

NOTE: You are not supposed to solve these questions using AI or copy-pasting open-source.

NOTE: You may solve each problem using any of the languages within the bracket. For example, [C, Python] means the solution should be in Python or C.

Q1 [C, Python] The probability of rain on a given calendar day in Vancouver is $p[i]$, where i is the day's index. For example, $p[0]$ is the probability of rain on January 1st, and $p[10]$ is the probability of precipitation on January 11th. Assume the year has 365 days (i.e., p has 365 elements). What is the chance it rains more than n (e.g., 100) days in Vancouver? Write a function that accepts p (probabilities of rain on a given calendar day) and n as input arguments and returns the possibility of raining at least n days.

```
def prob_rain_more_than_n(p: Sequence[float], n: int) -> float:
    pass
```

Q2 [C, Python] A phoneme is a sound unit (similar to a character for text). We have an extensive pronunciation dictionary (think millions of words). Below is a snippet:

| | |
|--------|----------------|
| ABACUS | AE B AH K AH S |
| BOOK | B UH K |
| THEIR | DH EH R |
| THERE | DH EH R |
| TOMATO | T AH M AA T OW |
| TOMATO | T AH M EY T OW |

Given a sequence of phonemes as input (e.g. ["DH", "EH", "R", "DH", "EH", "R"]), find all the combinations of the words that can produce this sequence (e.g. [["THEIR", "THEIR"], ["THEIR", "THERE"], ["THERE", "THEIR"], ["THERE", "THERE"]]). You can preprocess the dictionary into a different data structure if needed.

```
def find_word_combos_with_pronunciation(phonemes: Sequence[str]) -> Sequence[Sequence[str]]:
    pass
```

Q3 [C] Find the n most frequent words in the [TensorFlow Shakespeare dataset](#).

```
char **find_frequent_words(const char *path, int32_t n) {
    // implementation
}
```

Q4 [C, CUDA, Python] Implement CTC as this [paper](#) describes. Your implementation should support both forward and backward propagation operations.