Tapping Into the Power of Python

Data mining, data processing, logging, and e-mails

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Download the code listings for this article.

The Python programming language, first introduced in 1991, has made its way to the forefront of GIS programming in recent years. As a high-level programming language, Python offers clear syntax; readability; very strong and dynamic typing; automatic garbage collection; extensive standard libraries and third-party libraries for tackling virtually any task; a helpful, friendly user community; and, of course, an open-source license.

So what does all of this mean to GIS users? Several things. If you already have some programming experience with other languages, Python will be very easy for you to learn. If you have virtually no programming experience, you don't have to get a bachelor's degree in computer science to learn Python. Its strict adherence to structured form that uses indentation and white space to delimit statement blocks and its use of simple English keywords make Python incredibly easy for novices to read and understand.

If you need help, you can find it in the form of online tutorials, blogs, forums—you name it. Also, it appears that with the imminent release of ArcGIS 9.3 in mid-2008, ESRI has committed to using Python as its preferred language for geoprocessing scripting. Moreover, the extensive standard modules—as well as a plethora of third-party modules available under the open-source license—make Python, as a geoprocessing platform, capable of doing anything.

That's right, I said Python can do anything. Unfortunately, I don't have enough time to enumerate all of Python's strengths nor do I have an unlimited word count for this article, so I can't tell you everything Python can do. However, this article provides some highlights: lists and dictionaries, data mining, text file processing, logging process results to log files, and sending simple e-mails. All these capabilities can come in quite handy.

Lists and Dictionaries—Your New Best Friends

It is often said the list is Python's workhorse data type and for good reason. Lists come in handy for many tasks. In particular, they work well as iterators. Lists are ordered collections of arbitrary objects in which each object resides in its own location (or index) within the list as shown in Listing 1. Using a simple for-loop, it is easy to iterate through a list and print its members to standard output at a command prompt (stdout). List iterations will be demonstrated in greater detail later in this article.

```
>>> # create a new list
>>> a = ['zero','one','two','three']
>>> # indexing is zero-based
>>> print a[0]
'zero'
>>> # iterate through the list, print out members
>>> for b in a:
...     print b
...
'zero'
'one'
'two'
'three'
```

Listing 1: Iterating through a list

Old-school GIS users are intimately familiar with lookup tables. Python's version of a lookup table is called a dictionary. In Python, a dictionary is a built-in data type that defines one-to-one relationships between keys and values. Using a Python dictionary is similar to looking up a definition in a glossary: the word is the key and its definition is the value. Listing 2 shows a simple dictionary of land-use keys and values. This demonstration may seem trivial, but lists and dictionaries are the building blocks for bigger and better things to come.

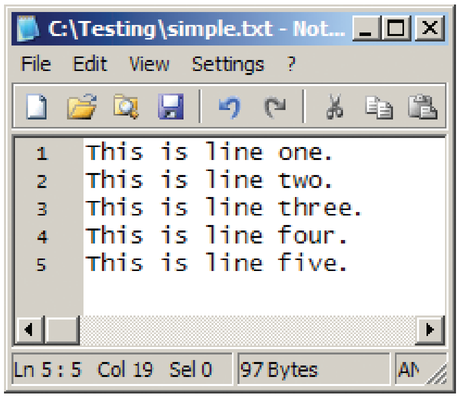
Fetching Datasets from the Web

The text file we will use for the remainder of this tutorial is located on the Web. Sure, we could open a Web browser, navigate to the site, and download the data by right-clicking on each file and saving it locally, but that is so 1999, isn't it? Instead, let's look at how we might fetch data from the Web using Python and the urllib module from the standard library as shown in Listing 3.

Working with Text Files

More people are becoming aware of the elegance of the once omnipresent text file. Text files are simple, cross-platform, and (thanks to Python) quite easy to parse and process. As a matter of fact, this article was originally written in a text file. Python's standard library provides all the tools needed to process text files. Listing 4 demonstrates how to open the text file, read all of the lines into memory, and print them to standard output. Figure 1 illustrates the output.

Comma-separated values (CSV) files are another common text file format that can be easily processed using Python's standard library. The csv module in Python provides tools to read and write tabular data in CSV format. It is in much the same way as the code for opening a plain text file.


C:\Testing\simple.txt - Not...
File Edit View Settings ?

```
This is line one.
This is line two.
This is line three.
This is line four.
This is line five.
```

Ln 5 : 5 Col 19 Sel 0 97 Bytes

Figure 1: Output from opening the text file, reading all of the lines into memory, and printing them to standard output.

