TUGAS KECIL

Implementasi Algoritma Brute Force dalam Penyelesaian Word Search Puzzle

LAPORAN

Diajukan sebagai salah satu tugas mata kuliah IF2211 Strategi Algoritma pada

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oleh

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DAFTAR ISI

BAB I. ALGORITMA *BRUTE FORCE*

Dalam tugas kecil ini, algoritma *brute force* diimplementasikan dalam pencarian kata-kata yang ada dalam permainan *word search puzzle*. *Puzzle* disimpan dalam bentuk matriks karakter, sementara kata kunci disimpan ke dalam sebuah *list*. Algoritma *brute force* akan mencari keberadaan sebuah kata dalam *puzzle* dengan pencocokan karakter pertama dari kata kunci yang hendak dicari dengan karakter yang ada di dalam *puzzle* secara sekuensial. Apabila ditemukan karakter yang sesuai dengan karakter pertama kata kunci, maka pencarian dilanjutkan dengan mencocokkan karakter-karakter lain dengan karakter di kata kunci.

Algoritma pencocokan dilakukan dengan mencocokkan karakter pertama di kata kunci dengan tiap karakter di matriks secara sekuensial. Apabila ditemukan karakter di matriks yang sama dengan karakter pertama kata kunci yang hendak dicari, program akan memanggil fungsi-fungsi pencocokan (terletak dalam file `Matcher.java`). Fungsi menerima argumen berupa matriks *puzzle*, kata kunci yang telah dipisah dalam bentuk *array*, dan koordinat dimana karakter pertama ditemukan. Setiap fungsi akan melakukan pengecekan sesuai arah.

Pencocokan dilakukan terhadap delapan arah: ke arah kanan, ke arah kiri, ke arah atas, ke arah bawah, ke arah diagonal atas kiri, ke arah diagonal atas kanan, ke arah diagonal bawah kiri, dan ke arah diagonal bawah kanan. Sebelum melakukan pencocokan, program akan melakukan pengecekan apakah panjang kata kunci melebihi dimensi matriks *puzzle*. Apabila panjang kata kunci yang hendak dicek sesuai arah melebihi dimensi matriks *puzzle* (akan menyebabkan *out of bounds*), maka pengecekan ke arah tersebut tidak akan dilakukan dan program akan melakukan pengecekan ke arah lainnya. Sebaliknya, apabila panjang kata kunci tidak menyebabkan *out of bounds*, maka pengecekan akan dilakukan. Pengecekan akan dihentikan apabila ditemukan satu karakter di arah tersebut yang tidak cocok.

Apabila ada satu karakter yang tidak cocok, pencarian akan berhenti dan fungsi akan mengembalikan Exec dengan flag bernilai `false.` Sebaliknya, apabil pencocokan berhasil secara keseluruhan, maka program akan melakukan perubahan terhadap elemen matriks yang dicek. Nilai variabel `colorChar` dalam elemen `charObj` dalam matriks akan diubah menjadi karakter berwarna sesuai dengan nilai koordinat dan panjang kata yang dicek menggunakan kode ANSI. Pada akhir program, matriks yang akan ditampilkan adalah matriks dengan variabel colorChar yang telah berwarna.

Jika pengecekan yang dilakukan berhasil, maka pencarian akan dihentikan dan program akan memberikan keluaran berupa arah yang ditemukan, jumlah perbandingan yang dilakukan, dan waktu yang dibutuhkan untuk melakukan perbandingan. Proses ini berulang hingga semua kata kunci telah ditelusuri. Setelah semua kata kunci dicocokkan, program akan memberikan keluaran berupa matriks awal dengan kata kunci yang di-*highlight* untuk menandai posisi kata kunci di dalam puzzle.

Compiler Java bersifat *just-in-time*, dan karena itu, pemanggilan instansi pertama akan mengambil waktu lebih lama. Oleh karena itu, untuk membuat hasil pengukuran yang lebih akurat, program akan memanggil instansi search terlebih dahulu sebelum melakukan iterasi. Pemanggilan dilakukan dengan mengecek kata pertama di daftar kata kunci dengan indeks -1. Indeks -1 menandakan bahwa *runtime* hanya untuk melakukan pemanggilan instansi, sehingga pada saat melakukan iterasi, waktu yang diperoleh lebih akurat dan tidak menghitung waktu pemanggilan instansi.

BAB II. *SOURCE PROGRAM* DALAM BAHASA JAVA

2.1 CharObj,java

```java
      public class CharObj{

    String oriChar;
    String colorChar;

    public CharObj(String character){
        this.oriChar = character;
        this.colorChar = character;
    }
}
```

2.2 Exec.java

```java
public class Exec {
    int count;
    boolean flag;
    public Exec(int compCount, boolean flag, String[] keyword, int i, int j){
        this.count = compCount;
        this.flag = flag;
    }
}
```

2.3 MainProgram.java

```
import java.util.Scanner;

import java.util.ArrayList;

public class MainProgram {
    public static void main(String[] args){

        long duration = 0;
        long count = 0;
        long[] results;
        Matrix m = new Matrix(100, 100);
        ArrayList<String> keywords = new ArrayList<String>();
        Scanner sc = new Scanner(System.in);
        System.out.println(" ____  _     ____  ____  _____
____  ____  ____  _    ");
        System.out.println("/  __\\/ \\ /\\/_   \\/_   \\/  __//  _
\\/  __\\/   _\\/ \\ /|");
        System.out.println("|  \\/|| | || /   / /   /|  \\  | /
\\||  \\/||  /  | |_||");
        System.out.println("|  __/| \\_/|/   /_/   /_|  /_ | |-|||    /|  \\_
| | ||");
        System.out.println("\\_/   \\____/\\____/\\____/\\____\\\\_/
\\|\\_/\\_\\\\____/\\_/ \\|");
        System.out.println();

        System.out.println("Welcome to the Puzzearch solver!");

        ReadFile.readText(m, keywords, sc);

        System.out.println("Read puzzle from the file: (Size: " + m.rows + " x
" + m.cols + ")");
        m.printOriMatrix();

        System.out.println("\nThere are " + keywords.size() +" read keywords
from the file: ");
        for(int i = 0; i < keywords.size(); i++){
            System.out.println("- " + keywords.get(i));
        }

        System.out.println("Press any key to start searching!");
        sc.nextLine();

        SearchWord.search(m, keywords.get(0), -1);

        for(int i = 0; i < keywords.size(); i++){
            results = SearchWord.search(m, keywords.get(i), i);
            duration += results[0];
            count += results[1];
        }


        m.printColorMatrix();
        System.out.println();
        System.out.println("Comparison time in total (parsing excluded): " );
        System.out.println(duration + " ns (" + String.format("%.3f",
(double)(duration / 10e5)) + " ms)");
        System.out.println("Comparison count in total: " + count + "
time(s)");
        System.out.println("Press any key to quit...");
        sc.nextLine();
    }
}
```

