通配符参数**使用名称中的部分字符来筛选元素。

Crime_Ch4.mxd - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

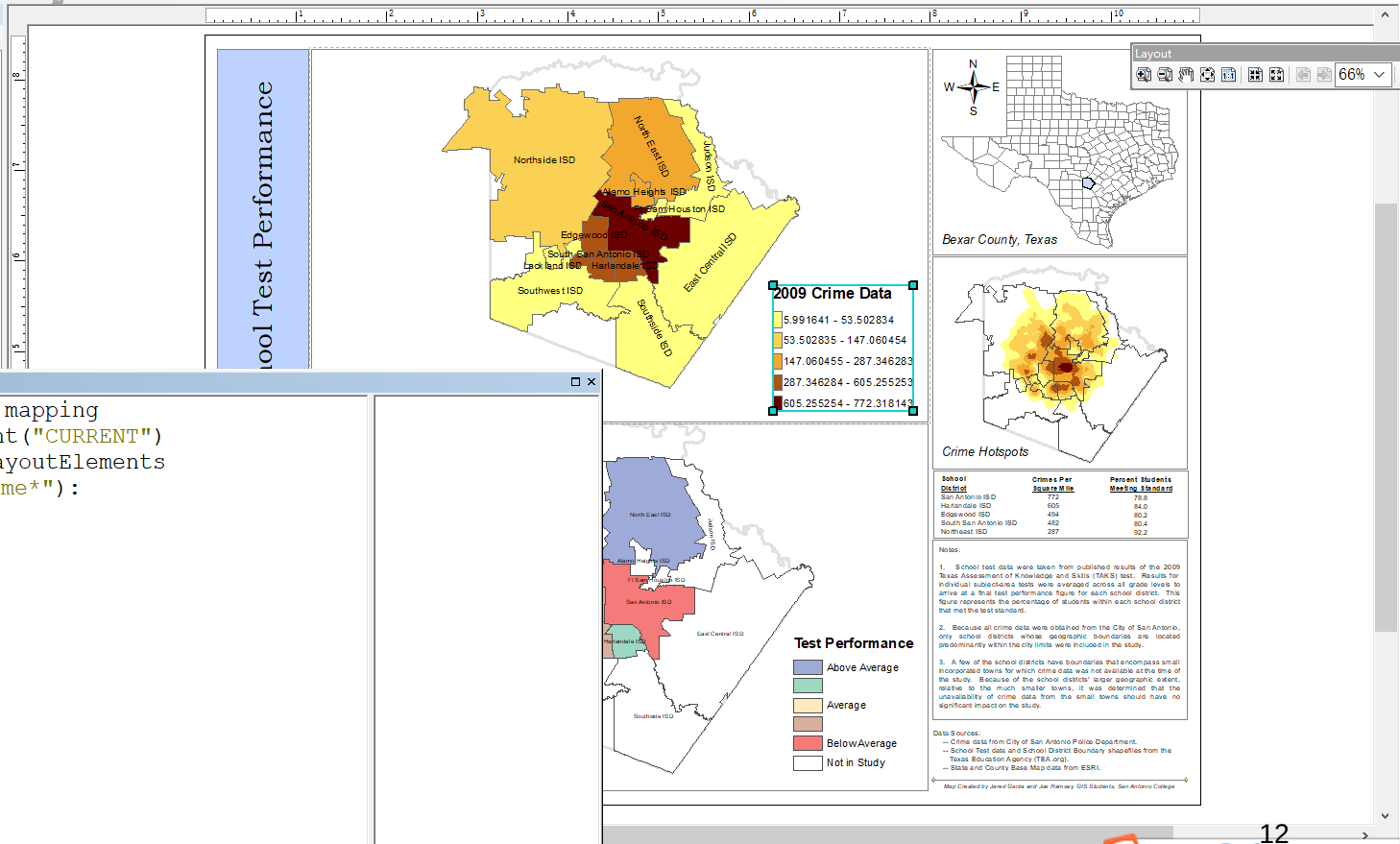
1:769, 749

Table Of Contents

- C:\ArcpyBook\data\CityOfSanAntonio.gdb
  - Burglaries in 2009
  - Crime Density by School District
  - Bexar County Boundary
  - Crime2009Table
- Test_Performance
  - C:\ArcpyBook\data\CityOfSanAntonio.gdb
  - Test Performance by School District
    - Test_Perf2
    - Above Average

Python

```
>>> import arcpy.mapping as mapping
... mxd = mapping.MapDocument("CURRENT")
... for el in mapping.ListLayoutElements
 (mxd,"LEGEND_ELEMENT","*Crime*"):
...     print el.name
...
Crime Legend
>>>
```



Layout 66%

Crime_Ch4.mxd - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:787, 625

63%

Table Of Contents

Crime

Crime Legend Properties

General | Items | Layout | Frame | Size and Position

Position

X: 6.2831 in

Y: 4.348 in

As Offset Distance

Anchor Point:

