Assignment 04 | Advance Algorithms CE-092

Assignment submission for Advance Algorithms subject week 4.

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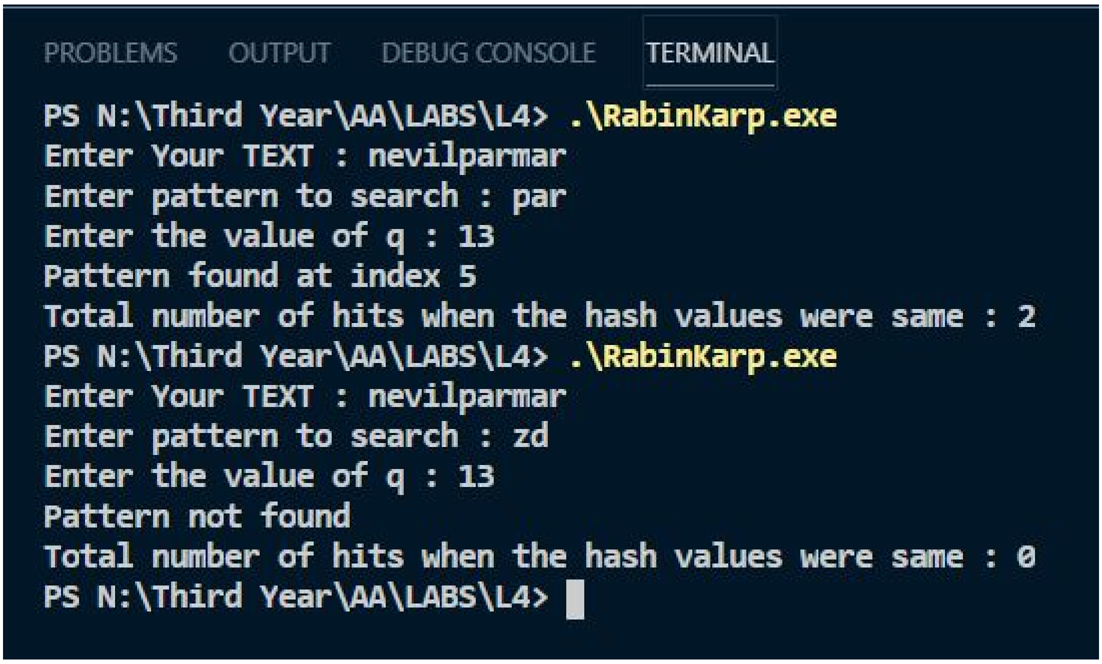
Task 1:

To Implement RabinKarp's algorithm for pattern searching.