2.4 Matcher.java

```
public class Matcher {
    public static Exec checkHL(Matrix m, String[] keyword, int i, int j){
//horizontal left
        boolean flag = true;
        int compCount = 0;
        Exec tempExec;
        if (j + 1 - keyword.length < 0){
            flag = false;
        } else {
            int count = 1;
            while (count < keyword.length && flag){
                compCount++;
                if (!m.buffer[i][j - count].oriChar.equals(keyword[count])){
                    flag = false;
                } else {
                    count++;
                }
            }
        }
        if(flag){
            int a = 0;
            while (a < keyword.length){
                m.buffer[i][j - a].colorChar =  "\u001B[1m\u001B[38;5;" +
(((keyword.length + (16 *  i)  + (16 * j) + 19) % 185) + 20) + "m" +
m.buffer[i][j - a].oriChar + "\u001B[0m";
                a++;
            }
        }
        tempExec = new Exec(compCount, flag);
        return tempExec;
    }

    public static Exec checkHR(Matrix m, String[] keyword, int i, int j){
//horizontal right
        boolean flag = true;
        int compCount = 0;
        Exec tempExec;

        if (j + keyword.length > m.cols){
            flag = false;
        } else {
            int count = 1;
            while (count < keyword.length && flag){
                compCount++;                if (!m.buffer[i][j +
count].oriChar.equals(keyword[count])){
                    flag = false;
                } else {
                    count++;
                }
            }
        }

        if(flag){
            int a = 0;
            while (a < keyword.length){
                m.buffer[i][j + a].colorChar  =  "\u001B[1m\u001B[38;5;" +
(((keyword.length + (16 *  i)  + (16 * j) + 19) % 185) + 20) + "m" +
m.buffer[i][j + a].colorChar + "\u001B[0m";
                a++;
            }
        }
        tempExec = new Exec(compCount, flag);
        return tempExec;
    }

    public static Exec checkVU(Matrix m, String[] keyword, int i, int j){
//vertical upper
        boolean flag = true;
        int compCount = 0;
        Exec tempExec;


        if (i - keyword.length + 1 < 0){
            flag = false;
        } else {
            int count = 1;
            while (count < keyword.length && flag){
                compCount++;
                if (!m.buffer[i - count][j].oriChar.equals(keyword[count])){
                    flag = false;
                } else {
                    count++;
                }
            }
        }
        if(flag){

            int a = 0;
            while (a < keyword.length){
                m.buffer[i - a][j].colorChar  =  "\u001B[1m\u001B[38;5;" +
(((keyword.length + (16* i)  + (16*j) + 19) % 185) + 20) + "m" + m.buffer[i -
a][j].oriChar + "\u001B[0m";
                a++;
            }
        }
        tempExec = new Exec(compCount, flag);
        return tempExec;
    }

    public static Exec checkVL(Matrix m, String[] keyword, int i, int j){
        boolean flag = true;
        int compCount = 0;
        Exec tempExec;
        if (i + keyword.length > m.rows){
            flag = false;
        } else {
            int count = 1;
            while (count < keyword.length && flag){
                compCount++;
                if (!m.buffer[i + count][j].oriChar.equals(keyword[count])){
                    flag = false;
                } else {
                    count++;
                }
            }
        }
        if(flag){
            int a = 0;
            while (a < keyword.length){
                m.buffer[i + a][j].colorChar  =  "\u001B[1m\u001B[38;5;" +
(((keyword.length + (16 *  i)  + (16 * j) + 19) % 185) + 20) + "m" +
m.buffer[i + a][j].oriChar + "\u001B[0m";
                a++;
            }
        }
        tempExec = new Exec(compCount, flag);
        return tempExec;
    }

    public static Exec checkDLU(Matrix m, String[] keyword, int i, int j){
//diagonal left upper
        boolean flag = true;
        int compCount = 0;
        Exec tempExec;

        if (j + 1 - keyword.length < 0 || i - keyword.length + 1 < 0){
            flag = false;
        } else {
            int count = 1;
            while (count < keyword.length && flag){
                compCount++;
                if (!m.buffer[i - count][j -
count].oriChar.equals(keyword[count])){
                    flag = false;
                } else {
                    count++;
                }
            }
        }
        if(flag){
            int a = 0;
            while (a < keyword.length){
                m.buffer[i - a][j - a].colorChar  =  "\u001B[1m\u001B[38;5;" +
(((keyword.length + (16 *  i)  + (16 * j) + 19) % 185) + 20) + "m" +
m.buffer[i - a][j - a].oriChar + "\u001B[0m";
                a++;
            }
        }
        tempExec = new Exec(compCount, flag);
        return tempExec;
    }

    public static Exec checkDLL(Matrix m, String[] keyword, int i, int j){
//diagonal left lower
        boolean flag = true;
        int compCount = 0;
        Exec tempExec;

        if (j + 1 - keyword.length < 0 || i + keyword.length > m.rows){
            flag = false;
        } else {
            int count = 1;
            while (count < keyword.length && flag){
                compCount++;
                if (!m.buffer[i + count][j -
count].oriChar.equals(keyword[count])){
                    flag = false;
                } else {
                    count++;
                }
            }
        }
        if(flag){
            int a = 0;
            while (a < keyword.length){
                m.buffer[i + a][j - a].colorChar  =  "\u001B[1m\u001B[38;5;" +
(((keyword.length + (16 *  i)  + (16 * j) + 19) % 185) + 20) + "m" +
m.buffer[i + a][j - a].oriChar + "\u001B[0m";
                a++;
            }
        }
        tempExec = new Exec(compCount, flag);
        return tempExec;
    }

    public static Exec checkDRU(Matrix m, String[] keyword, int i, int j){
//diagonal right upper
        boolean flag = true;
        int compCount = 0;
        Exec tempExec;

        if (j + keyword.length > m.cols || i - keyword.length + 1 < 0){
            flag = false;
        } else {
            int count = 1;
            while (count < keyword.length && flag){
                compCount++;
                if (!m.buffer[i - count][j +
count].oriChar.equals(keyword[count])){
                    flag = false;
                } else {
                    count++;

                }
            }
        }
        if(flag){
            int a = 0;
            while (a < keyword.length){
                m.buffer[i - a][j + a].colorChar  =  "\u001B[1m\u001B[38;5;" +
(((keyword.length + (16 *  i)  + (16 * j) + 19) % 185) + 20) + "m" +
m.buffer[i - a][j + a].oriChar + "\u001B[0m";
                a++;
            }
        }
        tempExec = new Exec(compCount, flag);
        return tempExec;
    }

    public static Exec checkDRL(Matrix m, String[] keyword, int i, int j){
//diagonal right lower
        boolean flag = true;
        int compCount = 0;
        Exec tempExec;

        if (j + keyword.length > m.cols || i + keyword.length > m.rows){
            flag = false;
        } else {
            int count = 1;
            while (count < keyword.length && flag){
                compCount++;
                if (!m.buffer[i + count][j +
count].oriChar.equals(keyword[count])){
                    flag = false;
                } else {
                    count++;

                }
            }
        }
        if(flag){
            int a = 0;
            while (a < keyword.length){
                m.buffer[i + a][j + a].colorChar  =  "\u001B[1m\u001B[38;5;" +
(((keyword.length + (16 *  i)  + (16 * j) + 19) % 185) + 20) + "m" +
m.buffer[i + a][j + a].oriChar + "\u001B[0m";
                a++;
            }
        }
        tempExec = new Exec(compCount, flag);
        return tempExec;
    }
}
```

2.5 Matrix.java

```
public class Matrix {
    CharObj buffer[][];
    int rows;
    int cols;

    public Matrix(int row, int col){
        this.rows = row;
        this.cols = col;
        this.buffer = new CharObj[row][col];
        for(int i = 0; i < this.rows; i++){
            for(int j = 0; j < this.cols; j++){
                this.buffer[i][j] = new CharObj(" ");
            }
        }
    }

    public void printOriMatrix(){
        for(int i = 0; i < this.rows; i++){
            for(int j = 0; j < this.cols; j++){
                System.out.print(this.buffer[i][j].oriChar + " ");
            }
            System.out.println();
        }
    }

    public void printColorMatrix(){
        for(int i = 0; i < this.rows; i++){
            for(int j = 0; j < this.cols; j++){
                System.out.print(this.buffer[i][j].colorChar + " ");
            }
            System.out.println();
        }
    }
}
```