Size

Width: 1.5492 in

Height: 1.3801 in

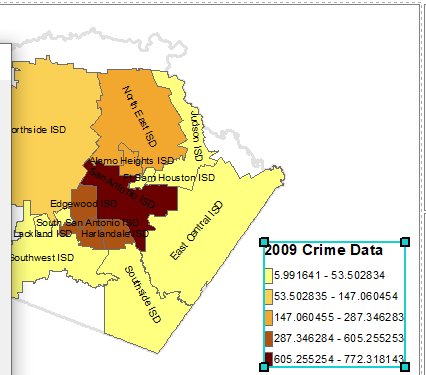
As Percentage

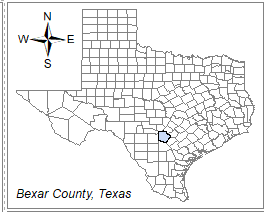
Preserve Aspect Ratio

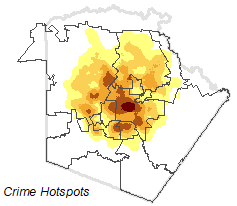
Element Name

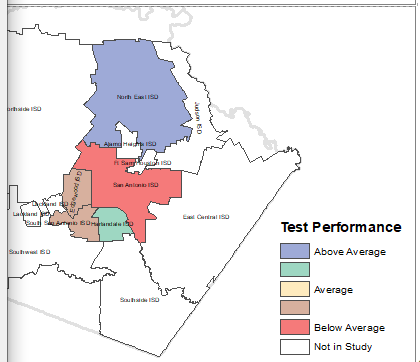
Crime Legend

确定 取消 应用(A)









School District	Crimes Per Square Mile	Percent Students Meeting Standard
San Antonio ISD	772	78.8
Harlandale ISD	605	84.0
Edgewood ISD	494	80.2
South San Antonio ISD	482	80.4
Northeast ISD	287	92.2

Notes:

1. School test data were taken from published results of the 2009 Texas Assessment of Knowledge and Skills (TAKS) test. Results for individual subject-area tests were averaged across all grade levels to arrive at a final test performance figure for each school district. This figure represents the percentage of students within each school district that met the test standard.

2. Because all crime data were obtained from the City of San Antonio, only school districts whose geographic boundaries are located predominantly within the city limits were included in the study.

3. A few of the school districts have boundaries that encompass small incorporated towns for which crime data was not available at the time of the study. Because of the school districts' larger geographic extent, relative to the much smaller towns, it was determined that the unavailability of crime data from the small towns should have no significant impact on the study.

Data Sources:
-- Crime data from City of San Antonio Police Department.
-- School Test data and School District Boundary shapefiles from the Texas Education Agency (TEA.org).
-- State and County Base Map data from ESRI.

