Start with the following Python code.

alphabet = "abcdefghijklmnopqrstuvwxyz"

test\_dups = ["zzz","dog","bookkeeper","subdermatoglyphic","subdermatoglyphics"]

test\_miss = ["zzz","subdermatoglyphic","the quick brown fox jumps over the lazy dog"]

# From Section 11.2 of:

# Downey, A. (2015). Think Python: How to think like a computer scientist. Needham, Massachusetts: Green Tree Press.

def histogram(s):  
     d = dict()  
     for c in s:  
          if c not in d:  
               d[c] = 1  
          else:  
               d[c] += 1  
     return d

Copy the code above into your program but write all the other code for this assignment yourself. **Do not copy any code from another source.**

**Part 1**

Write a function called has\_duplicates that takes a string parameter and returns True if the string has any repeated characters. Otherwise, it should return False.

Implement has\_duplicates by creating a histogram using the histogram function above. Do not use any of the implementations of has\_duplicates that are given in your textbook. Instead, your implementation should use the counts in the histogram to decide if there are any duplicates.

Write a loop over the strings in the provided test\_dups list. Print each string in the list and whether or not it has any duplicates based on the return value of has\_duplicates for that string. For example, the output for "aaa" and "abc" would be the following.

aaa has duplicates  
abc has no duplicates

Print a line like one of the above for each of the strings in test\_dups.

**Part 2**

Write a function called missing\_letters that takes a string parameter and returns a new string with all the letters of the alphabet that are **not** in the argument string. The letters in the returned string should be in alphabetical order.

Your implementation should use a histogram from the histogram function. It should also use the global variable alphabet. It should use this global variable directly, not through an argument or a local copy. It should loop over the letters in alphabet to determine which are missing from the input parameter.

The function missing\_letters should combine the list of missing letters into a string and return that string.

Write a loop over the strings in list test\_miss and call missing\_letters with each string. Print a line for each string listing the missing letters. For example, for the string "aaa", the output should be the following.

aaa is missing letters bcdefghijklmnopqrstuvwxyz

If the string has all the letters in alphabet, the output should say it uses all the letters. For example, the output for the string alphabet itself would be the following.

abcdefghijklmnopqrstuvwxyz uses all the letters

Print a line like one of the above for each of the strings in test\_miss.

Submit your Python program. It should include the following.

* The provided code for alphabet, test\_dups, test\_miss, and histogram.
* Your implementation of the has\_duplicates function.
* A loop that outputs duplicate information for each string in test\_dups.
* Your implementation of the missing\_letters function.
* A loop that outputs missing letters for each string in test\_miss.

Also submit the output from running your program.

Your submission will be assessed using the following Aspects.

1. Does the program include a function called has\_duplicates that takes a string parameter and returns a boolean?
2. Does the has\_duplicates function call the histogram function?
3. Does the program include a loop over the strings in test\_dups that calls has\_duplicate on each string?
4. Does the program correctly identify whether each string in test\_dups has duplicates?
5. Does the program include a function called missing\_letters that takes a string parameter and returns a string?
6. Does the missing\_letters function call the histogram function?
7. Does the missing\_letters function use the alphabet global variable directly?
8. Does the program include a loop over the strings in test\_miss that calls missing\_letters on each string?
9. Does the program correctly identify the missing letters for each string in test\_miss, including each string that "uses all the letters"?