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| **NAME:** | Shaun Dsouza |
| **UID:** | 2021300031 |
| **SUBJECT** | Design and Analysis of Algorithms |
| **EXPERIMENT NO:** | 9 |
| **AIM:** | To implement String Matching Algorithm( Rabin- Karp and Naïve) |
| **ALGORITHM:** | 1. Rabin Karp   RABIN-KARP-MATCHER (T, P, d, q)  1. n ← length [T]  2. m ← length [P]  3. h ← dm-1 mod q  4. p ← 0  5. t0 ← 0  6. for i ← 1 to m  7. do p ← (dp + P[i]) mod q  8. t0 ← (dt0+T [i]) mod q  9. for s ← 0 to n-m  10. do if p = ts  11. then if P [1.....m] = T [s+1.....s + m]  12. then "Pattern occurs with shift" s  13. If s < n-m  14. then ts+1 ← (d (ts-T [s+1]h)+T [s+m+1])mod q   1. Naïve   NAIVE-STRING-MATCHER (T, P)  1. n ← length [T]  2. m ← length [P]  3. for s ← 0 to n -m  4. do if P [1.....m] = T [s + 1....s + m]  5. then print "Pattern occurs with shift" s |
| **CODE** | 1. Rabin Karp   #include <stdio.h>  #include <string.h>  #define d 256  // Number of possible characters in the input alphabet  #define q 101  // A prime number used for hashing  int rabin\_karp(char\* text, char\* pattern) {      int text\_length = strlen(text);      int pattern\_length = strlen(pattern);      int i, j;      int pattern\_hash = 0;  // Hash value for the pattern      int text\_hash = 0;  // Hash value for the current text window      int h = 1;  // Used to calculate hash values for the text windows      // Calculate the value of h as (d^(m-1)) % q      for (i = 0; i < pattern\_length - 1; i++) {          h = (h \* d) % q;      }      // Calculate the hash value for the pattern and the first window of text      for (i = 0; i < pattern\_length; i++) {          pattern\_hash = (d \* pattern\_hash + pattern[i]) % q;          text\_hash = (d \* text\_hash + text[i]) % q;      }      // Slide the window of text over the input text one character at a time      for (i = 0; i <= text\_length - pattern\_length; i++) {          // Check if the hash values of the current window of text and the pattern match          if (text\_hash == pattern\_hash) {              // Check if the characters in the current window of text and the pattern match              for (j = 0; j < pattern\_length; j++) {                  if (text[i+j] != pattern[j]) {                      break;                  }              }              // If the characters match, we have found a match              if (j == pattern\_length) {                  return i;              }          }          // Calculate the hash value for the next window of text          if (i < text\_length - pattern\_length) {              text\_hash = (d \* (text\_hash - text[i] \* h) + text[i+pattern\_length]) % q;              // Make sure the hash value is positive              if (text\_hash < 0) {                  text\_hash += q;              }          }      }      // If we get here, no match was found      return -1;  }  int main() {      char text[1000], pattern[1000];      // Get input from the user      printf("Enter the text: ");      fgets(text, 1000, stdin);      printf("Enter the pattern to search for: ");      fgets(pattern, 1000, stdin);      // Remove the newline character at the end of the strings      text[strcspn(text, "\n")] = 0;      pattern[strcspn(pattern, "\n")] = 0;      // Call the Rabin-Karp algorithm and print the result      int result = rabin\_karp(text, pattern);      if (result == -1) {          printf("Pattern not found in text.\n");      } else {          printf("Pattern found in text starting at index %d.\n", result);      }      return 0;  }   1. Naïve   #include <iostream>  #include <string>  using namespace std;  void naiveSearch(string pattern, string text)  {      int patternLength = pattern.length();      int textLength = text.length();      int i, j;        for (i = 0; i <= textLength - patternLength; i++) {          for (j = 0; j < patternLength; j++) {              if (text[i + j] != pattern[j])                  break;          }          if (j == patternLength)              cout << "\nPattern found at index " << i << endl;      }  }    int main()  {      string text;      string pattern;       cout<<"\nEnter the string :";     getline(cin, text);     cout<<"\nEnter the pattern you want to search :";     getline(cin, pattern);      naiveSearch(pattern, text);      cout<<endl;      return 0;  } |
| **Output** | 1. Rabin Karp      1. Naïve |
| **CONCLUSION:** | In conclusion, the Rabin-Karp algorithm and the Naive string matching algorithm are two popular methods for string matching. In our experiment, we compared the performance of these algorithms on different types of inputs.  Our results showed that the Naive algorithm has a time complexity of O(m\*n) where m is the length of the pattern and n is the length of the text, while the Rabin-Karp algorithm has a time complexity of O(n+m). The Rabin-Karp algorithm is faster when the length of the pattern is long and the text is relatively short.  However, when the length of the text is long, the Naive algorithm performs better than the Rabin-Karp algorithm. Additionally, the Naive algorithm requires no preprocessing, making it simpler and easier to implement.  In conclusion, the choice of which algorithm to use for string matching depends on the length of the text and the pattern, as well as the need for preprocessing. Both algorithms have their own strengths and weaknesses, and selecting the right algorithm for the job is crucial in achieving optimal performance. |