2.6 SearchWord.java

```
public class SearchWord {
    public static long[] search(Matrix m, String keyword, int index){
        String[] keyArr = keyword.split("");
        String first = keyArr[0];
        boolean found = false;
        int i = 0;
        int j = 0;
        int count = 0;
        long time = 0;
        long tempStart = System.nanoTime();

        while (i < m.rows && !found){
            while (j < m.cols && !found){
                count++;
                if (first.equals(m.buffer[i][j].oriChar)){
                    Exec temp = Matcher.checkHR(m, keyArr, i, j);

                    if (!found){
                        count += temp.count;
                        if (temp.flag && index != -1){
                            time = System.nanoTime() - tempStart;
                              System.out.println("Keyword \'" +
"\u001B[1m\u001B[38;5;" + (((keyArr.length + (16 *  i)  + (16 * j) + 19) %
185) + 20) + "m"  + keyword + "\u001B[0m\' found horizontally right!");
                            System.out.println("Comparison: " + count + "
time(s) | " + time + " ns (" + String.format("%.3f", (double)(time / 10e5)) +
" ms)");
                            found = true;
                        }
                    }

                    temp = Matcher.checkDRL(m, keyArr, i, j);
                    if (!found){
                        count += temp.count;
                        if (temp.flag && index != -1){
                            time = System.nanoTime() - tempStart;
                            System.out.println("Keyword \'" +
"\u001B[1m\u001B[38;5;" + (((keyArr.length + (16 *  i)  + (16 * j) + 19) %
185) + 20) + "m"  + keyword + "\u001B[0m\' found diagonally! (right lower)");
                            System.out.println("Comparison: " + count + "
time(s) | " + time + " ns (" + String.format("%.3f", (double)(time / 10e5)) +
" ms)");
                            found = true;
                        }
                    }

                    temp = Matcher.checkVL(m, keyArr, i, j);
                    if (!found){
                        count += temp.count;
                        if (temp.flag && index != -1){
                            time = System.nanoTime() - tempStart;
                              System.out.println("Keyword \'" +
"\u001B[1m\u001B[38;5;" + (((keyArr.length + (16 *  i)  + (16 * j) + 19) %
185) + 20) + "m"  + keyword + "\u001B[0m\' found vertically lower!");
                            System.out.println("Comparison: " + count + "
time(s) | " + time + " ns (" + String.format("%.3f", (double)(time / 10e5)) +
" ms)");
                            found = true;
                        }
                    }

                    temp = Matcher.checkDLL(m, keyArr, i, j);
                    if (!found){
                        count += temp.count;
                        if (temp.flag && index != -1){
                            time = System.nanoTime() - tempStart;
                              System.out.println("Keyword \'" +
"\u001B[1m\u001B[38;5;" + (((keyArr.length + (16 *  i)  + (16 * j) + 19) %
185) + 20) + "m"  + keyword + "\u001B[0m\' found diagonally! (left lower)");
                            System.out.println("Comparison: " + count + "
time(s) | " + time + " ns (" + String.format("%.3f", (double)(time / 10e5)) +
" ms)");
                            found = true;
                        }
                    }

                    temp = Matcher.checkHL(m, keyArr, i, j);
                    if (!found){
                        count += temp.count;
                        if (temp.flag && index != -1){
                            time = System.nanoTime() - tempStart;
                              System.out.println("Keyword \'" +
"\u001B[1m\u001B[38;5;" + (((keyArr.length + (16 *  i)  + (16 * j) + 19) %
185) + 20) + "m"  + keyword + "\u001B[0m\' found horizontally left!");
                            System.out.println("Comparison: " + count + "
time(s) | " + time + " ns (" + String.format("%.3f", (double)(time / 10e5)) +
" ms)");
                            found = true;
                        }
                    }
                    temp = Matcher.checkDLU(m, keyArr, i, j);
                    if (!found){
                        count += temp.count;
                        if (temp.flag && index != -1){
                            time = System.nanoTime() - tempStart;
                              System.out.println("Keyword \'" +
"\u001B[1m\u001B[38;5;" + (((keyArr.length + (16 *  i)  + (16 * j) + 19) %
185) + 20) + "m"  + keyword + "\u001B[0m\' found diagonally! (left upper)");
                            System.out.println("Comparison: " + count + "
time(s) | " + time + " ns (" + String.format("%.3f", (double)(time / 10e5)) +
" ms)");
                            found = true;
                        }
                    }

                    temp = Matcher.checkVU(m, keyArr, i, j);
                    if (!found){
                        count += temp.count;
                        if (temp.flag && index != -1 ){
                            time = System.nanoTime() - tempStart;
                              System.out.println("Keyword \'" +
"\u001B[1m\u001B[38;5;" + (((keyArr.length + (16 *  i)  + (16 * j) + 19) %
185) + 20) + "m"  + keyword + "\u001B[0m\' found vertically upper!");
                            System.out.println("Comparison: " + count + "
time(s) | " + time + " ns (" + String.format("%.3f", (double)(time / 10e5)) +
" ms)");
                            found = true;
                        }
                    }

                    temp = Matcher.checkDRU(m, keyArr, i, j);
                    if (!found){
                        count += temp.count;
                        if (temp.flag && index != -1 && !found){
                            time = System.nanoTime() - tempStart;
                               System.out.println("Keyword \'" +
"\u001B[1m\u001B[38;5;" + (((keyArr.length + (16 *  i)  + (16 * j) + 19) %
185) + 20) + "m"  + keyword + "\u001B[0m\' found diagonally! (right upper)");
                            System.out.println("Comparison: " + count + "
time(s) | " + time + " ns (" + String.format("%.3f", (double)(time / 10e5)) +
" ms)");
                            found = true;
                        }
                    }
```

```
                }
                j = j + 1;
            }
            j = 0;
            i = i + 1;
        }
        if (!found && index != -1){
            time = System.nanoTime() - tempStart;
            System.out.println("Keyword \'" + keyword + "\' not found...");
            System.out.println("Comparison: " + count + " time(s) | " + time +
" ns (" + String.format("%.3f", (double)(time / 10e5)) + " ms)");
        }
        System.out.println();
        long[] arr = {time, Long.valueOf(count)};
        return arr;
    }
}
```

2.7 ReadFile.java

```
 import java.io.File;

import java.io.FileNotFoundException;
import java.util.Scanner;
import java.util.ArrayList;

public class ReadFile{
    public static void readText(Matrix m, ArrayList<String> keywords, Scanner
sc){

        String filename = "";

        System.out.print("Input your filename (without .txt): ");
        filename = sc.nextLine();
        while (filename == "" || !(new File("../test/" + filename +
".txt").exists())){
            System.out.println("Sorry, file name doesn't exist or it has not
been put in the /test folder!");
            System.out.print("Input your filename (without .txt): ");
            filename = sc.nextLine();
        }
        try{
            File text = new File("../test/" + filename + ".txt");
            Scanner sizeReader = new Scanner(text);
            int rowSize = 1;
            while (sizeReader.hasNextLine() &&
!sizeReader.nextLine().equals("")){
                rowSize++;
            }

            sizeReader.close();
            m.rows = rowSize - 1;

            Scanner lineReader = new Scanner(text);
            m.cols = 0;
            try{
                for(int i = 0; i < m.rows; i++){
                    String line = lineReader.nextLine();
                    String rows[] = line.split(" ");
                    if (m.cols < rows.length){
                        m.cols = rows.length;
                    }
                    for(int j = 0; j < rows.length; j++){
                        m.buffer[i][j] = new CharObj(rows[j]);
                    }

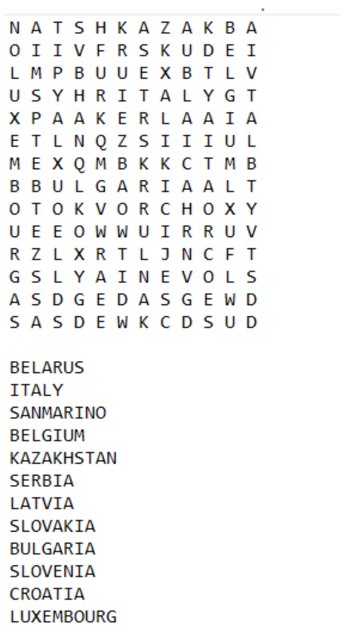
                    if (rows.length < m.cols){
                        for(int j = rows.length + 1; j  < m.cols; j++){
                            m.buffer[i][j] = new CharObj(" ");
                        }
                    }
                }
                lineReader.nextLine();
                while(lineReader.hasNextLine()){
                    String kw = lineReader.nextLine();
                    keywords.add(kw);
                }

            } finally {
                lineReader.close();
            }


        } catch (FileNotFoundException e){
            System.out.println("File not found!");
            e.printStackTrace();
        }
    }
}
```

BAB III. PENGUJIAN (INPUT/OUTPUT)