Map Created by Jared Garza and Joe Ramsey, GIS Students, San Antonio College

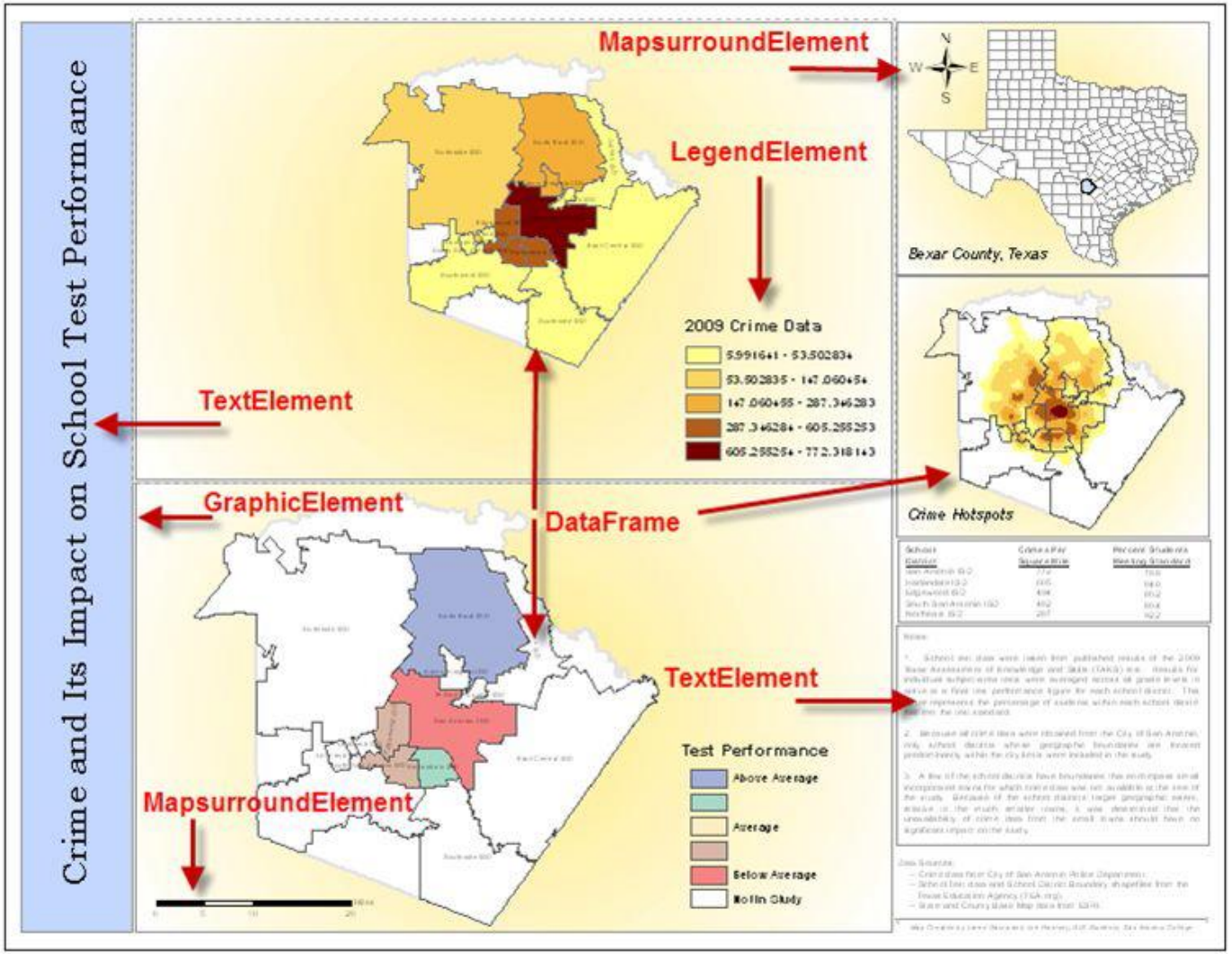
13

7.3 获得布局元素

布局元素类型

```
* DATAFRAME_ELEMENT:    Dataframe element
* GRAPHIC_ELEMENT:    Graphic element
* LEGEND_ELEMENT:    Legend element
* MAPSURROUND_ELEMENT:    Mapsurround element
* PICTURE_ELEMENT:    Picture element
* TEXT_ELEMENT:    Text element
```

7.3 获得


Crime and Its Impact on School Test Performance
MapsurroundElement
LegendElement
TextElement
GraphicElement
DataFrame
TextElement
MapsurroundElement
2009 Crime Data
Test Performance
Above Average
Average
Below Average
Not In Study
Bexar County, Texas
Crime Hotspots

7.4 更新布局元素的属性

布局元素有多种不同的类型，如图形、图例、文本、地图整饰和图片等。在arcpy.mapping模块中，每种类型的元素都用一个类来表示。每个类都具有许多**属性**，可以通过编程来**更改**元素。

DataFrame类提供了访问地图文档文件中数据框的属性，它可与地图单元和页面布局单元一起使用，具体使用哪一个取决于当前正在使用的属性。页面布局属性的“positioning and sizing”选项卡中可用的属性包括elementPositionX, elementPositionY, elementWidth和elementHeight等。

