Problem Statement

Perform **Burrows-Wheeler transform** or **block-sorting compression** on the below-mentioned sentence.

“Curneu MedTech Innovation is a health care technology firm based at Heidelberg, Germany. We work on a motive of building affordable and innovative healthcare solutions that address the clinical needs thereby bringing better lives for the needy.”

Neat Documentation is expected with from-scratch implementation with C++ and output characters.

Program Coding:

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

// Structure to store data of a rotation
struct rotation {
  int index;
  char* suffix;
};

// Compares the rotations and
// sorts the rotations alphabetically
int cmpfunc(const void* x, const void* y)
{
  struct rotation* rx = (struct rotation*)x;
  struct rotation* ry = (struct rotation*)y;
  return strcmp(rx->suffix, ry->suffix);
}

// Takes text to be transformed and its length as
// arguments and returns the corresponding suffix array
int* computeSuffixArray (char* input_text, int len_text)
{
```

```
  // Array of structures to store rotations and
  // their indexes
  struct rotation suff[len_text];

  // Structure is needed to maintain old indexes of
  // rotations after sorting them
  for (int i = 0; i < len_text; i++) {
    suff[i].index = i;
    suff[i].suffix = (input_text + i);
  }

  // Sorts rotations using comparison
  // function defined above
  qsort(suff, len_text, sizeof(struct rotation),
    cmpfunc);

  // Stores the indexes of sorted rotations
  int* suffix_arr
    = (int*)malloc(len_text * sizeof(int));
  for (int i = 0; i < len_text; i++)
    suffix_arr[i] = suff[i].index;

  // Returns the computed suffix array
  return suffix_arr;
}

// Takes suffix array and its size
// as arguments and returns the
// Burrows - Wheeler Transform of given text
char* findLastChar(char* input_text,
        int* suffix_arr, int n)
{
  // Iterates over the suffix array to find
  // the last char of each cyclic rotation
  char* bwt_arr = (char*)malloc(n * sizeof(char));
  int i;
  for (i = 0; i < n; i++) {
```

```
    // Computes the last char which is given by
    // input_text[(suffix_arr[i] + n - 1) % n]
    int j = suffix_arr[i] - 1;
    if (j < 0)
      j = j + n;

    bwt_arr[i] = input_text[j];
  }

  bwt_arr[i] = '\0';

  // Returns the computed Burrows - Wheeler Transform
  return bwt_arr;
}

// Driver program to test functions above
int main()
{
  char input_text[] = "Curneu MedTech Innovation is a health care technology firm based at Heidelberg, Germany. We work on a motive of building affordable and innovative healthcare solutions that address the clinical needs thereby bringing better lives for the needy$";
  int len_text = strlen(input_text);

  // Computes the suffix array of our text
  int* suffix_arr = computeSuffixArray(input_text, len_text);

  // Adds to the output array the last char
  // of each rotation
  char* bwt_arr = findLastChar(input_text, suffix_arr, len_text);
  printf("Input text : %s\n", input_text);
  printf("Burrows - Wheeler Transform : %s\n",bwt_arr);
  return 0;
}
```

OUTPUT:

Input text : Curneu MedTech Innovation is a health care technology firm based at Heidelberg, Germany. We work on a motive of building affordable and innovative healthcare solutions that address the clinical needs thereby bringing better lives for the needy

Burrows-WheelerTransform:

,thu.sntgedmgyfheysaednraleekeessrsegyy d d cee mccb hvv l a eih ee eneraildeelhvhvrrWhhrTtsMeennHdthbGvrbnoa fnnrnocttttt tcneudgrl ttf ttlraeibc oaaorr ooa riiiiIihnnoa lns iiffwmnneooaaedeboieuiensda eaa tl l auaoeebClooiii dbgn

Process finished.