Maximum length substring having all same characters after k changes

Difficulty Level : Hard • Last Updated : 14 Jul, 2022

We have a string of length n, which consist only UPPER and LOWER CASE characters and we have a number k (always less than n and greater than 0). We can make at most k changes in our string such that we can get a sub-string of maximum length which have all same characters.

Examples:

```
n = length of string
k = changes you can make
Input : n = 5 k = 2
        str = ABABA
Output : maximum length = 5
which will be (AAAAA)

Input : n = 6 k = 4
       str = HHHHHH
Output : maximum length=6
which will be(HHHHHH)
```

We check for each character of English alphabet (both upper and lower cases one by one). We are basically looking for maximum length of sub-string that can be formed by each character and whichever character will form the sub-string of maximum length then that length will be our answer.

1. We check for maximum length of sub-string that can be formed by every character in a set of 52 characters (From 'A' to 'Z' and from 'a' to 'z').
2. For doing this we traverse whole string and whenever we find a different character, we increase the count.
3. If count becomes greater than k (at right index), we again start from 0th index and if we found different character we will decrease the count.
4. When count will be equal to k (at left index) then at that point the length will be rightIndex-leftIndex+1.
5. We repeat this process until we reach at the end of string and at that point we will return the maximum length.
6. We do this for all characters and finally return the maximum length.

Implementation:

C++

```
// C++ program to find maximum length equal
// character string with k changes
#include <iostream>
using namespace std;

// function to find the maximum length of
// substring having character ch
int findLen(string& A, int n, int k, char ch)
{
    int maxlen = 1;
    int cnt = 0;
    int l = 0, r = 0;
    // traverse the whole string
    while (r < n) {

        /* if character is not same as ch
           increase count */
        if (A[r] != ch)
            ++cnt;

        /* While  count > k  traverse the string
           again until count becomes less than k
           and decrease the count when characters
           are not same */
        while (cnt > k) {
            if (A[l] != ch)
                --cnt;
            ++l;
        }

        /* length of substring will be rightIndex -
           leftIndex + 1. Compare this with the maximum
           length and return maximum length */
        maxlen = max(maxlen, r - l + 1);
        ++r;
    }
    return maxlen;
}

// function which returns maximum length of substring
int answer(string& A, int n, int k)
{
    int maxlen = 1;
    for (int i = 0; i < 26; ++i) {
        maxlen = max(maxlen, findLen(A, n, k, i+'A'));
        maxlen = max(maxlen, findLen(A, n, k, i+'a'));
    }
    return maxlen;
}

// Driver code
int main()
{
    int n = 5, k = 2;
    string A = "ABABA";
    cout << "Maximum length = " << answer(A, n, k) << endl;
    n = 6, k = 4;
    string B = "HHHHHH";
    cout << "Maximum length = " << answer(B, n, k) << endl;
    return 0;
}
```

Java

```
// Java program to find maximum length equal
// character string with k changes

public class GFG
{
    // method to find the maximum length of
    // substring having character ch
    static int findLen(String A, int n, int k, char ch)
    {
        int maxlen = 1;
        int cnt = 0;
        int l = 0, r = 0;

        // traverse the whole string
        while (r < n) {

            /* if character is not same as ch
               increase count */
            if (A.charAt(r) != ch)
                ++cnt;

            /* While  count > k  traverse the string
               again until count becomes less than k
               and decrease the count when characters
               are not same */
            while (cnt > k) {
                if (A.charAt(l) != ch)
                    --cnt;
                ++l;
            }

            /* length of substring will be rightIndex -
               leftIndex + 1. Compare this with the maximum
               length and return maximum length */
            maxlen = Math.max(maxlen, r - l + 1);
            ++r;
```

```java
        }
        return maxlen;
    }

    // method which returns maximum length of substring
    static int answer(String A, int n, int k)
    {
        int maxlen = 1;
        for (int i = 0; i < 26; ++i) {
            maxlen = Math.max(maxlen, findLen(A, n, k, (char) (i+'A')));
            maxlen = Math.max(maxlen, findLen(A, n, k, (char) (i+'a')));
        }
        return maxlen;
    }

    // Driver Method
    public static void main(String[] args)
    {
        int n = 5, k = 2;
        String A = "ABABA";
        System.out.println("Maximum length = " + answer(A, n, k));

        n = 6; k = 4;
        String B = "HHHHHH";
        System.out.println("Maximum length = " + answer(B, n, k));
    }
}
```

Python3

```python
# Python3 program to find maximum length
# equal character string with k changes

# function to find the maximum length of
# substring having character ch
def findLen(A, n, k, ch):
    maxlen = 1
    cnt = 0
    l = 0
    r = 0

    # traverse the whole string
    while r < n:
        # if character is not same as ch
        # increase count
        if A[r] != ch:
            cnt += 1

        # While count > k traverse the string
        # again until count becomes less than k
        # and decrease the count when characters
        # are not same
        while cnt > k:
            if A[l] != ch:
                cnt -= 1
            l += 1

        # length of substring will be rightIndex -
        # leftIndex + 1. Compare this with the
        # maximum length and return maximum length
        maxlen = max(maxlen, r - l + 1)
        r += 1

    return maxlen

# function which returns
# maximum length of substring
def answer(A, n, k):
    maxlen = 1
    for i in range(26):
        maxlen = max(maxlen, findLen(A, n, k,
                             chr(i + ord('A'))))
        maxlen = max(maxlen, findLen(A, n, k,
                             chr(i + ord('a'))))

    return maxlen

# Driver Code
if __name__ == "__main__":
    n = 5
    k = 2
    A = "ABABA"
    print("Maximum length =",
             answer(A, n, k))

    n = 6
    k = 4
    B = "HHHHHH"
    print("Maximum length =",
             answer(B, n, k))

# This code is contributed by
# sanjeev2552
```

