Name:

Email id:

Pledge:

Notices

- Based on your past educational achievements, I expect you to do well on this test.
- Answer the questions in any order that you want.
- Hand in both parts of the test.

Test rules

- Check before you leave the room, that you uploaded all of your solutions. Do not ask afterwards whether you can submit a forgotten solution.
- This pledged exam is closed notes. The only device you may access during the test is your laptop.
- Uploading after you leave the room means a test score of 0.
- Do not access class examples, web solutions, or your own past assignments during the test; that is, the only code you may access or view are ones that you develop for this test.
- The only windows to be open on your computer are PyCharm and a single browser with tabs reachable from the class website.
- With regard to your functions:
    - Comments including header identifying comments are not necessary.
    - You should follow other class style practices; e.g., whitespace, identifier naming, etc.
    - Only do what is requested.
    - None of the functions should get input or produce output.
    - Functions should not modify their parameters in any way.
    - Whether a function is testable is important.
- Any form of cheating on a test can result in failing the class and the incident being referred to the Honor Committee.

Part 1: Program implementation

1. Implement a program *hone.py*. The program prints *yes* if you have either asked a question of the instructor during class or answered a question of the instructor during class; otherwise, the program prints *maybe*. There should be no other output. FYI: some points will be awarded regardless of your output.

2. Implement a program *cab.py*. The program separately prompts and reads four values.

   - The integer number of taxis *t*.
   - The integer number of days *d*.
   - The decimal number of the expected number of rides per day *r*.
   - The decimal number of the expected number of miles per ride *m*.

   The program computes and prints the *decimal* number of miles driven by the *t* taxis over *d* days with *r* rides per day and with *m* miles per ride.

   Two sample program runs are given below.

```
Enter number of taxis: 4
Enter number of days: 12
Enter rides per day: 74.5
Enter miles per ride: 2.6
9297.6
```

```
Enter number of taxis: 1
Enter number of days: 7
Enter rides per day: 150.0
Enter miles per ride: 3.8
3990.0
```

3. Implement a program *ding.py*. The program prompts for a line of text. The program computes and prints the *integer* average word length of the text and the number of words having that average word length.

   Two sample program runs are given below.

```
Enter text: the yellow car jumped over the moon
4 2
```

```
Enter text: one hundred
5 0
```

4. Implement a program *esr.py*. The program prompts for a line of text. The program prints the reverse of the input.

   Two sample program runs are given below.

```
Enter text: the yellow car jumped over the moon
noom eht revo depmuj rac wolley eht
```

```
Enter text: one hundred
derdnuh eno
```

Part II. Function implementation

5. Implement a module *randy.py* that defines a function p() with parameters n, b, and s. Parameters n and b are integers; parameter s can be anything. The function first uses s to set the seed for the random number generator. The function then computes and returns a list of n base b numbers (i.e., numbers in the range 0 through b-1). The module has a built-in tester. The output of its testing is below.

```
p( 12, 2, 'randy' ): [0, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1]
p( 5, 10, 15 ): [3, 0, 8, 0, 2]
p( 3, 8, 38 ): [6, 6, 1]
p( 0, 8, 11 ): []
```

6. Implement a module *soda.py* that defines a function pop(). Function pop() has three integer parameters a, b, and c. The function returns 'x' if b is greater than a; the function returns 'y' if c is greater than a; and returns 'xy' if both b and c are greater than a. Otherwise, the function returns None. The module has a built-in tester. The output of the tester should be

```
pop( 3, 4, 1 ): x
pop( 3, 1, 5 ): y
pop( 3, 7, 5 ): xy
pop( 3, 2, 1 ): None
```

7. Implement a module *parse.py* that defines a function dec(). Function dec() has one string parameter s. The function returns whether s is a decimal string. The module has a built-in tester.

   For our purposes, a decimal string is a nonempty string containing exactly one decimal point, and where the parts of s both before and after the decimal point are composed of one or more digits.