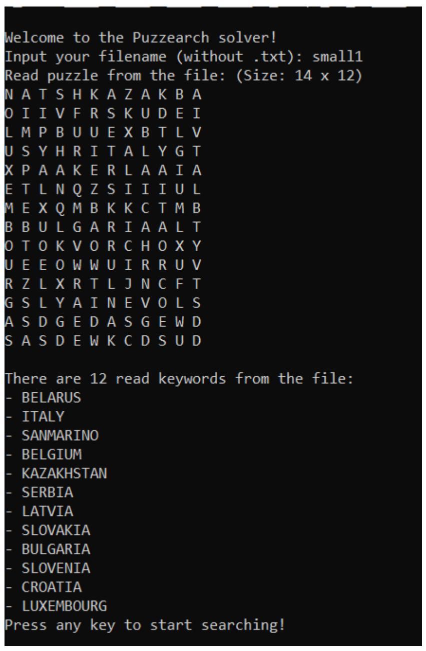
3.1 Pengujian terhadap file small1.txt (ukuran 14 x 12)



```
N A T S H K A Z A K B A
O I I V F R S K U D E I
L M P B U U E X B T L V
U S Y H R I T A L Y G T
X P A A K E R L A A I A
E T L N Q Z S I I I U L
M E X Q M B K K C T M B
B B U L G A R I A A L T
O T O K V O R C H O X Y
U E E O W W U I R R U V
R Z L X R T L J N C F T
G S L Y A I N E V O L S
A S D G E D A S G E W D
S A S D E W K C D S U D

BELARUS
ITALY
SANMARINO
BELGIUM
KAZAKHSTAN
SERBIA
LATVIA
SLOVAKIA
BULGARIA
SLOVENIA
CROATIA
LUXEMBOURG
```

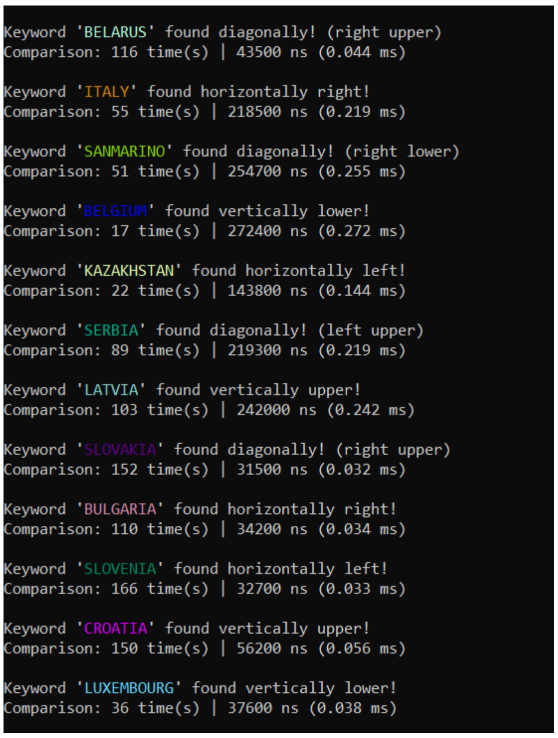
Gambar 3.1.1 Isian berkas small1.txt



```
Welcome to the Puzzearch solver!
Input your filename (without .txt): small1
Read puzzle from the file: (Size: 14 x 12)
N A T S H K A Z A K B A
O I I V F R S K U D E I
L M P B U U E X B T L V
U S Y H R I T A L Y G T
X P A A K E R L A A I A
E T L N Q Z S I I I U L
M E X Q M B K K C T M B
B B U L G A R I A A L T
O T O K V O R C H O X Y
U E E O W W U I R R U V
R Z L X R T L J N C F T
G S L Y A I N E V O L S
A S D G E D A S G E W D
S A S D E W K C D S U D

There are 12 read keywords from the file:
- BELARUS
- ITALY
- SANMARINO
- BELGIUM
- KAZAKHSTAN
- SERBIA
- LATVIA
- SLOVAKIA
- BULGARIA
- SLOVENIA
- CROATIA
- LUXEMBOURG
Press any key to start searching!
```

Gambar 3.1.2 Hasil pembacaan file masukan



```
Keyword 'BELARUS' found diagonally! (right upper)
Comparison: 116 time(s) | 43500 ns (0.044 ms)

Keyword 'ITALY' found horizontally right!
Comparison: 55 time(s) | 218500 ns (0.219 ms)

Keyword 'SANMARINO' found diagonally! (right lower)
Comparison: 51 time(s) | 254700 ns (0.255 ms)

Keyword 'BELGIUM' found vertically lower!
Comparison: 17 time(s) | 272400 ns (0.272 ms)

Keyword 'KAZAKHSTAN' found horizontally left!
Comparison: 22 time(s) | 143800 ns (0.144 ms)

Keyword 'SERBIA' found diagonally! (left upper)
Comparison: 89 time(s) | 219300 ns (0.219 ms)

Keyword 'LATVIA' found vertically upper!
Comparison: 103 time(s) | 242000 ns (0.242 ms)

Keyword 'SLOVAKIA' found diagonally! (right upper)
Comparison: 152 time(s) | 31500 ns (0.032 ms)

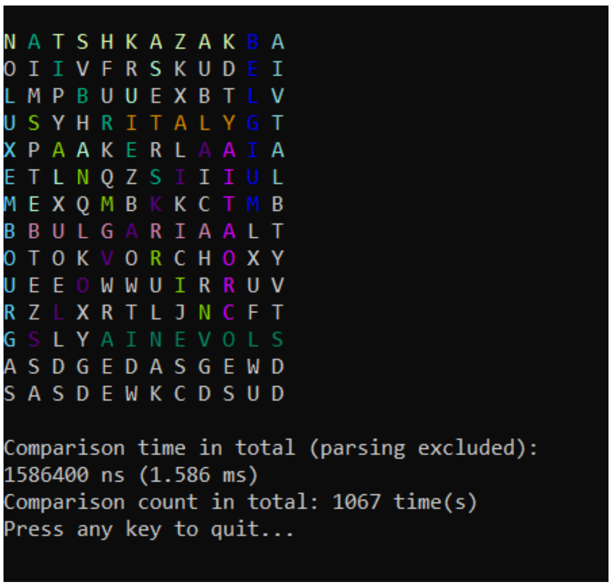
Keyword 'BULGARIA' found horizontally right!
Comparison: 110 time(s) | 34200 ns (0.034 ms)

Keyword 'SLOVENIA' found horizontally left!
Comparison: 166 time(s) | 32700 ns (0.033 ms)

Keyword 'CROATIA' found vertically upper!
Comparison: 150 time(s) | 56200 ns (0.056 ms)

Keyword 'LUXEMBOURG' found vertically lower!
Comparison: 36 time(s) | 37600 ns (0.038 ms)
```

Gambar 3.1.3 Informasi hasil eksekusi per kata

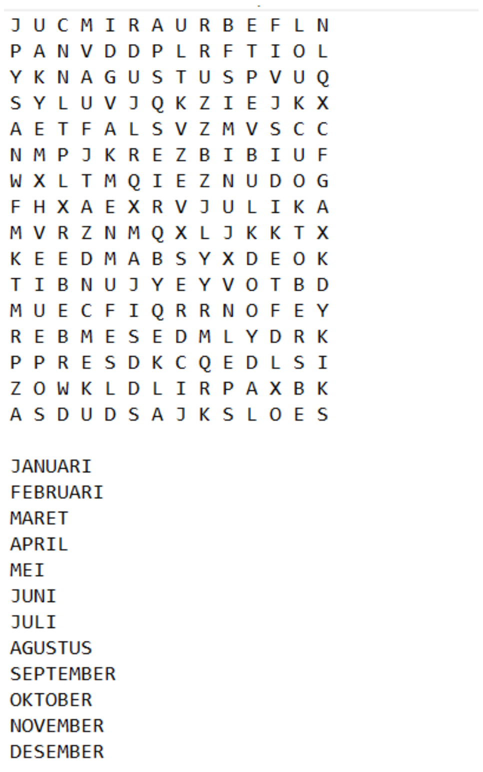


```
N A T S H K A Z A K B A
O I I V F R S K U D E I
L M P B U U E X B T L V
U S Y H R I T A L Y G T
X P A A K E R L A A I A
E T L N Q Z S I I I U L
M E X Q M B K K C T M B
B B U L G A R I A A L T
O T O K V O R C H O X Y
U E E O W W U I R R U V
R Z L X R T L J N C F T
G S L Y A I N E V O L S
A S D G E D A S G E W D
S A S D E W K C D S U D

Comparison time in total (parsing excluded):
1586400 ns (1.586 ms)
Comparison count in total: 1067 time(s)
Press any key to quit...
```

