32. (*expires 4/28*) 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 in that order (that is, "`abcdefghijklmnopqrstuvwxyz .`"). The keyword is known to be four characters long. Decrypt the message given below, and determine the encrypting keyword. You can find Maple for the Vignère cipher in this worksheet, and the encrypted text (with spaces unchanged) in vignere4.txt.)

    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 (_).

    ```
    xvlfpbebud_ijxhw.tlxcq_wiv_ijgsw.guofpoi.wijii_fmjbbjh_.pj
    _gppnruptdm._dcduw.wijii_fmjbc.ihh.hefpcdbsjlh.dfbgzgkupcovs
    _ltpyrvpdr.cow.iaolpaepjtbgzgkupcovs.
    ```

    Hint: As in the earlier problems, 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 useful clue.

33. (*expires 4/28*) Implement a "double transposition cipher" in Maple, and use it to encrypt the message "`I have left one million dollars cash in the freezer. Please pick it up by noon.`" with the words `TUITION` followed by `EXPENSES` as encryption keys. As is typical in such encryption, use a 26-letter alphabet of the letters A-Z, omitting all spaces and punctuation. See this web page for more details about the double transposition cipher.

    Specifically, enter the characters of the message as rows of an $m \times n$ grid where m is the length of the first key, and n is the length of the message divided by m (rounded up if necessary). Then reorder the columns of the grid according to the alphabetic order of the letters in the key (if a letter occurs multiple times, each occurrence is numbered one more than the previous), so `THAT` is ordered 3,2,1,4.) Now read out the message by columns; any unfilled entries should just be skipped. Repeat this process on the resulting text, but using the second key, to obtain the encrypted text.

    In order to check that your implementation works, the message "`Leave the gun. Take the cannoli.`" encrypted by double transposition using the key `GODFATHER` followed by the key `CLEMENZA` results in the crypttext

    ```
    HTEEV ILONN TUGKA EALAN CEEHT
    ```

    I found using `Matrix` and `Column` from `LinearAlgebra` helpful, as well as (of course) `Explode`, `Implode`, `UpperCase`, and other commands from `StringTools`. You might do it differently, though.

34. (*expires 4/28*) The string below was encrypted using an affine cipher on the 27-letter alphabet "` abcdefghijklmnopqrstuvwxyz`" (there is a space in the 0^{th} position of the `Alphabet`). You can decrypt it by guessing just two letters – do so.

    ```
    fmw segjaweoouanerj 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. In particular, using `msolve` should be helpful, and maybe `CharacterFrequencies` if you, like me, don't count so well.

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

35. (*expires 4/28*) With a one-time pad, any two messages of the same length can always encrypt to the same crypttext: `WEARE DISCO VERED FLEEA TONCE` and `THEYS USPEC TNOTH INGPR OCEED` are both valid decryptions the crypttext `VOVOC RWDRV FIOSX XIWCF WNRTD` (using different keys). Find those keys.