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Experiment No.	10

AIM:	String Matching algorithms
PROBLEM STATEMENT :	To implement Robin Karp algorithm
ALGORITHM/ THEORY:	<p>The Robin-Karp algorithm is a string matching algorithm that uses a circular hash function to quickly find occurrences of a pattern string in a larger text string. The algorithm works by computing a hash value for the pattern and then comparing the hash values of substrings of the text to the hash value of the pattern.</p> <p>The algorithm works as follows:</p> <ol style="list-style-type: none"> 1. Compute the hash value of the pattern string. 2. Compute the hash value of the first substring of the text string with the same length as the pattern. 3. Compare the hash value of the substring with the hash value of the pattern. If they are equal, check if the substring and pattern are actually equal. 4. If the hash values are not equal, move the sliding window one position to the right and compute the hash value of the new substring by subtracting the value of the character leaving the window and adding the value of the character entering the window. Then repeat step 3. <p>Time Complexity: $O(n+m)$; where n is the length of text and m is the length of the pattern</p> <p>The hash function used in the Robin-Karp algorithm is a circular hash function that updates the hash value of a substring by subtracting the value of the first character and adding the value of the last character. This allows the algorithm to compute the hash value of each substring in $O(1)$ time.</p>

PROGRAM:

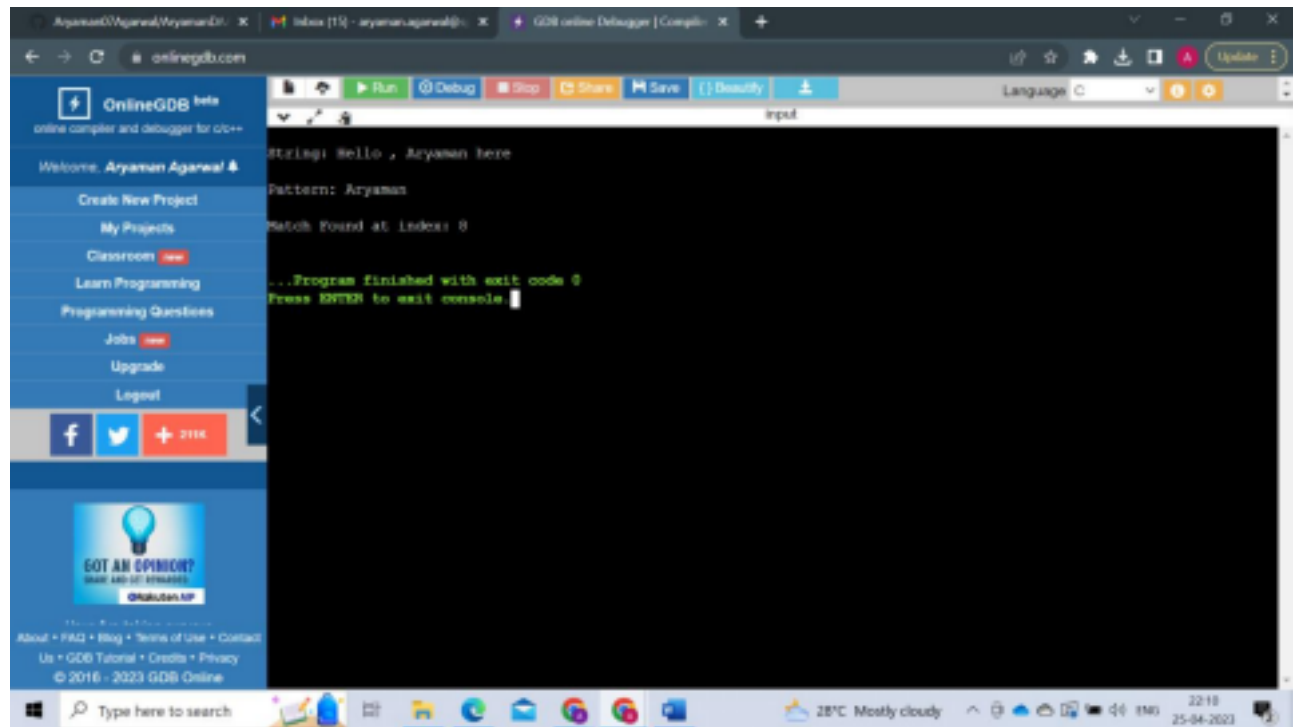
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#include <stdio.h>
#include <string.h>