Listing 5 demonstrates how to open, read, and print to stdout the data stored in the CSV file shown in Figure 2.

All data read by the CSV module is returned as strings, hence the single quotes around all list members—even numbers. We simply use a for-loop to iterate through the reader object and print out each line from the CSV file.

Python Resources

The Official Python Web site

www.python.org

```
>>> # create a new dictionary object
>>> #  note that here our keys are integers and values
are strings
>>> #  but this doesn't always have to be the case
>>> d = {1:'Urban',
...       2:'Wooded',
...       3:'Marsh',
...       4:'Pasture'}
>>> d
{1: 'Urban', 2: 'Wooded', 3: 'Marsh', 4: 'Pasture'}
>>> # access the value for key 2
>>> d[2]
'Wooded'
>>> # Create a new empty list object
>>> l=[]
>>> # use a list comprehension to iterate through the
dictionary
>>> #  items and append the values to list l
>>> for k,v in d.iteritems():
...     l.append(v)
>>> # print out list l
>>> l
['Urban', 'Wooded', 'Marsh', 'Pasture']
>>> # or just use the built-in methods to get the keys
>>> d.keys()
[1, 2, 3, 4]
>>> # or to get the values
>>> d.values()
['Urban', 'Wooded', 'Marsh', 'Pasture']
>>> # test for existence of a key
>>> d.has_key('5')
False
>>> # likewise
>>> 1 in d
True
```

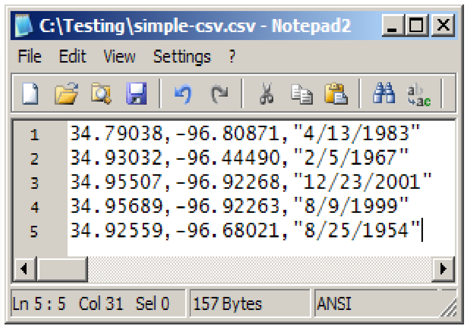
Listing 2: Working with a dictionary

Now let's look at a file that is a little more involved. The U.S. Department of Transportation Federal Highway Administration's (FHWA) National Bridge Inventory (NBI) (http://www.fhwa.dot.gov/bridge/nbi.htm) provides ASCII text files containing bridge data for the United States (www.fhwa.dot.gov/bridge/nbi/ascii.cfm). We just used the code in Listing 3 to download one of these files using the urllib.urlretrieve function. Figure 3 shows a snippet of NBI data, and Listing 6 shows the code used to parse this snippet along with the results.

Note that all list members are also returned as string data types. Later we can convert the numbers back to integers/floats easily. The method for accessing different data "columns" is known as slicing and is the most common method for extracting substrings in Python. Like most indexing operations in Python, slicing is zero based.

Using Dictionaries as Lookup Tables

Earlier we looked at a basic dictionary in Listing 2. Now let's take that one step further and put a dictionary to use while parsing the NBI data. Notice the first member of list each line in Figure 3, which shows the results of Listing 6, is a three-digit code. This is the state code for the bridge; it is actually a combination of the Federal Information Processing Standards (FIPS) code and the FHWA region code. The FHWA publication, *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nations Bridges* (available from www.fhwa.dot.gov/bridge/bripub.htm), provides the list of states and state codes. Copying and pasting from that list into a Microsoft Excel spreadsheet produces a dictionary to get the state names (values) from the state codes (keys). Listing 7 shows the dictionary, code, and results of the process. Simply wrap up the dictionary lookup process in a function, and call it to get a state name from a state code. Compare the results of Listing 7 with those of Listing 6.

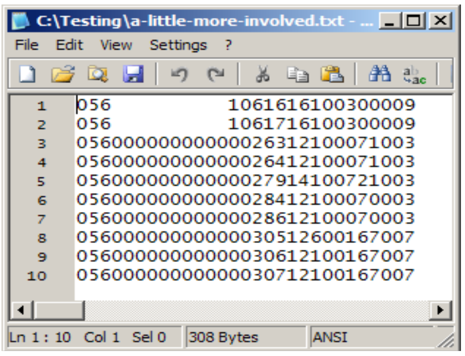

C:\Testing\simple-csv.csv - Notepad2
File Edit View Settings ?
Ln 5 : 5 Col 31 Sel 0
157 Bytes
ANSI

```
34.79038,-96.80871,"4/13/1983"
34.93032,-96.44490,"2/5/1967"
34.95507,-96.92268,"12/23/2001"
34.95689,-96.92263,"8/9/1999"
34.92559,-96.68021,"8/25/1954"
```

Figure 2: Data stored in the CSV file.