C#

```
// C# program to find maximum length equal
// character string with k changes
using System;

class GFG
{

    // method to find the maximum length of
    // substring having character ch
    public static int findLen(string A, int n,
                               int k, char ch)
    {
        int maxlen = 1;
        int cnt = 0;
        int l = 0, r = 0;

        // traverse the whole string
        while (r < n)
        {

            // if character is
            // not same as ch
            // increase count
            if (A[r] != ch)
            {
                ++cnt;
            }

            // While count > k traverse
            // the string again until
            // count becomes less than
            // k and decrease the
            // count when characters
            // are not same
            while (cnt > k)
```

```
                {
                    if (A[l] != ch)
                    {
                        --cnt;
                    }
                    ++l;
                }

                // length of substring
                // will be rightIndex -
                // leftIndex + 1.
                // Compare this with the maximum
                // length and return maximum length
                maxlen = Math.Max(maxlen, r - l + 1);
                ++r;
            }
            return maxlen;
        }

        // method which returns
        // maximum length of substring
        public static int answer(string A, int n, int k)
        {
            int maxlen = 1;
            for (int i = 0; i < 26; ++i)
            {
                maxlen = Math.Max(maxlen,
                  findLen(A, n, k, (char)(i + 'A')));

                maxlen = Math.Max(maxlen,
                  findLen(A, n, k, (char)(i + 'a')));
            }
            return maxlen;
        }

    // Driver Method
    public static void Main(string[] args)
    {
        int n = 5, k = 2;
        string A = "ABABA";
        Console.WriteLine("Maximum length = "
                          + answer(A, n, k));

        n = 6;
        k = 4;
        string B = "HHHHHH";
        Console.WriteLine("Maximum length = "
                          + answer(B, n, k));
    }
    }

    // This code is contributed by Shrikant13
```

PHP

```
<?php
// PHP program to find maximum length equal
// character string with k changes

// function to find the maximum length
// of substring having character ch
function findLen($A, $n, $k, $ch)
{
    $maxlen = 1; $cnt = 0;
    $l = 0; $r = 0;

    // traverse the whole string
    while ($r < $n)
    {

        /* if character is not same as
        ch increase count */
        if ($A[$r] != $ch)
            ++$cnt;

        /* While count > k traverse the string
        again until count becomes less than k
        and decrease the count when characters
        are not same */
        while ($cnt > $k)
        {
            if ($A[$l] != $ch)
                --$cnt;
            ++$l;
        }

        /* length of substring will be rightIndex -
        leftIndex + 1. Compare this with the maximum
        length and return maximum length */
        $maxlen = max($maxlen, $r - $l + 1);
        ++$r;
    }
    return $maxlen;
}

// function which returns maximum
// length of substring
function answer($A, $n, $k)
{
    $maxlen = 1;
    for ($i = 0; $i < 26; ++$i)
    {
        $maxlen = max($maxlen,
                      findLen($A, $n, $k, $i + 'A'));
        $maxlen = max($maxlen,
                      findLen($A, $n, $k, $i + 'a'));
    }
    return $maxlen;
}

// Driver code
$n = 5; $k = 2; $A = "ABABA";
echo "Maximum length = " . answer($A, $n, $k) . "\n";

$n = 6; $k = 4; $B = "HHHHHH";
echo "Maximum length = " . answer($B, $n, $k) . "\n";

// This code is contributed by ita_c
?>
```

Javascript

```
<script>
// Javascript program to find maximum length equal
// character string with k changes

    // method to find the maximum length of
    // substring having character ch
    function findLen(A,n,k,ch)
    {
        let maxlen = 1;
        let cnt = 0;
        let l = 0, r = 0;
        // traverse the whole string
        while (r < n) {

            /* if character is not same as ch
               increase count */
            if (A[r] != ch)
                ++cnt;

            /* While  count > k  traverse the string
               again until count becomes less than k
               and decrease the count when characters
               are not same */
            while (cnt > k) {
                if (A[l] != ch)
                    --cnt;
                ++l;
            }

            /* length of substring will be rightIndex -
               leftIndex + 1. Compare this with the maximum
               length and return maximum length */
            maxlen = Math.max(maxlen, r - l + 1);
            ++r;
        }
        return maxlen;
    }

    // method which returns maximum length of substring
    function answer(A,n,k)
    {
        let maxlen = 1;
        for (let i = 0; i < 26; ++i) {
            maxlen = Math.max(maxlen, findLen(A, n, k, String.fromCharCod
            maxlen = Math.max(maxlen, findLen(A, n, k, String.fromCharCod
        }
        return maxlen;
    }

    // Driver Method
    let  n = 5, k = 2;
    let A = "ABABA";
    document.write("Maximum length = " + answer(A, n, k)+"<br>");

    n = 6; k = 4;
```

```
    let B = "HHHHHH";
    document.write("Maximum length = " + answer(B, n, k));

    //This code is contributed by rag2127

</script>
```

Output

```
Maximum length = 5
Maximum length = 6
```

Time Complexity: O(n)
Auxiliary Space: O(1)

This article is contributed by **Niteesh Kumar**. If you like GeeksforGeeks and would like to contribute, you can also write an article using write.geeksforgeeks.org or mail your article to review-team@geeksforgeeks.org. See your article appearing on the GeeksforGeeks main page and help other Geeks.

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