

Question 9

In this question we were trying to determine if an array or a linked list is a de Bruijn sequence, I decided to take a straightforward approach.

To solve this we utilize two important functions.

The first, the function `combin` this function creates a vector or vectors with each row being one combination of an alphabet of a certain size and this function is called by `makecombin` which returns the vector of solutions.

*note: function `combin` and `makecombin` I did not write myself, it is a combination of code we did on udemy in section 15, and some code I found on geeks for geeks that returns the array of arrays. I would have written the code myself but due to a lack of time that was not possible.

Next, our function is `DeBruijn` which calls `makecombin` to create all the different combinations, and then we check if a certain row from the vector containing a solution is in our array and if it is there only once. If it is, we keep checking, moving one cell at a time checking if the rest of the combinations from the vector are present in the array and if all of them are there once. If that is true we have a DeBruijn sequence.

The same idea is used for the linked list just with linked list notation to fit this model.

If an array or a linked list is not DeBruijn then we mutate each spot with 5% probability. This is done by utilizing the `rand` function which has equal distribution probability (it can be thought of as rolling a dice) and by checking when the random numbers are less than 5, then we get a 5% probability (this is for function probability).

Now, the way I chose to deal with the issue of the DeBruijn sequence wrapping around, is by simply copying the array/linked list to a new one, and adding to the end of the list the first `n` (size of the subset) indexes/nodes from the original list, but only checking the sequence up to the original size, therefore, allowing the check to wrap around the array/list.

To time the two functions running on an array and a linked list I utilized the `#include <chrono>` since it has built-in functions to measure passage of time.