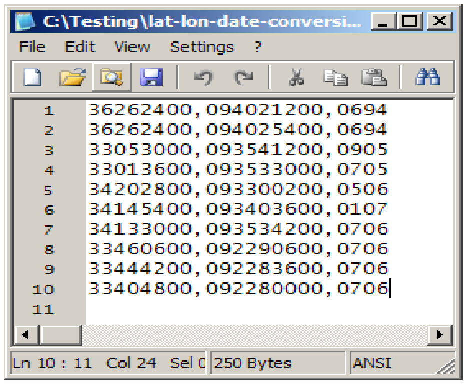
Performing In-line Operations on Data

It is not uncommon for data to need some cleaning up and/or reformatting. The NBI data is no exception. The latitude and longitude are in degrees-minutes-seconds strings such as 36262400 or 124452300; where latitude is expressed as XX degrees XX minutes XX.XX seconds, and longitude is expressed as XXX degrees XX minutes XX.XX seconds. Dates also come in strings in the format 0956 where the first two digits are the month as a decimal number (01, 10) and the last two digits are the year without century as a decimal number


C:\Testing\a-little-more-involved.txt - ...
File Edit View Settings ?
Ln 1 : 10 Col 1 Sel 0
308 Bytes
ANSI

```
056              1061616100300009
056              1061716100300009
0560000000000002631210007100З
05600000000000026412100071003
05600000000000027914100721003
05600000000000028412100070003
05600000000000028612100070003
05600000000000030512600167007
05600000000000030612100167007
05600000000000030712100167007
```

Figure 3: A snippet of NBI data



```
36262400,094021200,0694
36262400,094025400,0694
33053000,093541200,0905
33013600,093533000,0705
34202800,093300200,0506
34145400,093403600,0107
34133000,093534200,0706
33460600,092290600,0706
33444200,092283600,0706
33404800,092280000,0706
```

C:\Testing\lat-lon-date-conversi...
File Edit View Settings ?
Ln 10 : 11 Col 24 Sel 0 250 Bytes ANSI

Figure 4: Data requiring simple type conversions, string formatting, and other work.

(00,89).

Obviously, the latitude and longitude need some reformatting before we can plot them as points and the dates could use reformatting so they look more alike. To accomplish these tasks, we will do simple type conversions, math on the latitude/longitude data, and string formatting to the dates in Listing 8 using the data shown in Figure 4.

Getting the Text Data into a Geodatabase

Now that we have looked at ways of processing text files, let’s look at how to get the data into a geodatabase and eventually into a feature class. First we will create a new file geodatabase and import the text file into the geodatabase as a stand-alone table as shown in Listing 9.

Creating a Point Feature Class

Going from a stand-alone geodatabase to a point feature class is easy using several standard ESRI geoprocessing methods that are made available through the geoprocessor object. MakeXyEventLayer and CopyFeatures are both located in the Data Management Tools toolbox in ArcToolbox. MakeXyEventLayer takes the stand-alone table and—based on the X and Y fields specified—creates a temporary in-memory layer. Next, using CopyFeatures, the in-memory layer is copied to a new feature class as shown in Listing 10. Figure 5 shows the sample Arkansas bridges feature class in ArcMap along with the attribute table. Note the field aliases created earlier in Listing 9.