void matchString(char str[], char pat[], int q)
{
    int x = strlen(pat);
    int y = strlen(str);
    int p = 0, t = 0, h = 1, d = 256;
    int i, j;
    for (i = 0; i < x - 1; i++)
    {
        h = (h * d) % q;
    }
    for (i = 0; i < x; i++)
    {
        p = (d * p + pat[i]) % q;
        t = (d * t + str[i]) % q;
    }
    for (i = 0; i <= y - x; i++)
    {
        if (p == t)
        {
            for (j = 0; j < x; j++)
            {
                if (str[i + j] != pat[j])
                {
                    break;
                }
            }
            if (j == x)
            {
                printf("\nMatch Found at index: %d \n", i); return;
            }
        }
        if (i < y - x)
        {
            t = (d * (t - str[i] * h) + str[i + x]) % q; if (t
```

	< 0)
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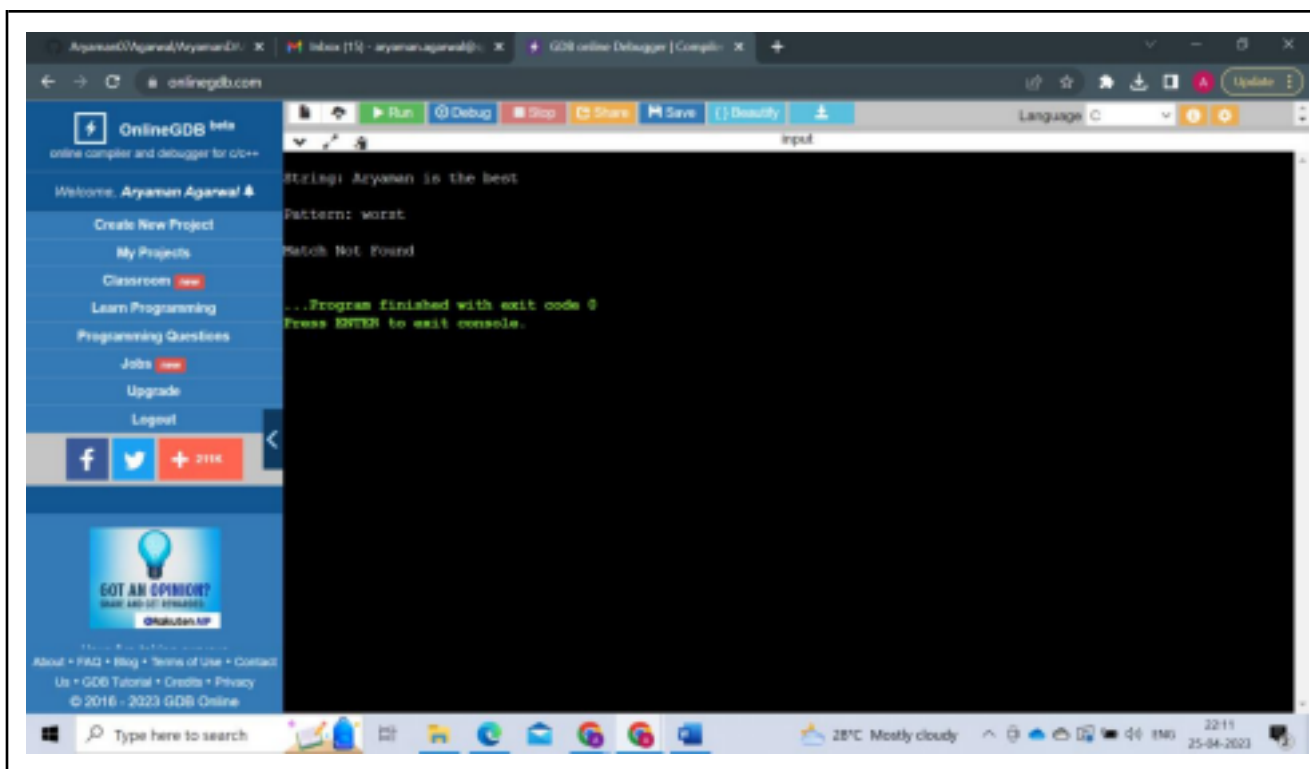
	<pre>{ t = (t + q); } } } printf("\nMatch Not Found\n"); } int main() { char str[100], pat[100]; printf("\nString: "); scanf("%[^\\n]s", str); getchar(); printf("\nPattern: "); scanf("%[^\\n]s", pat); int q = 269; matchString(str, pat, q); return 0; }</pre>
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RESULT:



The screenshot shows the OnlineGDB interface with the following content:

- Left Sidebar:** OnlineGDB logo, navigation links (Welcome, Create New Project, My Projects, Classroom, Learn Programming, Programming Questions, Jobs, Upgrade, Logout), social media icons, and a footer with 'GOT AN OPINION?' and 'ONLINEGDB.COM'.
- Top Bar:** Browser tabs for 'Aryaman@Aryaman@Wryaman@...', 'Index [1] - aryaman@aryaman@...', and 'GDB online Debugger | Compile...'. The OnlineGDB toolbar includes buttons for Run, Debug, Stop, Share, Save, and Beautify, along with a Language dropdown set to 'C'.
- Main Console:** Displays the output of a C program. The input string is 'Hello , Aryaman here' and the pattern is 'Aryaman'. The output shows 'Match Found at Index: 8' and '...Program finished with exit code 0'. The prompt 'Press ENTER to exit console.' is visible.
- Bottom Taskbar:** Windows search bar, taskbar icons, and system tray showing '28°C Mostly cloudy' and the date '25-04-2023'.



The screenshot shows the OnlineGDB interface with the following content:

- Left Sidebar:** Identical to the first screenshot, showing the OnlineGDB navigation menu and footer.
- Top Bar:** Identical to the first screenshot, showing the browser tabs and OnlineGDB toolbar.
- Main Console:** Displays the output of a C program. The input string is 'Aryaman is the best' and the pattern is 'worst'. The output shows 'Match Not Found' and '...Program finished with exit code 0'. The prompt 'Press ENTER to exit console.' is visible.
- Bottom Taskbar:** Identical to the first screenshot, showing the Windows search bar, taskbar icons, and system tray.

CONCLUSION:

Successfully implemented and understood String matching using Robin Karp Algorithm.