页面布局中的每个元素都可以作为元素对象的一个实例返回。

Crime_Ch4.mxd - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:769, 749

63%

Table Of Contents

- Crime
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      - CrimeDens
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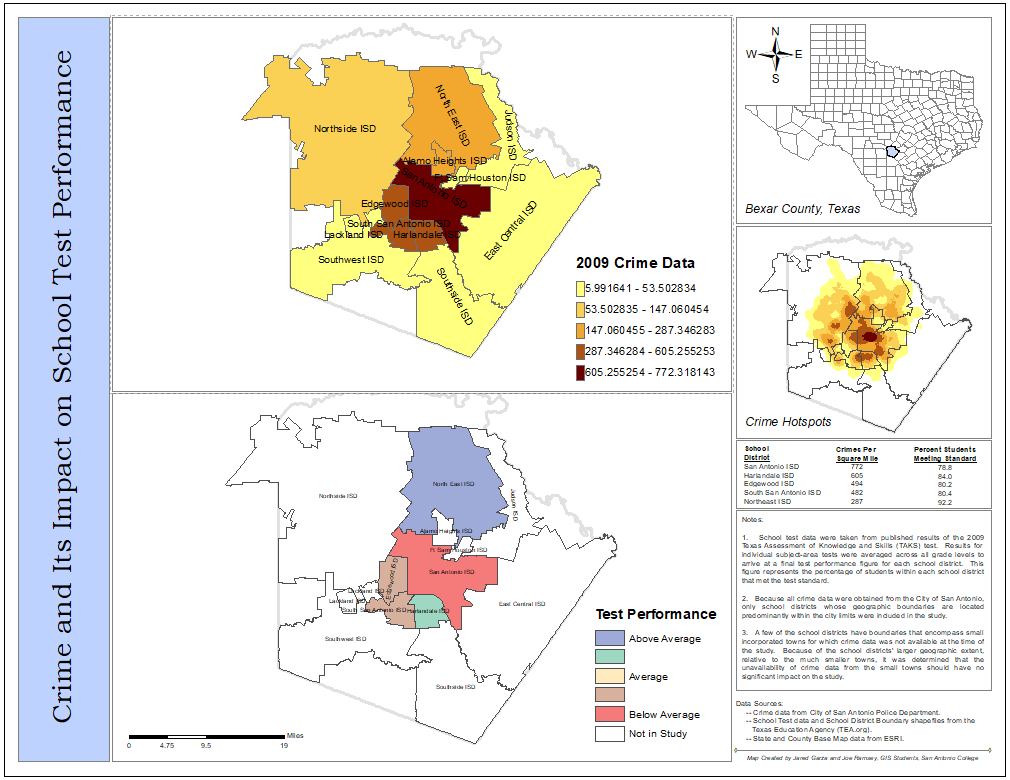
      - 53.502835 - 147.060454
      - 147.060455 - 287.346283
      - 287.346284 - 605.255253
      - 605.255254 - 772.318143
    - Bexar County Boundary
    - Crime2009Table
- Test_Performance
  - C:\ArcpyBook\data\CityOfSanAntonio.gdb
    - Test Performance by School District
      - Test_Perf2
      - Above Average
      - Average
      - Below Average
      - Not in Study
    - Bexar County Boundary
- Inset_Map
  - C:\ArcpyBook\data\CityOfSanAntonio.gdb
    - Bexar County Boundary
    - Texas Counties
- Crime_Inset
  - C:\ArcpyBook\data\CityOfSanAntonio.gdb
    - School_Districts
    - Crime Surface



1933975.408 13612087.436 Feet

1.64 4.95 Inches

Crime_Ch4.mxd - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:769, 749

63%

Table Of Contents

- Crime
  - C:\ArcpyBook\data\CityOfSanAntonio.gdb
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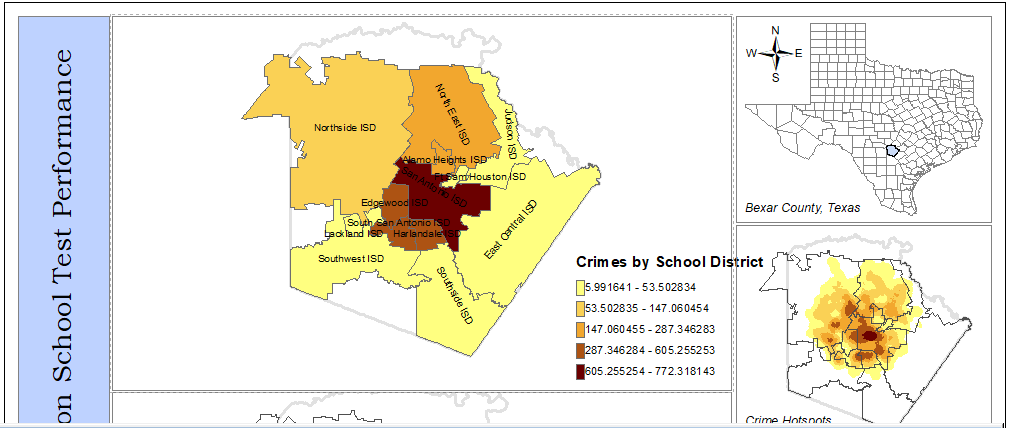
    - Texas Counties
- Crime_Inset
  - C:\ArcpyBook\data\CityOfSanAntonio.gdb
    - School_Districts
    - Crime Surface



Python

```
>>> import arcpy.mapping as mapping
... mxd = mapping.MapDocument("CURRENT")
... elLeg = mapping.ListLayoutElements(mxd,
"LEGEND_ELEMENT","*Crime*")[0]
... elLeg.title = "Crimes by School District"
... for item in elLeg.listLegendItemLayers():
...     print item.name
...
Burglaries in 2009
Crime Density by School District
>>>
```

Inches

WHY？？？

Crime_Ch4.mxd - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:769, 749

63%

Table Of Contents

Crime

C:\ArcpyBook\data\CityOfSanAntonio.gdb

Burglaries in 2009

Crime Density by School District

CrimeDens

5.991641 - 53.502834

Test_F

C:\A

Inset_

C:\A

Crime Legend Properties

General Items Layout Frame Size and Position

Apply settings to selected item(s)

Select All Select None

Burglaries in 2009

Crime Density by School Distric

Font

Apply to all labels

B I U

Bold

Symbol...

Map Extent Options

Only show classes that are visible in the current map extent

Show feature count

(Count) Show thousands separator

Use current index feature as the map extent (data driven pages)

Item Columns

Place item(s) in a new column

Crimes by School District

5.991641 - 53.502834

53.502835 - 147.060454

147.060455 - 287.346283

287.346284 - 605.255253

605.255254 - 772.318143

Bexar County, Texas

Crime Hotspots

Test Performance

LegendElement.listLegendItemLayers()
Returns a list of Layer object references for every legend item in a legend.

