

21. (*expires 3/27*) The string below was encrypted using an affine cipher on the 27 letter alphabet "abcdefghijklmnopqrstuvwxyz" (there is a space in the 0<sup>th</sup> position.) Decrypt it.

fmw segjaweooouanerj a ceyqrype aswaheoaqbrqabeafrua eeaojerf afmjeayperjpu

Hint: this phrase follows the the typical pattern in English where there are (almost) as many spaces as words (and so spaces are very common), and the letter "e" is also very common. You can use the technique described in section 7 of the [cryptography chapter of the notes](#).

If you wish, the encrypted text can be loaded from the file [afftext.txt](#). A version of the the affine cipher can be found on the website in the worksheet [Crypto.mw](#), or you can write your own.

22. (*expires 3/27*) The method we have been using to convert text to numbers (the procedure `StringToList`) doesn't deal well with letters that don't appear in the given `Alphabet` (it converts them to `-1`, which then becomes the final character in the alphabet).

Modify `StringToList` to remove any characters in the input string which do not appear in the global variable `Alphabet`. If you like, you can give a warning about such characters, or just silently discard them.

(As before, you can steal `StringToList` from the worksheet [Crypto.mw](#).)

23. (*expires 3/27*) The text below was encrypted using a Vignère cipher on the 28-letter alphabet consisting of the standard English alphabet, a space, and a period (that is, "abcdefghijklmnopqrstuvwxyz ."). The keyword is known to be four characters long. Decrypt the message given below, and determine the encrypting keyword.

The second two lines in the encrypted text begin with a space; linebreaks are not significant in the message. To make it easier to see the spaces, they have been written here as underscores (.).

```

xvlfpbepbud.ijxhw.tlxcq_wiv.ijgsw.guofpoi.wijii_fmjbbjh_.pj
_gppnrupdm._dcduw.wijii_fmjbc.ihh.hefpcdbsjlh.dfbgzgkupcovs
_ltpyrvpdr.cow.iaolpaepjtbgzgkupcovs.

```

Hint: as in the earlier problem, the message follows the rules of ordinary English, so spaces are quite common. Periods come at the end of sentences, so while they are not common, this can be a clue.

The encrypted text (with the spaces left as spaces) can be found in the file [vignere4.txt](#).)

24. (*expires 3/27*) Modify the implementation of the Vignère cipher as used in class (or in [Crypto.mw](#)) to use the contents of a webpage for the keyphrase. That is, be able to encrypt some text with a command like

```
WebVignere(text, "http://xroads.virginia.edu/~hyper/poe/gold_bug.html")
```

Be careful to account for the situation where the webpage may contain characters not in the `Alphabet`.