Logging Process Information to a Log File

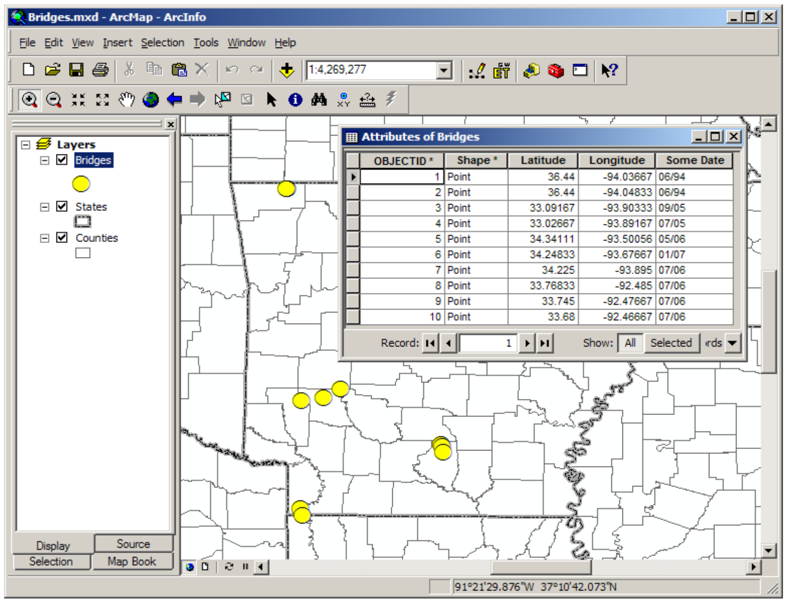
When running a process, it is quite handy to have a record (or log file) of what occurred during processing—both good and bad events. The log file is a simple text file that can supply a wealth of information if you take the time to actually create one. Luckily, Python makes writing to a text file just as simple as reading from one. Listing 11 shows the code required to produce the simple log file shown in Figure 6.

```
>>> # in its simplest form - fetch one file and save it locally
>>> import urllib
>>> urllib.urlretrieve(‘http://www.fhwa.dot.gov/bridge/nbi/2007/AR07.txt’,\
    ‘C:/testing/nbi/ar07.txt’)
(‘C:/testing/nbi/ar07.txt’, <httplib.HTTPMessage instance at 0x733e68>)
>>> # more advanced, iterate through a list to fetch multiple files
>>> url = ‘http://www.fhwa.dot.gov/bridge/nbi/2007/’
>>> # let’s grab 3 files - Arkansas, Oklahoma, and Missouri
>>> files = [‘ar’,’ok’,’mo’]
>>> for file in files:
...     urllib.urlretrieve(url + file + ‘07.txt’, ‘C:/testing/nbi/’\
        + file + ‘07.txt’)
...
(‘C:/testing/nbi/ar07.txt’, <httplib.HTTPMessage instance at 0x73a418>)
(‘C:/testing/nbi/ok07.txt’, <httplib.HTTPMessage instance at 0x73a0d0>)
(‘C:/testing/nbi/mo07.txt’, <httplib.HTTPMessage instance at 0x73a418>)
```

Listing 3: Fetching files from the Web

```
>>> # open the text file, read all of the lines into memory
>>> file = open(‘C:/testing/simple.txt’).read().splitlines()
>>> # print file contents to stdout line by line
>>> for line in file:
...     print line
...
This is line one.
This is line two.
This is line three.
This is line four.
This is line five
```

Listing 4: Reading a simple text file



Bridges.mxd - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
1:4,269,277
Layers
Bridges
States
Counties
Display Source
Selection Map Book
91°21'29.876"W 37°10'42.073"N
Attributes of Bridges

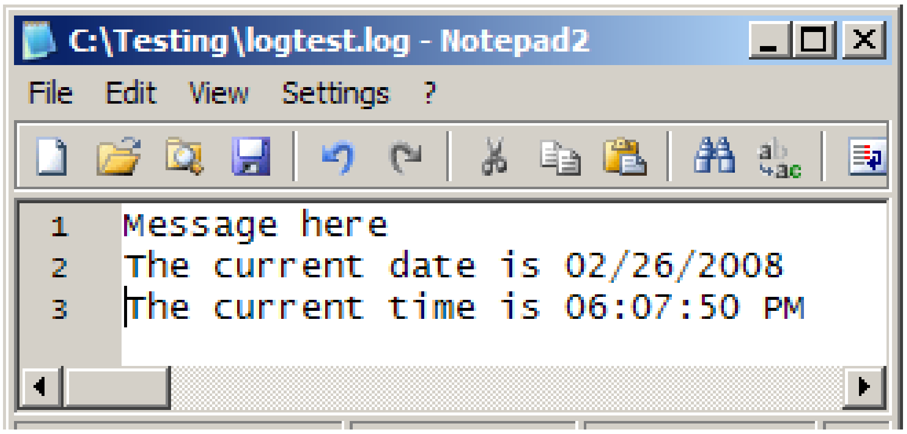
OBJECTID *	Shape *	Latitude	Longitude	Some Date
1	Point	36.44	-94.03667	06/94
2	Point	36.44	-94.04833	06/94
3	Point	33.09167	-93.90333	09/05
4	Point	33.02667	-93.89167	07/05
5	Point	34.34111	-93.50056	05/06
6	Point	34.24833	-93.67667	01/07
7	Point	34.225	-93.895	07/06
8	Point	33.76833	-92.485	07/06
9	Point	33.745	-92.47667	07/06
10	Point	33.68	-92.46667	07/06

Record: 1 Show: All Selected

Figure 5: The sample Arkansas bridges feature class displayed in ArcMap along with its attribute table.