20

7.5 获取可用的打印机的列表

- ListPrinterNames()

使用 PrintMap()函数打印地图之前，通常需要先调用ListPrinterNames()函数，它会返回本地计算机的可用打印机的列表。然后迭代打印机列表，将打印机名称作为参数输入到PrintMap()函数中，就可以找到指定的打印机。

7.5 获取可用的打印机的列表

- ListPrinterNames()

Python

```
>>> import arcpy.mapping as mapping
... mxd = mapping.MapDocument("CURRENT")
... for printerName in mapping.ListPrinterNames():
...     print printerName
...
OneNote for Windows 10
OneNote (Desktop)
Microsoft XPS Document Writer
Microsoft Print to PDF
HP Laser NS MFP 1005 PCLm-S
Fax
Adobe PDF
>>>
```

7.6 打印地图

- PrintMap()

使用PrintMap()函数可以很容易地将地图文档布局输出到打印机。默认情况下，打印任务会输出到地图文档保存的**默认打印机**，但也可以通过自定义一个特定打印机来完成打印任务。

在调用PrintMap()函数之前，通常需要先调用ListPrinterNames()函数，返回本地计算机的可用打印机列表。然后迭代打印机列表，将打印机名称作为参数输入到PrintMap()函数中，就可以找到指定的打印机。

Crime_Ch4.mxd - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:769, 749

63%

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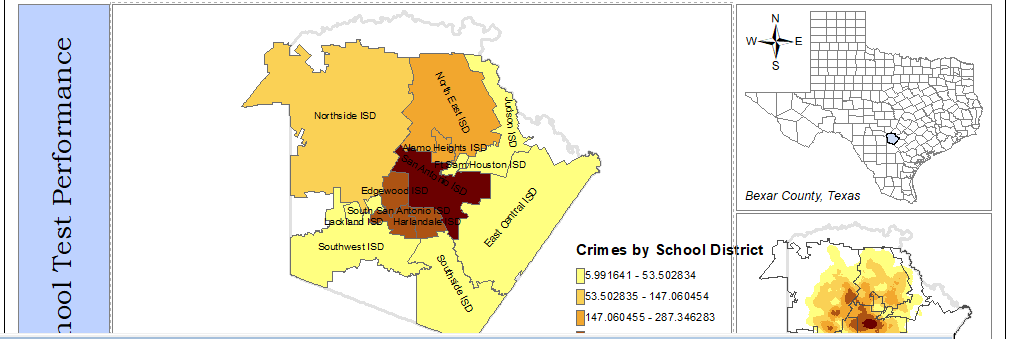
      - 147.060455 - 287.346283
      - 287.346284 - 605.255253
      - 605.255254 - 772.318143
    - Bexar County Boundary
    - Crime2009Table
- Test_Performance
  - C:\ArcpyBook\data\CityOfSan
    - Test Performance by School
      - Test_Perf2
      - Above Average
      - Average
      - Below Average
      - Not in Study
    - Bexar County Boundary
- Inset_Map
  - C:\ArcpyBook\data\CityOfSan



Python

```
>>> import arcpy.mapping as mapping
... mxd = mapping.MapDocument("CURRENT")
... for df in mapping.ListDataFrames(mxd):
...     if df.name == "Test_Performance":
...         mapping.PrintMap(mxd,"",df)
...
```

7.7 导出地图为PDF文件

- ExportToPDF()

PDF是一种非常普遍的交换格式，可以在多种不同的平台上浏览和打印文件。ArcPy制图模块提供的ExportToPDF()函数可以将数据框或页面布局导出为PDF文件。**默认情况下，ExportToPDF()函数导出页面布局**，但是可以传入一个引用特定数据框的可选参数，即可导出**数据框**。

ExportToPDF()函数需要两个参数：一个是对地图文档的引用，一个是输出的PDF文件的全路径。该函数还有一些其他的可选参数，包括特定的数据框参数，以及一些与输出内容和文件质量相关的参数。

