Python for data scientists SP1 2021/2022

Assignment 4 (individual assignment!)

There are two problems in this assignment.
You can either submit:

- One Python file for Problem 1 (solutionA4_P1.py)
- One Python file for Problem 2 (solutionA4_P2.py)
- A PDF file for the explanation part (if any).

Or a Jupyter Notebook with clearly marked solutions for which problems/which tasks and any explanation.
Note: If you add any details or make any assumptions, please clearly describe in your submission.

Problem 1

The task in this problem is to write an *encoder* and *decoder* for strings.

The encoder compresses a non-digit string by replacing each consecutive sequence of the same letter by this letter and its frequency (for example, the string
”bbccccccdrrrff?????____ hhhh” will be encoded as
”b2c6d1r3f2?5_4 3h4”).

The decoder reverses the encoder process by transforming a compressed string, with a fix format containing a repetition of non-digit character followed by a positive integer, to its full representation (for example, given "b2c6d1r3f2?5_4 3h4”, the decoder will return ”bbccccccdrrrff?????____ hhhh”).

Solve this problem by using *generators*.

Example of usage 1:

```
s = 'AAABBBBCDDDDDDDDDDEEDDDD ooi'
encoded = ''.join(encode(s))
print (encoded)
decoded = ''.join(decode(encoded))
print (decoded)

Output:
A3B4C1D10E2D4 1o2i1
AAABBBBCDDDDDDDDDDEEDDDD ooi
```

Example of usage 2:

```
s = 'bbccccccdrrrff?????____   hhhh'
encoded = ''.join(encode(s))
print (encoded)
decoded = ''.join(decode(encoded))
print (decoded)

Output:
b2c6d1r3f2?5_4 3h4
bbccccccdrrrff?????____   hhhh
```

Problem 2

Create a function *merge_k_sorted_lists()* where the input is k (k>0) sorted lists of size n each and returns as an output a list of k*n sorted elements.

Example:

Input list: [[1, 3, 5],[1, 2, 7, 9], [0, 6, 8]]

Output: [0, 1, 1, 2, 3, 5, 6, 7, 8, 9]

Solve this problem by using recursion. Please test your code with other input to make sure that it behaves as we expected.

Problem 3

What is the complexity of your solution for Problem 2? Motivate your answer, explain how you get to the answer.