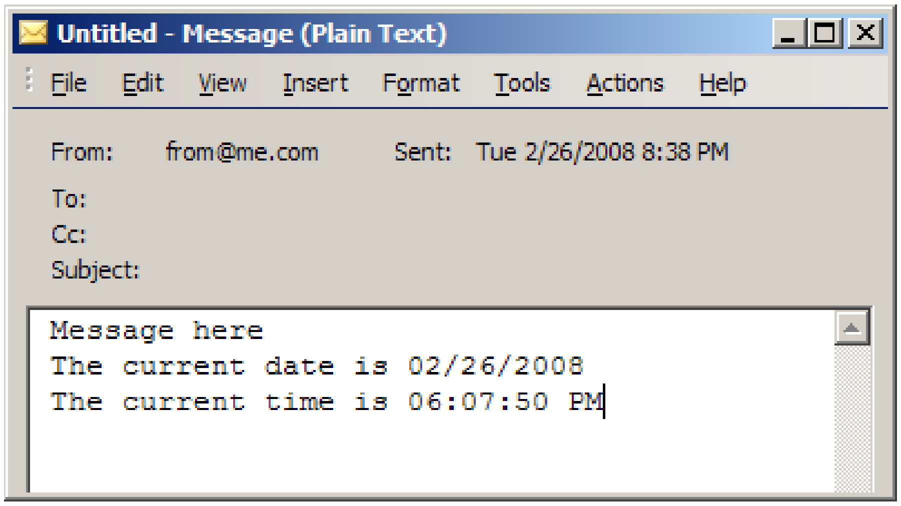
```
>>> # import csv module
>>> import csv
>>> # open and read the csv file into memory
>>> file = open('C:/testing/simple-csv.csv')
>>> reader = csv.reader(file)
>>> # iterate through the lines and print them to stdout
>>> # the csv module returns us a list of lists and we
>>> #  simply iterate through it
>>> for line in reader:
...     print line
...
['34.79038', '-96.80871', '4/13/1983']
['34.93032', '-96.44490', '2/5/1967']
['34.95507', '-96.92268', '12/23/2001']
['34.95689', '-96.92263', '8/9/1999']
['34.92559', '-96.68021', '8/25/1954']
```

Listing 5: Reading a simple CSV file



```
Message here
The current date is 02/26/2008
The current time is 06:07:50 PM
```

Figure 6: The code in Listing 11 produces this simple log file.



From: from@me.com Sent: Tue 2/26/2008 8:38 PM
To:
Cc:
Subject:

```
Message here
The current date is 02/26/2008
The current time is 06:07:50 PM
```

Figure 7: A sample e-mail

What do we do with the log file? We will e-mail it to ourselves so we read it. Again, the Python standard library steps up and provides the smtplib module, which allows us to easily send e-mail messages. This requires nothing more than the IP address of your e-mail server and unblocking port 25 on the machine that will be sending the e-mail. (Unblocking port 25 might require the help of your systems administrator.) Listing 12 shows just how little code it takes to send the contents of a log file in a plain-text e-mail. Figure 7 shows a sample e-mail.

Conclusion

Python is an incredibly powerful programming language that is easily learned and can be used to accomplish and automate both GIS and non-GIS tasks. Its large, worldwide user base is growing rapidly and support is easy to find. In this tutorial, we downloaded a text file from the Web, processed it using modules from Python's standard library, and created a point feature class from the dataset using ESRI geoprocessing library methods. We also discussed ways to log processing information and send e-mails. What I have shown merely scratches the surface of Python's capabilities. I have demonstrated some of the powerful yet simple and elegant ways Python can be used to process data, and I hope these examples will serve as building blocks for bigger and better applications.

