NAME:

Open book, open notes, and with computer.
Write all answers on these sheets. Do not ask questions!

question	1	2	3	4	5	total
points						
maximum	10	10	10	10	10	50

1. To measure large quantities in computer science, we use Kilo (K), Mega (M), Giga (G), and Tera (T) to abbreviate respectively 2^{10}, 2^{20}, 2^{30}, and 2^{40}

   (a) Illustrate how to encode this information in Python in a dictionary, with keys K, M, G, and T.

   (b) Using your dictionary, show how a string such as `s = '200 MB'` is converted into `'209715200 B'`. You may assume that the number in the string `s` is integer and separated by exactly one space from the letter K, M, G, or T.

   Instead of 'B' in the example for `s`, we could have any sequence of characters, such as bytes or Hz.

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2. Define a function `quadric` that evaluates a quadric $ax^2 + bx + c$.
   The input parameters are x and the coefficients a, b, and c. The default values for the coefficients are zero. The function returns the value of $ax^2 + bx + c$.

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3. Use list comprehensions to solve the following problem:

   Find all natural numbers less than or equal than 1,000,000 that have their square and cube root both as a natural number.

   For example $1,000,000 = 10^6$, its square root is $10^{6/2} = 10^3 = 1,000$ and its cube root is $10^{6/3} = 10^2 = 100$. Thus 1,000,000 has natural square and cube roots.
   So does 64: $64 = 2^6 = 4^3 = 8^2$, as $4 = 2^{6/3}$ and $8 = 2^{6/2}$.

   The algorithm runs as follows:
   (1) make a list of all natural numbers from 0 to 1000, 1000 included;
   (2) compute the list of all squares of this list of 1001 numbers;
   (3) compute the list of all cubes of this list of 1001 numbers;
   (4) take from the list of squares those that are also in the cubes.

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4. Write a Python script that prompts the user for a list of items and a tuple of integers. The length of the list must be the same as the length of the tuple. The list may contain objects of any type, whereas the integers in the tuple must between 0 and the length of the list minus one.

   The script computes a new list, placing the objects in the given list as defined by the tuple as follows: the k-th element in the given list is placed at the position equal to the value of the k-th integer in the tuple.

   Two examples of running the script `q.py` at the command prompt `$` are below:

```
$ python q.py
Give a list : ['a', 'b', 'c']
Give a tuple of positions : (2, 1, 0)
The new list : ['c', 'b', 'a']
$ python q.py
Give a list : ['a', 'b', 'c']
Give a tuple of positions : (1, 2, 0)
The new list : ['c', 'a', 'b']
```

   Write code for your Python script below.

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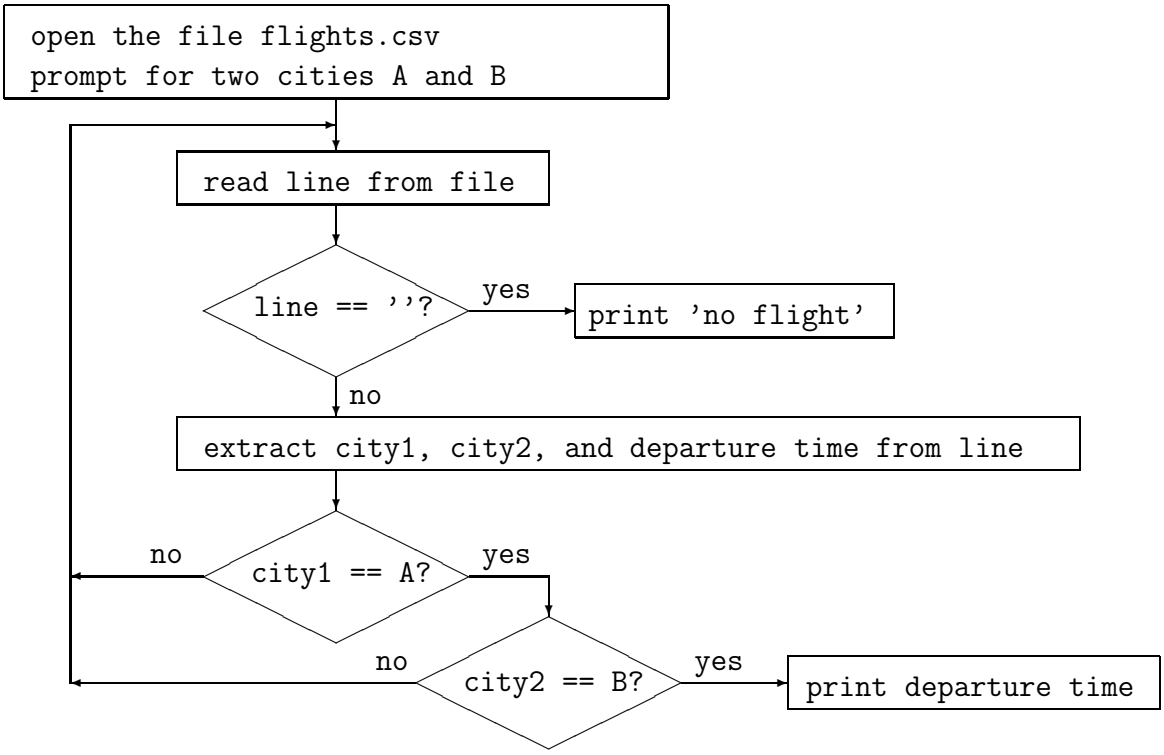
5. Assume the file `flights.csv` contains all departure times for all domestic flights of an airline company scheduled on a day. Each line on file contains 3 items separated by commas: city of origin, destination, and departure time. For example, one line on file could be `Chicago,Detroit,9:23`. Flights are sorted on departure time.
Consider the flowchart of an algorithm that searches `flights.csv`.



Write Python code for the algorithm defined in the flowchart.

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