

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"?