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About the Author

Chad Cooper, who has been working in GIS for five years in technician and analyst positions, has worked with Southwestern Energy Company for the last three years. Cooper holds a bachelor's degree from Mississippi State University and a master's degree from the University of Arkansas, both in geology. He realized he could both have fun and earn a living in working with GIS. He has also worked with HTML, PHP, CSS, VBA, and VBScript over the past eight years but in the last two years focused on Python. Cooper lives in Arkansas with his beautiful wife and two handsome, lively young boys.

```
# open the text file, read it into memory
file = open(‘c:/testing/a-little-more-involved.txt’).read().splitlines()
# define a new, empty list object
l = []
# iterate through the lines of the file, slice up the line by index
#   position of each data column
for line in file:
    v0 = line[0:3]
    v1 = line[3:18].strip()
    v2 = line[18:19]
    v3 = line[19:20]
    v4 = line[20:21]
    v5 = line[21:26]
    v6 = line[26:27]
    v7 = line[27:29]
    # add the parsed items to list l; as we go through the lines,
    #   we create a nested list
    l.extend([[v0,v1,v2,v3,v4,v5,v6,v7]])
# iterate through list, print out members
for each in l:
    print each

[‘056’, ‘10616’, ‘1’, ‘6’, ‘1’, ‘00300’, ‘0’, ‘09’]
[‘014’, ‘10617’, ‘1’, ‘6’, ‘1’, ‘00300’, ‘0’, ‘09’]
[‘056’, ‘000000000000263’, ‘1’, ‘2’, ‘1’, ‘00071’, ‘0’, ‘03’]
[‘056’, ‘000000000000264’, ‘1’, ‘2’, ‘1’, ‘00071’, ‘0’, ‘03’]
[‘020’, ‘000000000000279’, ‘1’, ‘4’, ‘1’, ‘00721’, ‘0’, ‘03’]
[‘069’, ‘000000000000284’, ‘1’, ‘2’, ‘1’, ‘00070’, ‘0’, ‘03’]
[‘056’, ‘000000000000286’, ‘1’, ‘2’, ‘1’, ‘00070’, ‘0’, ‘03’]
[‘088’, ‘000000000000305’, ‘1’, ‘2’, ‘6’, ‘00167’, ‘0’, ‘07’]
[‘056’, ‘000000000000306’, ‘1’, ‘2’, ‘1’, ‘00167’, ‘0’, ‘07’]
[‘069’, ‘000000000000307’, ‘1’, ‘2’, ‘1’, ‘00167’, ‘0’, ‘07’]
```

Listing 6: Parsing a text file by index position

```
# define our function
def getState( st_code ):
    “”” Maps a state name to a state code “””
    dict = {‘014’:’Alabama’,
            ‘020’:’Alaska’,
            ‘049’:’Arizona’,
            ‘056’:’Arkansas’,
            ‘069’:’California’,
            ‘088’:’Colorado’}
    # test to see if state code exists as a key in dict
    if st_code in dict.keys():
        # if so, then get the value (state name)
        state = dict[st_code]
    else:
        # if not, map code to unknown
        state = ‘UNKNOWN’
    # return the state name
    return state

# open the text file, read it into memory
file = open(‘c:/testing/a-little-more-involved.txt’).read().splitlines()
# define a new, empty list object
l = []
# iterate through the lines of the file, slice up the line by index
#   position of each data column
for line in file:
    # call our function
    v0 = getState( line[0:3] )
    v1 = line[3:18].strip()
    v2 = line[18:19]
    v3 = line[19:20]
    v4 = line[20:21]
    v5 = line[21:26]
    v6 = line[26:27]
    v7 = line[27:29]
    # add the parsed items to list l; as we go through the lines,
    #   we create a nested list
    l.extend([[v0,v1,v2,v3,v4,v5,v6,v7]])
# iterate through list, print out members
for each in l:
    print each

[‘Arkansas’, ‘10616’, ‘1’, ‘6’, ‘1’, ‘00300’, ‘0’, ‘09’]
[‘Alabama’, ‘10617’, ‘1’, ‘6’, ‘1’, ‘00300’, ‘0’, ‘09’]
[‘Arkansas’, ‘000000000000263’, ‘1’, ‘2’, ‘1’, ‘00071’, ‘0’, ‘03’]
[‘Arkansas’, ‘000000000000264’, ‘1’, ‘2’, ‘1’, ‘00071’, ‘0’, ‘03’]
[‘Alaska’, ‘000000000000279’, ‘1’, ‘4’, ‘1’, ‘00721’, ‘0’, ‘03’]
[‘California’, ‘000000000000284’, ‘1’, ‘2’, ‘1’, ‘00070’, ‘0’, ‘03’]
[‘Arkansas’, ‘000000000000286’, ‘1’, ‘2’, ‘1’, ‘00070’, ‘0’, ‘03’]
[‘Colorado’, ‘000000000000305’, ‘1’, ‘2’, ‘6’, ‘00167’, ‘0’, ‘07’]
[‘Arkansas’, ‘000000000000306’, ‘1’, ‘2’, ‘1’, ‘00167’, ‘0’, ‘07’]
[‘California’, ‘000000000000307’, ‘1’, ‘2’, ‘1’, ‘00167’, ‘0’, ‘07’]
```