   The output of the tester should be

```
dec( '3.14' ): True
dec( '.14' ): False
dec( '14.' ): False
dec( '.' ): False
dec( '3.1.4' ): False
dec( '' ): False
dec( 'x' ): False
```

8. Implement a module *condo.py* that defines a function sider(). Function sider() has two parameters s and x, where s is a string and x is a list of strings. The function returns the number of strings in x that equal s if both capitalization, and leading and trailing whitespace is ignored when comparing. The module has a built-in tester. The output of the tester should be

```
sider( 'cat', ['cat', 'dog'] ): 1
sider( 'CAT', ['cat', 'dog', 'CAT'] ): 2
sider( 'cat', [' cat', 'cat ', ' cat ', 'dog'] ): 3
sider( 'cat', [' cat', 'cAt ', ' caT ', 'dog'] ): 3
sider( ' cat ', ['dog', ' cat', 'cAt ', ' caT ', 'dog'] ): 3
```

9. Implement a module *dis.py* that defines a function `anti()`. The function has two list parameters `x` and `y`. The function returns a new list consisting of the elements of `x` that are not part of `y`, followed by the elements of `y` that are not part of `x`. The function does not modify the contents of `x` and `y`. The module has a built-in tester. The output of the tester should be

```
anti( [3, 1, 4] , [4, 3, 1] ): []
anti( [] , [1] ): [1]
anti( ['a', 1] , [4, 'a', '1'] ): [1, 4, '1']
anti( ['a', 'b', 'c', 'd'] , ['e', 'c', 'a'] ): ['b', 'd', 'e']
```

10. Implement a module *flat.py* that defines a function `ten()`. The function has one dataset parameter `d`; that is, it is a list of row data. The function does not modify the contents of `d`. The module has a built-in tester.

    Function `ten()` returns a new list that is a flattened version of `d`; that is, the new list consists of all of the data cells in `d` in row-major order; that is, the elements of the first row occur first, followed by the elements of the next row, and so on.

    The testing makes use of the following datasets.

```
d1 = [ [ 0 ],              [ 1, 2 ],              [ 1, 2, 3 ], [ 0 ] ]
d2 = [ [ 1, 0, 1, 2, 2 ], [ 3, 0, 1, 1, 1, 0 ], [ 2 ],        [ 0, 0, 1 ] ]
d3 = [ [ 3, 0, 3],         [ 3, 0, 3, 0, 1],      [ 1, 0, 2 ] ]
d4 = [ ]
```

    The output of its testing should be

```
ten( d1 ): [0, 1, 2, 1, 2, 3, 0]
ten( d2 ): [1, 0, 1, 2, 2, 3, 0, 1, 1, 1, 0, 2, 0, 0, 1]
ten( d3 ): [3, 0, 3, 3, 0, 3, 0, 1, 1, 0, 2]
ten( d4 ): []
```

11. Implement a module *game.py* that defines one function `encode()` with two parameters `s` and `x`, where `s` is a string and `x` is a list of characters. The module has a built-in tester.

    The function turns a new string whose value is related to `s`. The new string leaves all copies of the characters in `x` alone and replaces all of the other characters with underscores. For example, `encode( 'hello', [ 'l', 'a', 'h' ] )` evaluates to `'h_ll_'`.

    The output of the tester should be

```
_ee_ ['e']
_ee_ ['e', 'b']
_ee_ ['e', 'b', 'h']
_ee_ ['e', 'b', 'h', 'l']
_ee_ ['e', 'b', 'h', 'l', 'j']
peep ['e', 'b', 'h', 'l', 'j', 'p']
success
```

12. Implement a module *data.py* that defines three functions `row_sum()`, `col_sum()`, and `d_sum()`. Functions `row_sum()` and `col_sum()` both have two parameters `d` and `k`. Functions `d_sum()` has one parameter `d`. For all three functions, `d` is a dataset; that is, it is a list of row data. For `row_sum()` and `col_sum()`, parameter `k` is an integer index. The functions do not modify the contents of `d`. The module has a built-in tester. The tester makes use of two datasets `d1` and `d2`. The rows of the datasets are taken respectively from web datasets:

    - `www.cs.virginia.edu/~cs1112/datasets/csv/trex.csv`
    - `www.cs.virginia.edu/~cs1112/datasets/csv/rotunda.csv`

    Function `row_sum( d, k )`

    - Returns the sum of the k^{th} row in d.

    Function `col_sum( d, k )`

    - Returns the sum of the k^{th} column in d.

    Function `d_sum( d )`

    - Returns the sum of all of the elements in d.

    The output of the tester should be

```
row_sum( d1, 3 ): 317
row_sum( d2, 3 ): 158

col_sum( d1, 0 ): 343
col_sum( d2, 2 ): 1239

d_sum( d1 ): 1104
d_sum( d2 ): 4354
```

    Note: in my implementation of the module, none of the functions made use of the other functions in the module.

