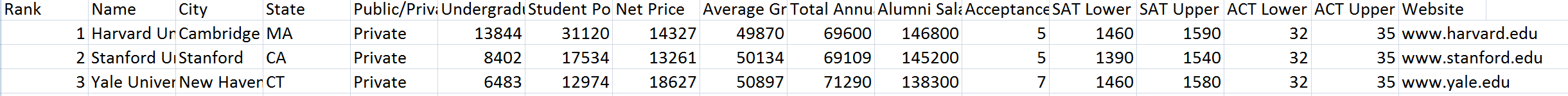
CIS 41B - Lab 1: Review of CIS 41A topics; New topics: iterables, callables

Write an application that lets the user look up the top colleges in the US, as ranked by Forbes.

**Input file**

The app uses data from [Forbes](https://www.forbes.com/top-colleges/#3c36fbc41987)' s 2019 ranking of top US colleges. The data are in the file topcolleges.csv.

Each line of the file is for one school. Here are the top 3 schools in the first 4 lines of the file:



The 5 fields used for this lab are: name, state, public/private, total annual cost, and alumni salary

**Overview**

Lab 1 consists of 3 files that you will turn in: college.py, topColleges.py, and lab1.py

* college.py has the College class, which contains all the data fields for one college
* topColleges.py has the TopColleges class, which contains all the College objects and the methods to search for college data.
* lab1.py interacts with the user and calls methods in topColleges.py, to display the result in a user-friendly format.

The user has 4 ways to look up college data:

1. Show states by number of top colleges: show all the state abbreviations, in order of the most to least number of top colleges in the state
2. Show schools by rank and type: show public schools or private schools, in order of their ranking
3. Show schools by alumni salary: show the name, alumni salary, and cost of each school, in order of highest to lowest alumni salary
4. Show schools by name and/or state: show school info for all schools with names matching a given word and/or in a list of given states

It is recommended that you write code in the order shown below.

**college.py**

Create a College class with the following attributes for one college:

1. Instance attributes for the 5 data fields shown above in the input file. Recall that all instance attributes need to be initialized in the \_\_init\_\_ method.
2. Access methods ('get' methods) as needed for accessing the instance attributes
3. A method such that when a college object c is being printed with: print(c)  
   The print output will be similar to this example for UC Berkeley:

Name: University of California Berkeley, CA

School type: Public

Cost: $65,003

Alumni salary: $131,800

[To print a number with comma: f'{num:,}' where num contains the number]

**topColleges.py**

1. Create a TopCollege class with the following:

1. A class attribute to hold the default input filename topcolleges.csv
2. An \_\_init\_\_ method that will:

* Have a default input parameter which is the input filename. Use the class attribute for the default value.
* Loop to read the input file and store data in appropriate data structures, which are all instance variables:
  + a dictionary of state abbreviations as keys, the values are the list of colleges in each state
  + a list of colleges, ordered by their ranking (Hint: what order are the colleges being read in?)

Don't forget that each college in the data structures is a College object.

* The input file should be opened and read in only one time in the program.

1. A method to return the list of state abbreviations, in order of most to least number of top colleges in the state.   
   To consider:

* Use one of the data structures above to sort the states by the number of colleges it has. The sorting should be done in one line of code.
* The sorting only needs to be done one time. Don't do the same sort every time the user wants to see the list of sorted states, the result won't change.

1. A method to return all the schools of one school type: public or private. The method will:
   * Accept a school type as input argument
   * Returns a generator of all the schools with the given type.
   * Make sure the code returns a generator, not a list or set or dictionary. Note also that the generator needs to be returned (there should be a return statement, not a yield statement).
   * The code should not use any temporary data structures to create the generator. On main purpose of using a generator is to save memory.
2. A method to return all schools with a certain alumni income level.
   * Accept an income level as input. This is the lowest limit.
   * Return a generator of school info for all schools where the alumni income level is above the limit.
   * The school info in the generator are: school name, alumni income, cost
   * Same considerations as the generator above: make sure a *generator* is *returned,* and don't use temporary data structures
3. A method to return all schools matching a given name and/or state(s)

* Accept an optional name and optional list of states
* If there is only a name and no state: return a list of schools with names matching the given name
* If there is no name and only a list of states: return a list of schools in each of the states
* If there is both a name and a list of states: return a list of schools with names matching the given name and are in one of the states

Make sure you don't write 3 independent if statements. The 3 conditions above are related.  
 Challenge: to find the matching schools in each if condition, only one line of code is needed.