Listing 7: Parsing a text file and using a dictionary to decipher coded values

```
# open the text file, read it into memory
file = open('c:/testing/lat-lon-date-conversions.txt').read().splitlines()
# define a new, empty list object
l = []
# iterate through the lines of the file, slice up the line by index
#   position of each data column
for line in file:
    v1 = line[0:8].strip()  # lat dms
    v2 = v1[0:2]  # lat deg
    v3 = v1[2:4]  # lat min
    v4 = v1[4:6]+'.'+v1[6:8]  # lat sec
    v5 = str(int(v2)+(float(v3)/60)+(float(v4)/3600))  # lat dd
    v6 = line[8:17].strip()  # lon dms
    v7 = v6[0:3]  # lon deg
    v8 = v6[3:5]  # lon min
    v9 = v6[5:7]+'.'+v6[7:9]  # lon sec
    v10 = str('-'+str(int(v7)+(float(v8)/60)+float(v9)/3600))  # lon dd
    v11 = line[17:21]  # date as MMYY
    v12 = str(v11[0:2])+'/'+str(v11[2:4])  # concatenate date as MM/YY
    # add our line to list l
    # do string formatting to lat/long to display only 5 decimal points
    l.extend([[('%.5f' % float(v5)),('%.5f' % float(v10)),v12]])
    # print out each line to stdout
for each in l:
    print each

['36.44000', '-94.03667', '06/94']
['36.44000', '-94.04833', '06/94']
['33.09167', '-93.90333', '09/05']
['33.02667', '-93.89167', '07/05']
['34.34111', '-93.50056', '05/06']
['34.24833', '-93.67667', '01/07']
['34.22500', '-93.89500', '07/06']
['33.76833', '-92.48500', '07/06']
['33.74500', '-92.47667', '07/06']
['33.68000', '-92.46667', '07/06']
```

Listing 8: Reformatting data in-line

```
import arcgisscripting, csv, os
gp = arcgisscripting.create()

# Here we have three custom functions we will call later in our code

def killObject( object ):
    """ Kills an input object """
    if gp.Exists(object):
        gp.Delete_management(object)

def makeFgdb( dir, db, fd, spatRef ):
    """ Create a file geodatabase and featuredataset """
    if os.path.isdir(dir) != 1:
        os.mkdir(dir)
    killObject( os.path.join(dir, db) )
    gp.CreateFileGDB_management(dir, db)
    gp.CreateFeatureDataset_management(os.path.join(dir, db), fd, spatRef)

def createGdbTable( db, table, fields ):
    """ Creates an empty standalone GDB table and adds fields provided in a list
        - with a set schema """
    killObject(db + '/' + table)
    gp.CreateTable(db, table)
    for field in fields:
```

(Listing continues on next page.)

Listing 9: Bringing the text data into a file geodatabase

(Listing continued from previous page.)

```
        if field[1] == ‘TEXT’:
            gp.AddField_management(db + ‘/’ + table,field[0],field[1],’#’,’#’,field[2],field[3],\
           ’NULLABLE’,’NON_REQUIRED’,’#’)
        else:
            gp.AddField_management(db + ‘/’ + table,field[0],field[1],’#’,’#’,’#’,field[3],’NULLABLE’,\
            ’NON_REQUIRED’,’#’)

# our spatial reference, this can be copied from a prj file
sr = ‘GEOGCS[“GCS_North_American_1927”,DATUM[“D_North_American_1927”,\
      SPHEROID[“Clarke_1866”,6378206.4,294.9786982]],\
      PRIMEM[“Greenwich”,0.0],UNIT[“Degree”,0.0174532925199433]]’
# our list of fields and their properties:
#   [field_name,field_type,field_length (zero for non-text fields),field_alias]
fields = [[‘LAT’,’DOUBLE’,’0’,’Latitude’],
          [‘LON’,’DOUBLE’,’0’,’Longitude’],
          [‘SOMEDATE’,’TEXT’,’6’,’Some Date’]]

# create our new file geodatabase to work with
makeFgdb( ‘C:/Testing’, ‘NBI.gdb’, ‘Bridges’, sr )
# create our standalone geodatabase table and its schema
createGdbTable( ‘C:/Testing/NBI.gdb’, ‘Test’, fields )

# start slurping our text file into gdb table
# create a cursor on the table
rows = gp.InsertCursor(‘C:/Testing/NBI.gdb/Test’)
# open the text file, read it into memory
file = open(‘c:/Testing/lat-lon-date-conversions.txt’).read().splitlines()
# define a new, empty list object
l = []
# iterate through the lines of the file, slice up the line by index
#   position of each data column
for line in file:
    v1 = line[0:8].strip()  # lat dms
    v2 = v1[0:2]  # lat deg
    v3 = v1[2:4]  # lat min
    v4 = v1[4:6]+’.’+v1[6:8]  # lat sec
    v5 = str(int(v2)+(float(v3)/60)+(float(v4)/3600))  # lat dd
    v6 = line[8:17].strip()  # lon dms
    v7 = v6[0:3]  # lon deg
    v8 = v6[3:5]  # lon min
    v9 = v6[5:7]+’.’+v6[7:9]  # lon sec
    v10 = str(‘-’+str(int(v7)+(float(v8)/60)+float(v9)/3600))  # lon dd
    v11 = line[17:21]  # date as MMYY
    v12 = str(v11[0:2])+’/’+str(v11[2:4])  # concatenate date as MM/YY
    # add our line to list l
    # do string formatting to lat/long to only display 5 decimal points
    l.extend([[(‘%.5f’ % float(v5)),(‘%.5f’ % float(v10)),v12]])
ln = 0
# iterate through our data
for line in l:
    t = 0
    # create a new row
    row = rows.NewRow()
    # iterate through the fields
    for field in fields:
        val = line[t].strip()
        # set the value for each field
        if field[1] == ‘DOUBLE’:
            row.SetValue(field[0], ‘%.5f’ % float(val))
        else:
            row.SetValue(field[0], val)
        t = t + 1
    # insert the row into the table
    rows.InsertRow(row)
    ln = ln + 1
    del row
    del t
    del line
del rows
```