Crime_Ch4.mxd - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:530, 919

Table Of Contents

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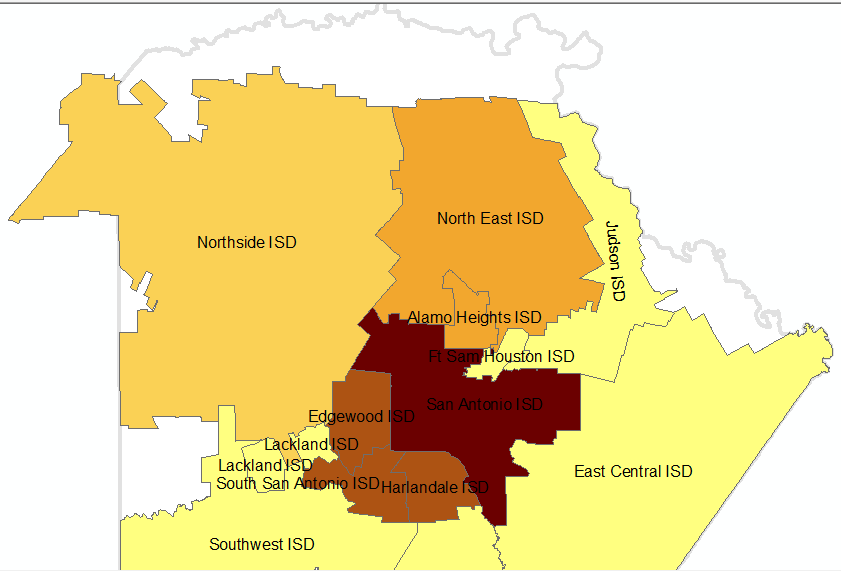
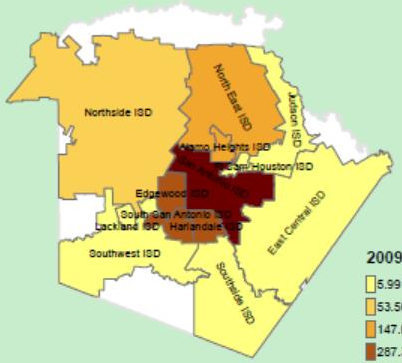
- Inset_Map
  - C:\ArcpyBook\data\CityOfSar



Python

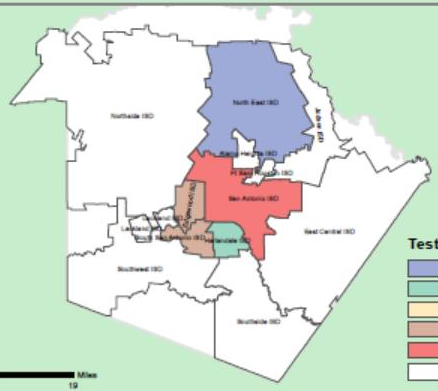
```
>>> import arcpy.mapping as mapping
... mxd = mapping.MapDocument("CURRENT")
... mapping.ExportToPDF(mxd,r"c:\ArcpyBook\Ch4
 \Map_PageLayout.pdf")
...
>>>
```

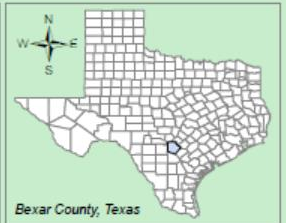
Crime and Its Impact on School Test Performance



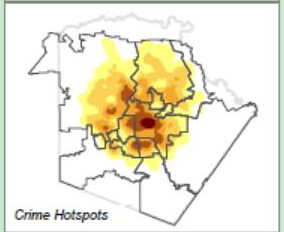
2009 Crime Data

- 5.991641 - 53.502834
- 53.502835 - 147.060454
- 147.060455 - 287.346283
- 287.346284 - 605.255253
- 605.255254 - 772.318143





Bexar County, Texas



Crime Hotspots

School District	Crimes Per Square Mile	Percent Students Meeting Standard
San Antonio ISD	772	76.8
Harlandale ISD	605	84.0
Edgewood ISD	494	80.2
South San Antonio ISD	482	80.4
Northeast ISD	287	92.2

Notes:

1. School test data were taken from published results of the 2009 Texas Assessment of Knowledge and Skills (TAKS) test. Results for individual subject-area tests were averaged across all grade levels to arrive at a final test performance figure for each school district. This figure represents the percentage of students within each school district that met the test standard.

2. Because all crime data were obtained from the City of San Antonio, only school districts whose geographic boundaries are located predominantly within the city limits were included in the study.

3. A few of the school districts have boundaries that encompass small incorporated towns for which crime data was not available at the time of the study. Because of the school districts' larger geographic extent, relative to the much smaller towns, it was determined that the unavailability of crime data from the small towns should have no significant impact on the study.

Data Sources:
- Crime data from City of San Antonio Police Department.
- School Test data and School District Boundary shapefiles from the Texas Education Agency (TEA.org).
- State and County Base Map data from ESRI.