13. Implement a module `gen.py` that defines two functions `neg_pixel()` and `neg_image()`. Function `neg_pixel()` has one parameter `p`, which is a pixel. Function `neg_image()` has one image parameter `original`. The module has a built-in tester.

    Function `neg_pixel( p )`

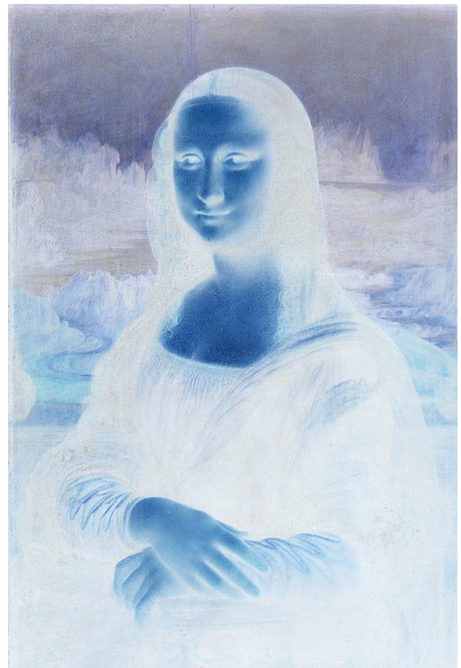
    - Returns a new color-negative version of pixel `p`, that is, it returns (255 - *r*, 255 - *g*, 255 - *b*), where *r*, *g*, and *b* are the RGB levels of *p*.

    Function `neg_image( original )`

    - Returns a new color-negative version of the `original` image, where for an `original` image pixel equal to (*r*, *g*, *b*), the new image has pixel (255 - *r*, 255 - *g*, 255 - *b*). The function does not modify `original`.

    The output of its testing is below. A color version of its imagery is available on the class website.

```
neg_pixel( 50, 100, 200 ): ( 205, 155, 55 )
```



14. Implement a module *trans.py* that defines three functions `factor()`, `analyze()`, and `mesh()`. The module has a built-in tester.

Function `factor(a, b )`

- The function returns `True` or `False` depending whether `b` evenly divides `a` or not.

Function `analyze( spot, k, c1, c2 )`

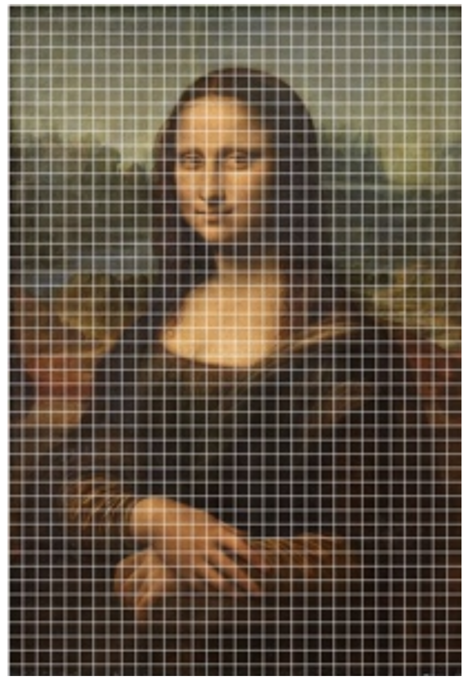
If `k` evenly divides either the `x` or `y` components of `spot`, then the function returns `c1`; otherwise, the function returns `c2`.

Function `mesh( original, k, c )`

- Returns a new copy of the `original` image except for its pixel locations where `k` evenly divides either the `x` or `y` location components. For those pixels, color `c` is used. The function does not modify `original`.

The output of its testing is below. A color version of its imagery is available on the class website.

```
factor( 11, 4 ):  False
factor( 12, 3 ):  True
(255, 255, 255)
(255, 255, 255)
(0, 0, 0)
```

15. Implement a module *nary.py* that defines one function `sym()`. The function has one `dict` parameter `d`. The function returns `True` or `False` depending whether `d` is symmetric. The module has a built-in tester.

    A dictionary is symmetric if for any mapping from `k` to `v` in the dictionary, then there is also a mapping from `v` to `k` in the dictionary.

    The testing makes use of the following dictionaries.

    ```
    d1 = { 'a': 1, 'b': 2, 2: 'b', 1: 'a' }
    d2 = { 'a': 1, 'b': 2, 2: 'b', 1: 2   }
    d3 = { 'a': 1, 'b': 2, 2: 'b' }
    ```

    The output of its testing is below.

    ```
    sym( d1 ): True
    sym( d2 ): False
    sym( d3 ): False
    ```