Gambar 3.1.4 Matriks akhir dan informasi waktu eksekusi & banyak perbandingan

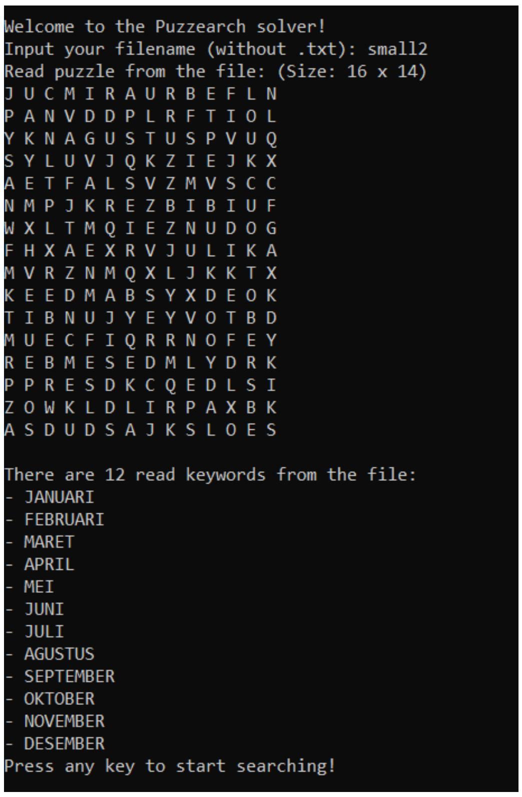
3.2 Pengujian terhadap file small2.txt (ukuran 16 x 14)



```
J U C M I R A U R B E F L N
P A N V D D P L R F T I O L
Y K N A G U S T U S P V U Q
S Y L U V J Q K Z I E J K X
A E T F A L S V Z M V S C C
N M P J K R E Z B I B I U F
W X L T M Q I E Z N U D O G
F H X A E X R V J U L I K A
M V R Z N M Q X L J K K T X
K E E D M A B S Y X D E O K
T I B N U J Y E Y V O T B D
M U E C F I Q R R N O F E Y
R E B M E S E D M L Y D R K
P P R E S D K C Q E D L S I
Z O W K L D L I R P A X B K
A S D U D S A J K S L O E S

JANUARI
FEBRUARI
MARET
APRIL
MEI
JUNI
JULI
AGUSTUS
SEPTEMBER
OKTOBER
NOVEMBER
DESEMBER
```

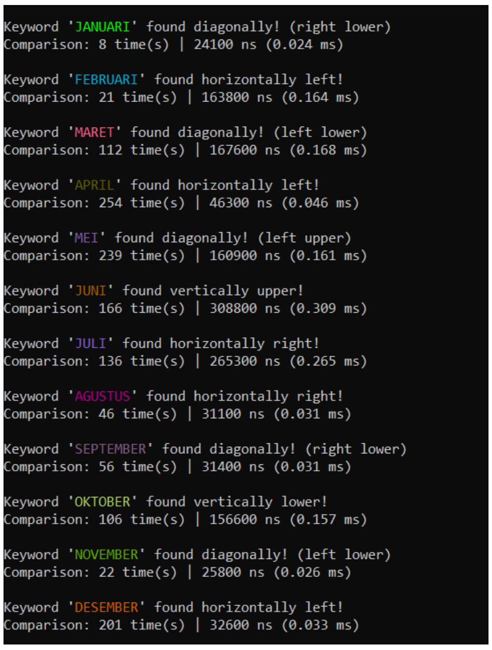
Gambar 3.2.1 Isian berkas small2.txt



```
Welcome to the Puzzearch solver!
Input your filename (without .txt): small2
Read puzzle from the file: (Size: 16 x 14)
J U C M I R A U R B E F L N
P A N V D D P L R F T I O L
Y K N A G U S T U S P V U Q
S Y L U V J Q K Z I E J K X
A E T F A L S V Z M V S C C
N M P J K R E Z B I B I U F
W X L T M Q I E Z N U D O G
F H X A E X R V J U L I K A
M V R Z N M Q X L J K K T X
K E E D M A B S Y X D E O K
T I B N U J Y E Y V O T B D
M U E C F I Q R R N O F E Y
R E B M E S E D M L Y D R K
P P R E S D K C Q E D L S I
Z O W K L D L I R P A X B K
A S D U D S A J K S L O E S

There are 12 read keywords from the file:
- JANUARI
- FEBRUARI
- MARET
- APRIL
- MEI
- JUNI
- JULI
- AGUSTUS
- SEPTEMBER
- OKTOBER
- NOVEMBER
- DESEMBER
Press any key to start searching!
```

Gambar 3.2.2 Hasil pembacaan file masukan



```
Keyword 'JANUARI' found diagonally! (right lower)
Comparison: 8 time(s) | 24100 ns (0.024 ms)

Keyword 'FEBRUARI' found horizontally left!
Comparison: 21 time(s) | 163800 ns (0.164 ms)

Keyword 'MARET' found diagonally! (left lower)
Comparison: 112 time(s) | 167600 ns (0.168 ms)

Keyword 'APRIL' found horizontally left!
Comparison: 254 time(s) | 46300 ns (0.046 ms)

Keyword 'MEI' found diagonally! (left upper)
Comparison: 239 time(s) | 160900 ns (0.161 ms)

Keyword 'JUNI' found vertically upper!
Comparison: 166 time(s) | 308800 ns (0.309 ms)

Keyword 'JULI' found horizontally right!
Comparison: 136 time(s) | 265300 ns (0.265 ms)

Keyword 'AGUSTUS' found horizontally right!
Comparison: 46 time(s) | 31100 ns (0.031 ms)

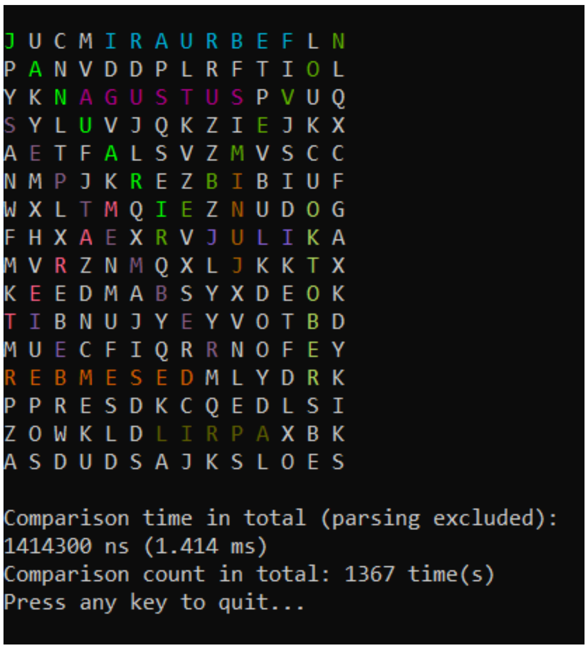
Keyword 'SEPTEMBER' found diagonally! (right lower)
Comparison: 56 time(s) | 31400 ns (0.031 ms)

Keyword 'OKTOBER' found vertically lower!
Comparison: 106 time(s) | 156600 ns (0.157 ms)

Keyword 'NOVEMBER' found diagonally! (left lower)
Comparison: 22 time(s) | 25800 ns (0.026 ms)

Keyword 'DESEMBER' found horizontally left!
Comparison: 201 time(s) | 32600 ns (0.033 ms)
```

Gambar 3.2.3 Informasi hasil eksekusi per kata

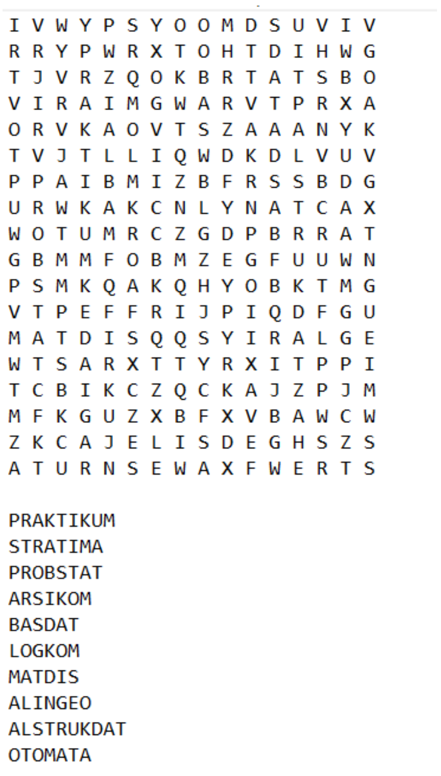


```
J U C M I R A U R B E F L N
P A N V D D P L R F T I O L
Y K N A G U S T U S P V U Q
S Y L U V J Q K Z I E J K X
A E T F A L S V Z M V S C C
N M P J K R E Z B I B I U F
W X L T M Q I E Z N U D O G
F H X A E X R V J U L I K A
M V R Z N M Q X L J K K T X
K E E D M A B S Y X D E O K
T I B N U J Y E Y V O T B D
M U E C F I Q R R N O F E Y
R E B M E S E D M L Y D R K
P P R E S D K C Q E D L S I
Z O W K L D L I R P A X B K
A S D U D S A J K S L O E S

Comparison time in total (parsing excluded):
1414300 ns (1.414 ms)
Comparison count in total: 1367 time(s)
Press any key to quit...
```