Map Created by Jared Garza and Joe Hansley, GIS Students, San Antonio College

Crime_Ch4.mxd - ArcMap

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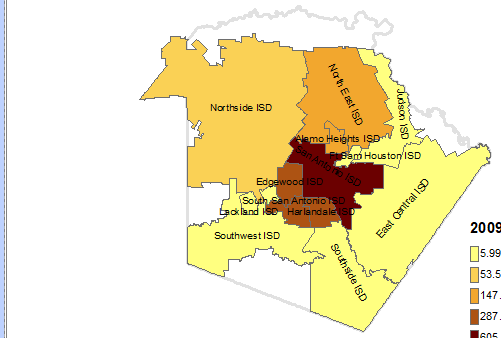
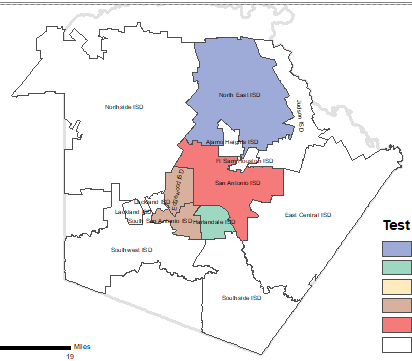
63%

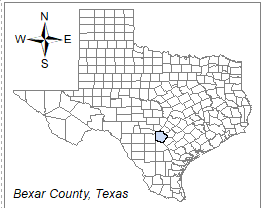
Table Of Contents

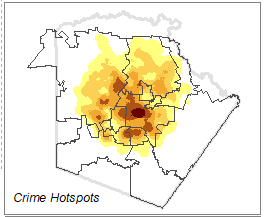
- Crime
  - C:\ArcpyBook\data\CityOfSanAntonio.g
  - Burglaries in 2009
  - Crime Density by School District
    - CrimeDens
    - 5.991641 - 53.502834
    - 53.502835 - 147.060454
    - 147.060455 - 287.346283
    - 287.346284 - 605.255253
    - 605.255254 - 772.318143
  - Bexar County Boundary
  - Crime2009Table
- Test_Performance
  - C:\ArcpyBook\data\CityOfSanAntonio.g
  - Test Performance by School District
    - Test_Perf2
    - Above Average
    - Average
    - Below Average
    - Not in Study
  - Bexar County Boundary
- Inset_Map

Crime and Its Impact on School Test Performance









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-- School Test data and School District Boundary shapefiles from the Texas Education Agency (TEA.org).
-- State and County Base Map data from ESRI.

Map Created by Jared Gans and Joe Ramsey, GIS Students, San Antonio College

28

1960610.663 13745620.841 Feet

2.10 6.88 Inches

Crime_Ch4.mxd - ArcMap

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Table Of Contents

- Crime
  - C:\ArcpyBook\data\CityOfSanAntonio.gdb
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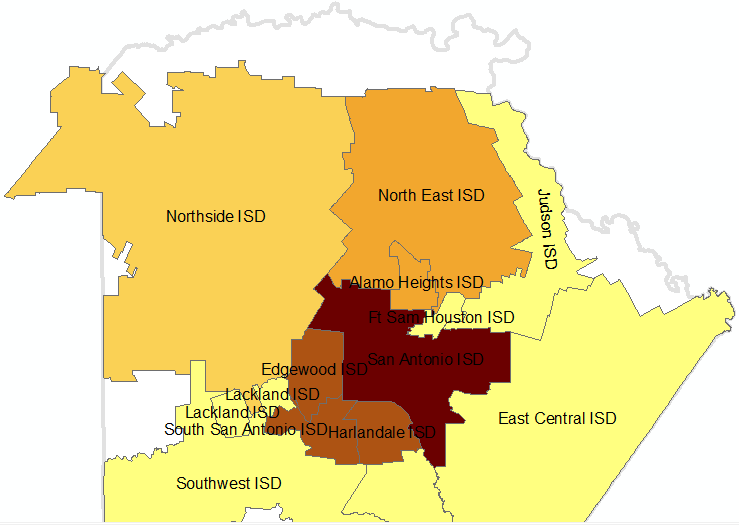
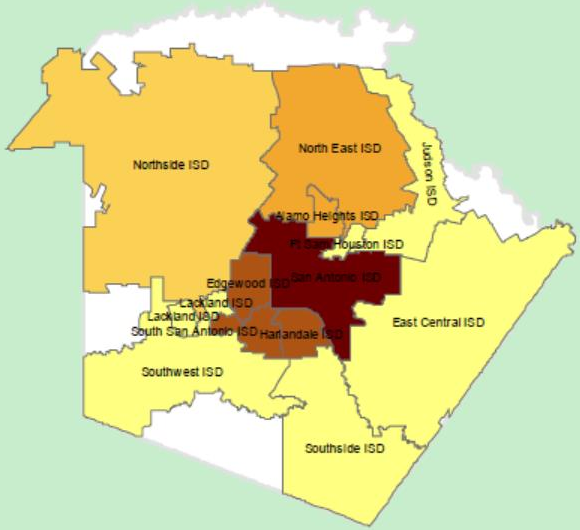
      - 605.255254 - 772.318143
    - Bexar County Boundary
    - Crime2009Table
- Test_Performance
- Inset_Map
  - C:\ArcpyBook\data\CityOfSanAntonio.gdb
    - Bexar County Boundary
    - Texas Counties
- Crime_Inset
  - C:\ArcpyBook\data\Ci
    - School_Districts
    - Crime Surface
    - Bexar County Bound