2. Create a decorator that prints the length of the return value of the function that it decorates, if there is a length. If there is no length, it returns 0. Use the decorator with method c-f above.

When done coding the TopCollege class, it's highly recommended that you add code to test the class, before going to the lab1.py module. The code to test should create a TopCollege object, then call each of the methods c-f to check that you see expected output.

**lab1.py**

Contains:

1. A global constant named PRINTNUM which stores the number of data values to be printed. Initialize it to 10.

2. class called UI (for user interface) that has the following:

1. An \_\_init\_\_ method that creates a TopCollege object.   
   To consider
   * The TopColleges object will open an input file to read in data. If the file open is not successful, the TopColleges object should not end the program or print an error message. That's the job of the UI object.
   * The UI object needs the filename and error message from the TopColleges object, and the UI object will print the error message and end the program.
2. A method that prints the states by order of number of top colleges in the state
   * Call a method of the TopColleges class to get the states abbreviations
   * Print the state abbreviations as rows of PRINTNUM's state abbreviations.   
     Since PRINTNUM is set to 10, this means print in rows of 10 abbreviations. But when testing your code, if I change PRINTNUM to 12, then rows of 12 abbreviations should be printed.
3. A method that prints the schools based on school type
   * Prompt the user with a menu: 1. Public  
      2. Private  
     and keep prompting until the user enters 1 or 2. Don't forget that the user can enter non-numeric input.
   * Call a method of the TopColleges class to get a generator of colleges
   * Loop to print the college names in the following steps:
   * Print PRINTNUM college names at a time from the generator in the format: number. name  
     where number starts at 1 and counts up, and names need to line up in column format, whether number is 1 digit or 3 digits.
   * After PRINTNUM names, tell the user to press the Enter key to get the next PRINTNUM names, or enter anything else to stop
   * Continue the loop until the user choose to stop or until all the names have finished print, in which case the code prints "No more schools" or equivalent message.
4. A method that prints schools by a salary limit.
   * Keep prompting the user until you get a number for the limit
   * Call a TopColleges method to get the generator of name, salary, cost of the colleges
   * Print a header line with: Name, Salary, Cost

Then print the name, salary, cost of each college, lined up in column format

1. A method that prints schools by name and/or states.

* Prompt for a name and let the user enter a name or nothing
* Prompt for a list of states, separated by space, or let the user enter nothing
* Call a TopColleges method to get the list of colleges
* Print all data for the colleges by using the print function with each College object: print(collegeObj),  
  or print "not found" if there is no college matching the name / state

1. A run() method that will:

* Loop to print the menu below and ask the user for one of 5 choices, until there is a valid choice.  
   1. States by number of top colleges

2. Schools by rank and type

3. Schools by alumni salary

4. Schools by name and/or state

5. Quit

* When there is a valid choice that's not 5, call the appropriate method to process the user choice *without having to use an if elif statement. (or multiple if statements)*

1. At the end of lab1.py, start the code with: UI().run()

**Documentation**

- At the top of each file: put your name and a short description of the file (description can be as short as: College class)

- For each public method: add a docstring

You don't need to add docstrings for private method or 'get' method where the method only returns a data attribute, but you're welcome to do so

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**Test**

The following does not cover all test cases, so make sure you add your own test cases, such as when the input file is not found or when the user enters invalid input.