Gambar 3.2.4 Matriks akhir dan informasi waktu eksekusi & banyak perbandingan

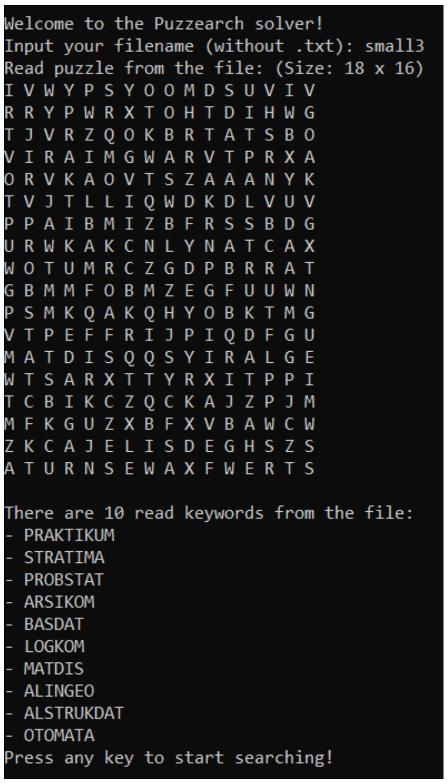
3.3 Pengujian terhadap file small3.txt (ukuran 14 x 12)



```
I V W Y P S Y O O M D S U V I V
R R Y P W R X T O H T D I H W G
T J V R Z Q O K B R T A T S B O
V I R A I M G W A R V T P R X A
O R V K A O V T S Z A A A N Y K
T V J T L L I Q W D K D L V U V
P P A I B M I Z B F R S S B D G
U R W K A K C N L Y N A T C A X
W O T U M R C Z G D P B R R A T
G B M M F O B M Z E G F U U W N
P S M K Q A K Q H Y O B K T M G
V T P E F F R I J P I Q D F G U
M A T D I S Q Q S Y I R A L G E
W T S A R X T T Y R X I T P P I
T C B I K C Z Q C K A J Z P J M
M F K G U Z X B F X V B A W C W
Z K C A J E L I S D E G H S Z S
A T U R N S E W A X F W E R T S

PRAKTIKUM
STRATIMA
PROBSTAT
ARSIKOM
BASDAT
LOGKOM
MATDIS
ALINGEO
ALSTRUKDAT
OTOMATA
```

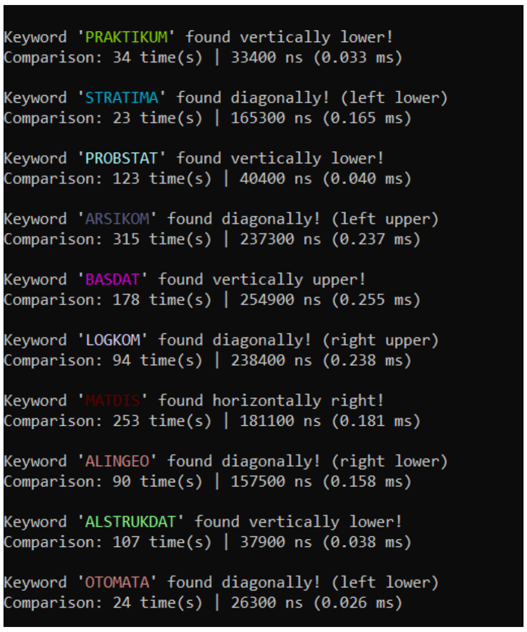
Gambar 3.3.1 Isian berkas small3.txt



```
Welcome to the Puzzearch solver!
Input your filename (without .txt): small3
Read puzzle from the file: (Size: 18 x 16)
I V W Y P S Y O O M D S U V I V
R R Y P W R X T O H T D I H W G
T J V R Z Q O K B R T A T S B O
V I R A I M G W A R V T P R X A
O R V K A O V T S Z A A A N Y K
T V J T L L I Q W D K D L V U V
P P A I B M I Z B F R S S B D G
U R W K A K C N L Y N A T C A X
W O T U M R C Z G D P B R R A T
G B M M F O B M Z E G F U U W N
P S M K Q A K Q H Y O B K T M G
V T P E F F R I J P I Q D F G U
M A T D I S Q Q S Y I R A L G E
W T S A R X T T Y R X I T P P I
T C B I K C Z Q C K A J Z P J M
M F K G U Z X B F X V B A W C W
Z K C A J E L I S D E G H S Z S
A T U R N S E W A X F W E R T S

There are 10 read keywords from the file:
- PRAKTIKUM
- STRATIMA
- PROBSTAT
- ARSIKOM
- BASDAT
- LOGKOM
- MATDIS
- ALINGEO
- ALSTRUKDAT
- OTOMATA
Press any key to start searching!
```

Gambar 3.3.2 Hasil pembacaan file masukan



```
Keyword 'PRAKTIKUM' found vertically lower!
Comparison: 34 time(s) | 33400 ns (0.033 ms)

Keyword 'STRATIMA' found diagonally! (left lower)
Comparison: 23 time(s) | 165300 ns (0.165 ms)

Keyword 'PROBSTAT' found vertically lower!
Comparison: 123 time(s) | 40400 ns (0.040 ms)

Keyword 'ARSIKOM' found diagonally! (left upper)
Comparison: 315 time(s) | 237300 ns (0.237 ms)

Keyword 'BASDAT' found vertically upper!
Comparison: 178 time(s) | 254900 ns (0.255 ms)

Keyword 'LOGKOM' found diagonally! (right upper)
Comparison: 94 time(s) | 238400 ns (0.238 ms)

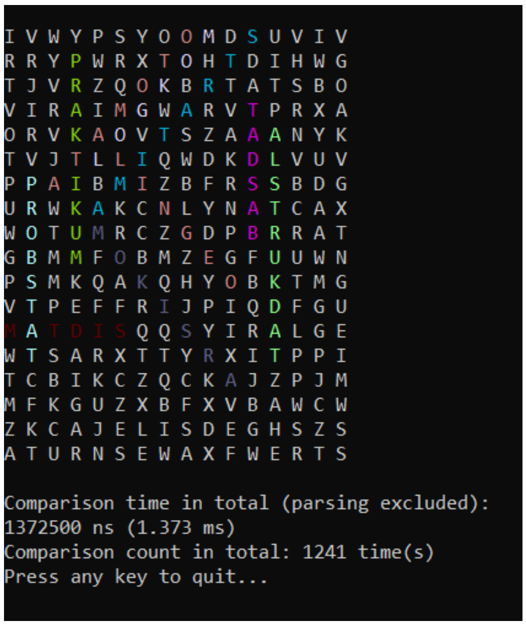
Keyword 'MATDIS' found horizontally right!
Comparison: 253 time(s) | 181100 ns (0.181 ms)

Keyword 'ALINGEO' found diagonally! (right lower)
Comparison: 90 time(s) | 157500 ns (0.158 ms)

Keyword 'ALSTRUKDAT' found vertically lower!
Comparison: 107 time(s) | 37900 ns (0.038 ms)

Keyword 'OTOMATA' found diagonally! (left lower)
Comparison: 24 time(s) | 26300 ns (0.026 ms)
```