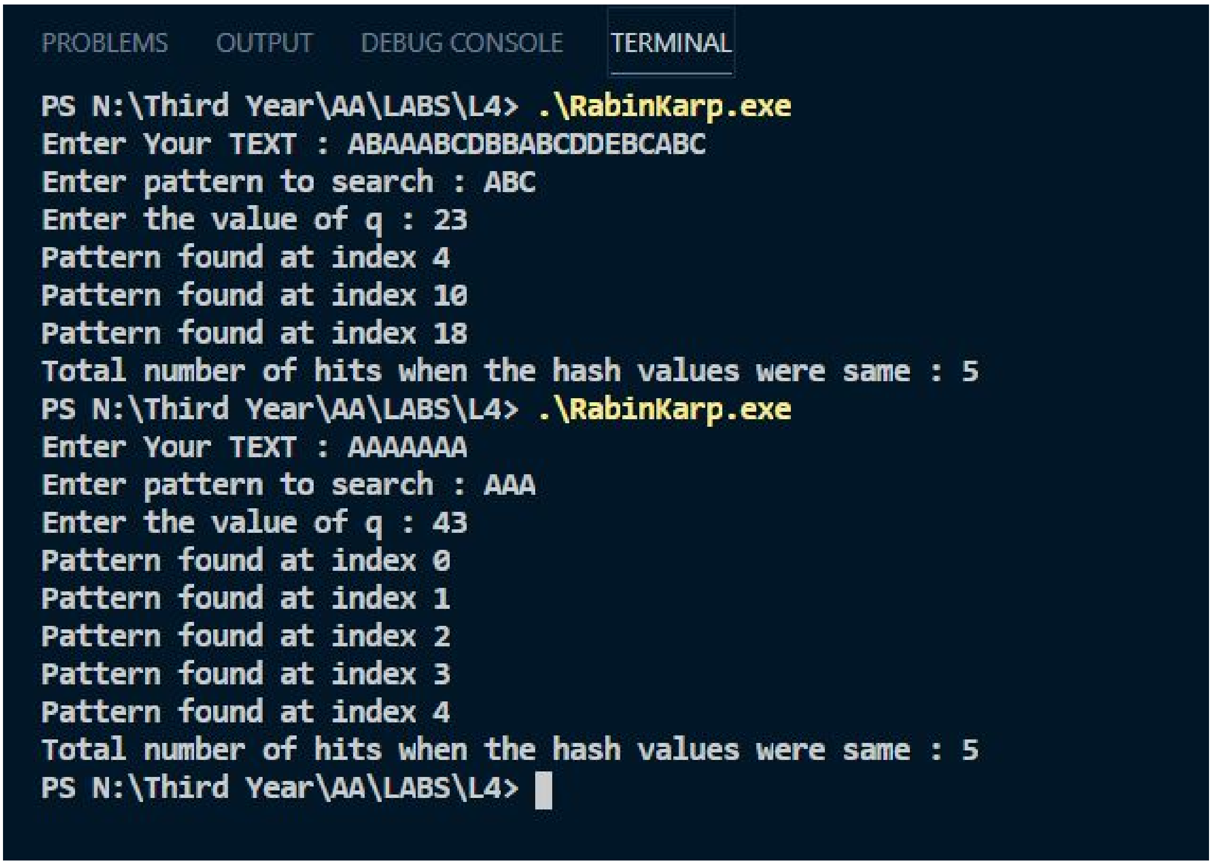
Code:

```
/*
* @Author: nevil
* @Date:   2020-07-31 15:35:40
* @Last Modified by:   nevil
* @Last Modified time: 2020-07-31 16:18:11
*/

#include <bits/stdc++.h>
using namespace std;

#define d 256

void rabinKarp(string pat, string txt, int q)
{
    int M = pat.length();
    int N = txt.length();
    int i, j;
    int p = 0;
    int t = 0;
    int h = 1;
    bool found = 0;
    int hits = 0;

    for (i = 0; i < M - 1; i++)
        h = (h * d) % q;

    for (i = 0; i < M; i++)
    {
        p = (d * p + pat[i]) % q;
        t = (d * t + txt[i]) % q;
    }

    for (i = 0; i <= N - M; i++)
    {
        if ( p == t )
        {
            for (j = 0; j < M; j++)
            {
                if (txt[i+j] != pat[j])
                    break;
            }

            if (j == M)
            {
                cout<<"Pattern found at index "<<
i<<endl;
                found = 1;
            }
            hits++;
        }
        if ( i < N-M )
        {
            t = (d*(t - txt[i]*h) + txt[i+M])%q;
            if (t < 0)
            t = (t + q);
        }
    }

    if(!found)
        cout << "Pattern not found" << endl;

    cout << "Total number of hits when the hash values were same : " << hits << endl;
}

int main()
{
    string text, pattern;
    int q; //  this is the mode value we will be using in the rabinkarpt algo
    cout << "Enter Your TEXT : ";
    cin >> text;
    cout << "Enter pattern to search : ";
    cin >> pattern;
    cout << "Enter the value of q : ";
    cin >> q;


    rabinKarp(pattern, text, q);
    return 0;
}
```

Output:



```
PS N:\Third Year\AA\LABS\L4> .\RabinKarp.exe
Enter Your TEXT : nevilparmar
Enter pattern to search : par
Enter the value of q : 13
Pattern found at index 5
Total number of hits when the hash values were same : 2
PS N:\Third Year\AA\LABS\L4> .\RabinKarp.exe
Enter Your TEXT : nevilparmar
Enter pattern to search : zd
Enter the value of q : 13
Pattern not found
Total number of hits when the hash values were same : 0
PS N:\Third Year\AA\LABS\L4>
```



```
PS N:\Third Year\AA\LABS\L4> .\RabinKarp.exe
Enter Your TEXT : ABAAABCDBBABCDDEBCABC
Enter pattern to search : ABC
Enter the value of q : 23
Pattern found at index 4
Pattern found at index 10
Pattern found at index 18
Total number of hits when the hash values were same : 5
PS N:\Third Year\AA\LABS\L4> .\RabinKarp.exe
Enter Your TEXT : AAAAAAA
Enter pattern to search : AAA
Enter the value of q : 43
Pattern found at index 0
Pattern found at index 1
Pattern found at index 2
Pattern found at index 3
Pattern found at index 4
Total number of hits when the hash values were same : 5
PS N:\Third Year\AA\LABS\L4>
```

Complexity :

Spurious Hit :

When the hash value of the pattern matches with the hash value of a window of the text but the window is not the actual pattern then it is called a spurious hit.

The average and best case running time of the Rabin-Karp algorithm is O(n+m), but its worst-case time is O((n-m+1)m). Worst case of Rabin-Karp algorithm occurs when all characters of pattern and text are the same as the hash values of all the substrings of txt[] match with hash value of pat[].
The example test case for worst scenario from the above inputs are :
TEXT : “AAAAAA”
PATTERN : “AAA”
We can observe the total number of hits when the hash values were the same for this input.

Application of Rabin-Karp’s Algorithm :

- **Pattern Matching**
- **To search a string in bigger text**
- **To implement find , find & replace functionalities in text editors like word, notepad etc.**

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CE-092
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