Python

```
>>> import arcpy.mapping as mapping
... mxd = mapping.MapDocument("CURRENT")
... for df in mapping.ListDataFrames(mxd):
...     if df.name == "Crime":
...         df.referenceScale = df.scale
...         mapping.ExportToPDF(mxd,r"c:\ArcpyBook\Ch4
 \DataFrameCrime.pdf",df)
...
>>>
```


Northside ISD
North East ISD
Judson ISD
Alamo Heights ISD
Houston ISD
San Antonio ISD
Edgewood ISD
Lackland ISD
Lackland ISD
South San Antonio ISD
Harlandale ISD
East Central ISD
Southwest ISD
Southside ISD

7.8 导出地图为图像文件

- ExportToJPEG()等

arcpy.mapping提供的导出函数不仅可以将数据框和页面布局导出为PDF文件，而且可以将其导出为图像文件，其中可用的图像格式有AI、BMP、EMF、EPS、GIF、JPEG、SVG和TIFF等。不同类型的图像文件需要使用不同的导出函数，如ExportToJPEG()、ExportToGIF()和ExportToBMP()等。

Crime_Ch4.mxd - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

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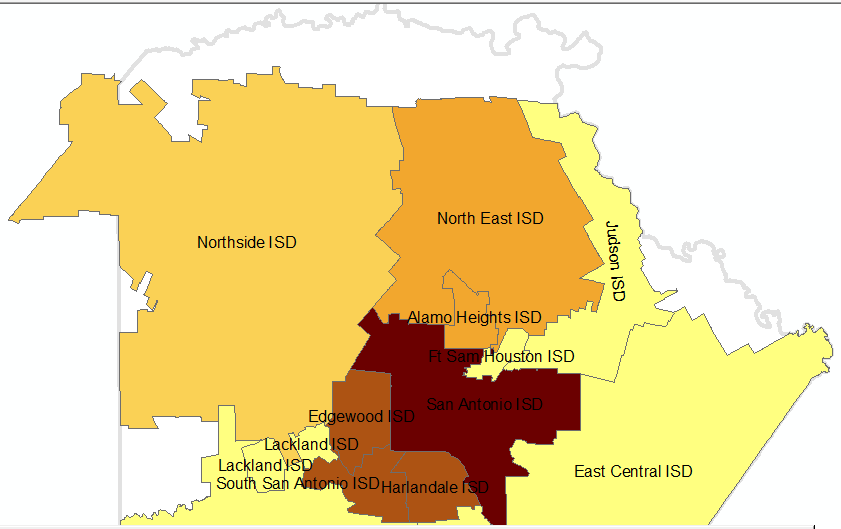
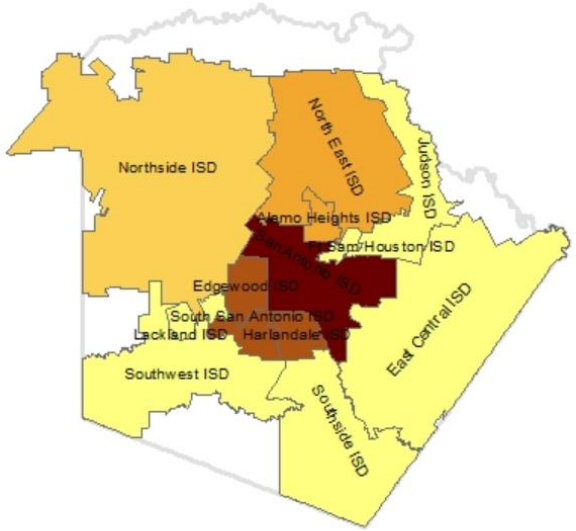


Python

```
>>> import arcpy.mapping as mapping
... mxd = mapping.MapDocument("CURRENT")
... for df in mapping.ListDataFrames(mxd):
...     if df.name == "Crime":
...         mapping.ExportToJPEG(mxd,r"c:\ArcpyBook\Ch4
 \DataFrameCrime.jpg",df)
...
>>>
```


Northside ISD
North East ISD
Judson ISD
Alamo Heights ISD
Sam Houston ISD
San Antonio ISD
Edgewood ISD
South San Antonio ISD
Lackland ISD
Harlandale ISD
East Central ISD
Southwest ISD
Southside ISD

7.9 导出报表

- ExportReport()

arcpy.mapping提供的导出函数不仅可以将数据框和页面布局导出为PDF文件，而且可以将其导出为图像文件，其中可用的图像格式有AI、BMP、EMF、EPS、GIF、JPEG、SVG和TIFF等。不同类型的图像文件需要使用不同的导出函数，如ExportToJPEG()、ExportToGIF()和ExportToBMP()等。

7.9 导出报表

- ExportReport()

ExportReport(report_source, report_layout_file, output_file)

- report_source：图层或表视图对象的引用
- report_layout_file：报表模板文件
- output_file：输出文件路径

The End