Sample output (user input is in blue)

1. States by number of top colleges

2. Schools by rank and type

3. Schools by alumni salary

4. Schools by name and/or state

5. Quit

Enter your choice 1-5: 1

51 # printed by decorator

NY CA PA MA OH IL TX VA FL NC

IN MN MI MD TN GA NJ MO WI IA

CO WA KY OR CT SC LA AL RI ME

OK NE DC VT UT AR MS AZ MT SD

NM ID NH KS NV ND AK DE WY HI

WV

1. States by number of top colleges

2. Schools by rank and type

3. Schools by alumni salary

4. Schools by name and/or state

5. Quit

Enter your choice 1-5: 2

1. Public

2. Private

Enter your choice: 1

0 # printed by decorator

1. University of California Berkeley

2. University of Michigan Ann Arbor

3. United States Naval Academy

4. United States Military Academy

5. University of Virginia

6. University of California Los Angeles

7. United States Air Force Academy

8. University of North Carolina Chapel Hill

9. College of William & Mary

10. United States Coast Guard Academy # note names are lined up on left

Press Enter key for next 10 schools or anything else to quit: # press Enter

11. University of Maryland College Park

12. University of Washington Seattle

13. Georgia Institute of Technology

14. United States Merchant Marine Academy

15. University of Illinois Urbana-Champaign

16. University of Wisconsin Madison

17. University of Florida

18. University of Texas Austin

19. University of California San Diego

20. University of California Santa Barbara

Press Enter key for next 10 schools or anything else to quit: q

1. States by number of top colleges

2. Schools by rank and type

3. Schools by alumni salary

4. Schools by name and/or state

5. Quit

Enter your choice 1-5: 3

Enter salary lowest limit: 142000

0 # printed by decorator

Name Salary Cost

Harvey Mudd College 158,200 74,428

Massachusetts Institute of Technology 155,200 67,430

United States Naval Academy 152,800 0

California Institute of Technology 151,600 68,901

Harvard University 146,800 69,600

Stanford University 145,200 69,109

United States Military Academy 144,000 0

1. States by number of top colleges

2. Schools by rank and type

3. Schools by alumni salary

4. Schools by name and/or state

5. Quit

Enter your choice 1-5: 4

Enter school name or press Enter key for no name: college # note case insensitive

Enter state abbreviations or press Enter key for no state: WI

5 # printed by decorator

Name: Beloit College, WI

School type: Private

Cost: $59,442

Alumni salary: $85,700

Name: St. Norbert College, WI

School type: Private

Cost: $48,110

Alumni salary: $88,700

Name: Ripon College, WI

School type: Private

Cost: $52,341

Alumni salary: $89,600

Name: Wisconsin Lutheran College, WI

School type: Private

Cost: $41,996

Alumni salary: $82,500

Name: Carthage College, WI

School type: Private

Cost: $57,250

Alumni salary: $85,400

1. States by number of top colleges

2. Schools by rank and type

3. Schools by alumni salary

4. Schools by name and/or state

5. Quit

Enter your choice 1-5: 4

Enter school name or press Enter key for no name:

Enter state abbreviations or press Enter key for no state: AK HI

3 # printed by decorator

Name: University of Alaska Fairbanks, AK

School type: Public

Cost: $32,563

Alumni salary: $101,800

Name: University of Alaska Anchorage, AK

School type: Public

Cost: $39,902

Alumni salary: $101,000

Name: University of Hawaii Manoa, HI

School type: Public

Cost: $51,550

Alumni salary: $91,600

1. States by number of top colleges

2. Schools by rank and type

3. Schools by alumni salary

4. Schools by name and/or state

5. Quit

Enter your choice 1-5: 4

Enter school name or press Enter key for no name: uNITed

Enter state abbreviations or press Enter key for no state:

5 # printed by decorator

Name: United States Naval Academy, MD

School type: Public

Cost: $0

Alumni salary: $152,800

Name: United States Military Academy, NY

School type: Public

Cost: $0

Alumni salary: $144,000

Name: United States Air Force Academy, CO

School type: Public

Cost: $0

Alumni salary: $138,100

Name: United States Coast Guard Academy, CT

School type: Public

Cost: $0

Alumni salary: $118,100

Name: United States Merchant Marine Academy, NY

School type: Public

Cost: $8,646

Alumni salary: $140,700