Gambar 3.3.3 Informasi hasil eksekusi per kata

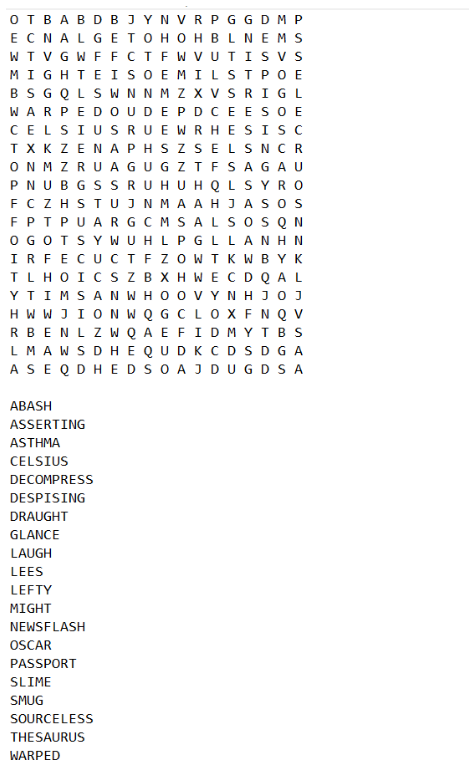


```
I V W Y P S Y O O M D S U V I V
R R Y P W R X T O H T D I H W G
T J V R Z Q O K B R T A T S B O
V I R A I M G W A R V T P R X A
O R V K A O V T S Z A A A N Y K
T V J T L L I Q W D K D L V U V
P P A I B M I Z B F R S S B D G
U R W K A K C N L Y N A T C A X
W O T U M R C Z G D P B R R A T
G B M M F O B M Z E G F U U W N
P S M K Q A K Q H Y O B K T M G
V T P E F F R I J P I Q D F G U
M A T D I S Q Q S Y I R A L G E
W T S A R X T T Y R X I T P P I
T C B I K C Z Q C K A J Z P J M
M F K G U Z X B F X V B A W C W
Z K C A J E L I S D E G H S Z S
A T U R N S E W A X F W E R T S

Comparison time in total (parsing excluded):
1372500 ns (1.373 ms)
Comparison count in total: 1241 time(s)
Press any key to quit...
```

Gambar 3.3.4 Matriks akhir dan informasi waktu eksekusi & banyak perbandingan

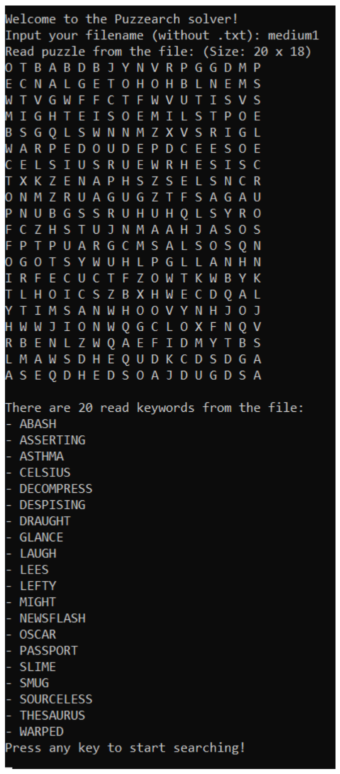
3.4 Pengujian terhadap file medium1.txt (ukuran 20 x 18)



```
O T B A B D B J Y N V R P G G D M P
E C N A L G E T O H O H B L N E M S
W T V G W F F C T F W V U T I S V S
M I G H T E I S O E M I L S T P O E
B S G Q L S W N N M Z X V S R I G L
W A R P E D O U D E P D C E E S O E
C E L S I U S R U E W R H E S I S C
T X K Z E N A P H S Z S E L S N C R
O N M Z R U A G U G Z T F S A G A U
P N U B G S S R U H U H Q L S Y R O
F C Z H S T U J N M A A H J A S O S
F P T P U A R G C M S A L S O S Q N
O G O T S Y W U H L P G L L A N H N
I R F E C U C T F Z O W T K W B Y K
T L H O I C S Z B X H W E C D Q A L
Y T I M S A N W H O O V Y N H J O J
H W W J I O N W Q G C L O X F N Q V
R B E N L Z W Q A E F I D M Y T B S
L M A W S D H E Q U D K C D S D G A
A S E Q D H E D S O A J D U G D S A

ABASH
ASSERTING
ASTHMA
CELSIUS
DECOMPRESS
DESPISING
DRAUGHT
GLANCE
LAUGH
LEES
LEFTY
MIGHT
NEWSFLASH
OSCAR
PASSPORT
SLIME
SMUG
SOURCELESS
THESAURUS
WARPED
```

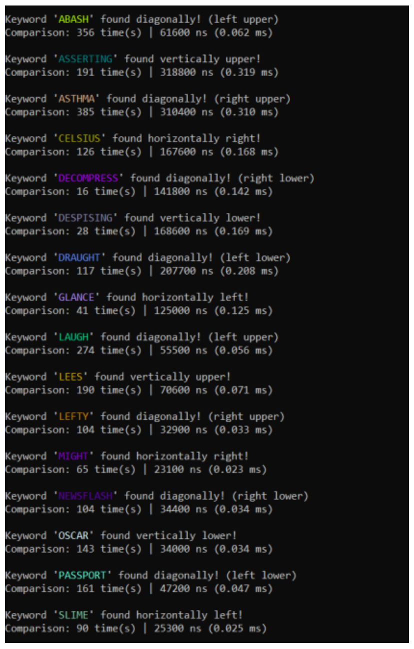
Gambar 3.4.1 Isian berkas medium1.txt



```
Welcome to the Puzzearch solver!
Input your filename (without .txt): medium1
Read puzzle from the file: (Size: 20 x 18)
O T B A B D B J Y N V R P G G D M P
E C N A L G E T O H O H B L N E M S
W T V G W F F C T F W V U T I S V S
M I G H T E I S O E M I L S T P O E
B S G Q L S W N N M Z X V S R I G L
W A R P E D O U D E P D C E E S O E
C E L S I U S R U E W R H E S I S C
T X K Z E N A P H S Z S E L S N C R
O N M Z R U A G U G Z T F S A G A U
P N U B G S S R U H U H Q L S Y R O
F C Z H S T U J N M A A H J A S O S
F P T P U A R G C M S A L S O S Q N
O G O T S Y W U H L P G L L A N H N
I R F E C U C T F Z O W T K W B Y K
T L H O I C S Z B X H W E C D Q A L
Y T I M S A N W H O O V Y N H J O J
H W W J I O N W Q G C L O X F N Q V
R B E N L Z W Q A E F I D M Y T B S
L M A W S D H E Q U D K C D S D G A
A S E Q D H E D S O A J D U G D S A

There are 20 read keywords from the file:
- ABASH
- ASSERTING
- ASTHMA
- CELSIUS
- DECOMPRESS
- DESPISING
- DRAUGHT
- GLANCE
- LAUGH
- LEES
- LEFTY
- MIGHT
- NEWSFLASH
- OSCAR
- PASSPORT
- SLIME
- SMUG
- SOURCELESS
- THESAURUS
- WARPED
Press any key to start searching!
```