Listing 9: Bringing the text data into a file geodatabase

```
# import arcgisscripting module
import arcgisscripting
# instantiate gp object
gp = arcgisscripting.create()

# define our function we call to delete objects
def killObject( object ):
    “”” Kills an input object “””
    if gp.Exists(object):
        gp.Delete_management(object)

# make xy event layer from table
gp.MakeXyEventLayer_management(‘C:/Testing/NBI.gdb/Test’, ‘LON’, ‘LAT’, ‘tempXyFc’, ‘’)
# set our spatial reference
sr = ‘GEOGCS[“GCS_North_American_1927”,DATUM[“D_North_American_1927”,\
     SPHEROID[“Clarke_1866”,6378206.4,294.9786982]],\
     PRIMEM[“Greenwich”,0.0],UNIT[“Degree”,0.0174532925199433]]’
# if the featureclass already exists, lets get rid of it first
#   actually we have to do this or it will bomb
killObject( ‘C:/Testing/NBI.gdb/Bridges/Bridges’ )
# copy features from temp layer created via xy event layer to featureclass
gp.CopyFeatures_management(‘tempXyFc’, ‘C:/Testing/NBI.gdb/Bridges/Bridges’)
```

Listing 10: Creating a point featureclass from a standalone geodatabase table

```
# import time module
import time
# open our log file; if it doesn’t exist, it gets created
#  here we set it to append (‘a’) to an existing log file
#  but we can also set to write over an existing one (‘w’)
log = open(‘c:/testing/logtest.log’,’a’)
# write out a simple message to the log file - notice how
#   we escape the apostrophe with a backslash
log.write(‘Here\’s your log file!’)
# create datestamp and timestamp based on current local time
datestamp = time.strftime(‘%m/%d/%Y’, time.localtime())
timestamp = time.strftime(‘%I:%M:%S %p’, time.localtime())
# write date/time stamps to log file
log.write(‘\nThe current date is ‘ + datestamp)
log.write(‘\nThe current time is ‘ + timestamp)
# close the log file
log.close()
```

Listing 11: Writing to a log file

```
# import smtplib module
import smtplib
# open our log file, read it into memory
file = open(‘c:/testing/logtest.log’).read()
# print the file object to stdout just to see what it looks like
file
‘Message here\nThe current date is 02/26/2008\nThe current time is 06:07:50 PM’
# create a connection to our email server via the IP address
server = smtplib.SMTP(‘XXX.X.XX.XXX’)
# let our message be the contents of the log file
msg = file
# send out the email
server.sendmail(‘from@me.com’,’to@you.com’, msg)
# terminate the connection to server and quit
server.quit()
```

Listing 12: Sending log file contents in a email

```
# import smtplib module
import smtplib
# open our log file, read it into memory
file = open(‘c:/testing/logtest.log’).read()
# print the file object to stdout just to see what it looks like
file
‘Message here\nThe current date is 02/26/2008\nThe current time is 06:07:50 PM’
# create a connection to our email server via the IP address
server = smtplib.SMTP(‘XXX.X.XX.XXX’)
# let our message be the contents of the log file
msg = file
# send out the email
server.sendmail(‘from@me.com’,’to@you.com’, msg)
# terminate the connection to server and quit
server.quit()
```

Listing 12: Sending log file contents in a e-mail