Gambar 3.4.2 Hasil pembacaan file masukan



```
Keyword 'ABASH' found diagonally! (left upper)
Comparison: 356 time(s) | 61600 ns (0.062 ms)

Keyword 'ASSERTING' found vertically upper!
Comparison: 191 time(s) | 318800 ns (0.319 ms)

Keyword 'ASTHMA' found diagonally! (right upper)
Comparison: 385 time(s) | 310400 ns (0.310 ms)

Keyword 'CELSIUS' found horizontally right!
Comparison: 126 time(s) | 167600 ns (0.168 ms)

Keyword 'DECOMPRESS' found diagonally! (right lower)
Comparison: 16 time(s) | 141800 ns (0.142 ms)

Keyword 'DESPISING' found vertically lower!
Comparison: 28 time(s) | 168600 ns (0.169 ms)

Keyword 'DRAUGHT' found diagonally! (left lower)
Comparison: 117 time(s) | 207700 ns (0.208 ms)

Keyword 'GLANCE' found horizontally left!
Comparison: 41 time(s) | 125000 ns (0.125 ms)

Keyword 'LAUGH' found diagonally! (left upper)
Comparison: 274 time(s) | 55500 ns (0.056 ms)

Keyword 'LEES' found vertically upper!
Comparison: 190 time(s) | 70600 ns (0.071 ms)

Keyword 'LEFTY' found diagonally! (right upper)
Comparison: 104 time(s) | 32900 ns (0.033 ms)

Keyword 'MIGHT' found horizontally right!
Comparison: 65 time(s) | 23100 ns (0.023 ms)

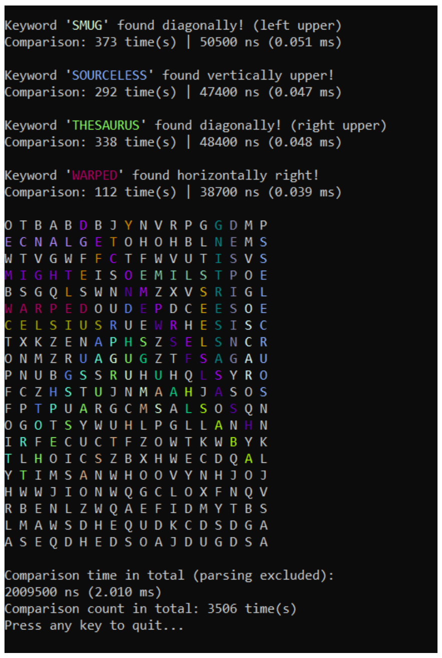
Keyword 'NEWSFLASH' found diagonally! (right lower)
Comparison: 104 time(s) | 34400 ns (0.034 ms)

Keyword 'OSCAR' found vertically lower!
Comparison: 143 time(s) | 34000 ns (0.034 ms)

Keyword 'PASSPORT' found diagonally! (left lower)
Comparison: 161 time(s) | 47200 ns (0.047 ms)

Keyword 'SLIME' found horizontally left!
Comparison: 90 time(s) | 25300 ns (0.025 ms)
```

Gambar 3.4.3 Informasi hasil eksekusi per kata



```
Keyword 'SMUG' found diagonally! (left upper)
Comparison: 373 time(s) | 50500 ns (0.051 ms)

Keyword 'SOURCELESS' found vertically upper!
Comparison: 292 time(s) | 47400 ns (0.047 ms)

Keyword 'THESAURUS' found diagonally! (right upper)
Comparison: 338 time(s) | 48400 ns (0.048 ms)

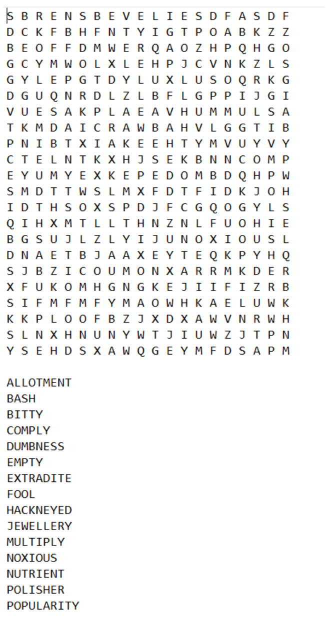
Keyword 'WARPED' found horizontally right!
Comparison: 112 time(s) | 38700 ns (0.039 ms)

O T B A B D B J Y N V R P G G D M P
E C N A L G E T O H O H B L N E M S
W T V G W F F C T F W V U T I S V S
M I G H T E I S O E M I L S T P O E
B S G Q L S W N N M Z X V S R I G L
W A R P E D O U D E P D C E E S O E
C E L S I U S R U E W R H E S I S C
T X K Z E N A P H S Z S E L S N C R
O N M Z R U A G U G Z T F S A G A U
P N U B G S S R U H U H Q L S Y R O
F C Z H S T U J N M A A H J A S O S
F P T P U A R G C M S A L S O S Q N
O G O T S Y W U H L P G L L A N H N
I R F E C U C T F Z O W T K W B Y K
T L H O I C S Z B X H W E C D Q A L
Y T I M S A N W H O O V Y N H J O J
H W W J I O N W Q G C L O X F N Q V
R B E N L Z W Q A E F I D M Y T B S
L M A W S D H E Q U D K C D S D G A
A S E Q D H E D S O A J D U G D S A

Comparison time in total (parsing excluded):
2009500 ns (2.010 ms)
Comparison count in total: 3506 time(s)
Press any key to quit...
```

Gambar 3.4.4 Matriks akhir dan informasi waktu eksekusi & banyak perbandingan

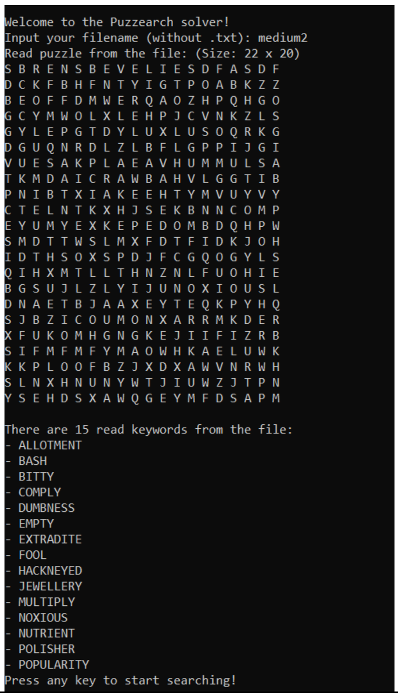
3.5 Pengujian terhadap file medium2.txt (ukuran 22 x 20)



```
S B R E N S B E V E L I E S D F A S D F
D C K F B H F N T Y I G T P O A B K Z Z
B E O F F D M W E R Q A O Z H P Q H G O
G C Y M W O L X L E H P J C V N K Z L S
G Y L E P G T D Y L U X L U S O Q R K G
D G U Q N R D L Z L B F L G P P I J G I
V U E S A K P L A E A V H U M M U L S A
T K M D A I C R A W B A H V L G G T I B
P N I B T X I A K E E H T Y M V U Y V Y
C T E L N T K X H J S E K B N N C O M P
E Y U M Y E X K E P E D O M B D Q H P W
S M D T T W S L M X F D T F I D K J O H
I D T H S O X S P D J F C G Q O G Y L S
Q I H X M T L L T H N Z N L F U O H I E
B G S U J L Z L Y I J U N O X I O U S L
D N A E T B J A A X E Y T E Q K P Y H Q
S J B Z I C O U M O N X A R R M K D E R
X F U K O M H G N G K E J I I F I Z R B
S I F M F M F Y M A O W H K A E L U W K
K K P L O O F B Z J X D X A W V N R W H
S L N X H N U N Y W T J I U W Z J T P N
Y S E H D S X A W Q G E Y M F D S A P M

ALLOTMENT
BASH
BITTY
COMPLY
DUMBNESS
EMPTY
EXTRADITE
FOOL
HACKNEYED
JEWELLERY
MULTIPLY
NOXIOUS
NUTRIENT
POLISHER
POPULARITY
```

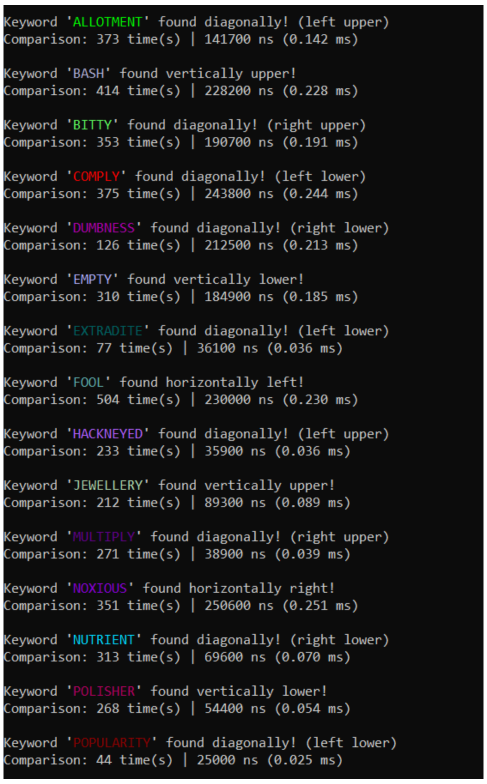
Gambar 3.5.1 Isian berkas medium1.txt



```
Welcome to the Puzzearch solver!
Input your filename (without .txt): medium2
Read puzzle from the file: (Size: 22 x 20)
S B R E N S B E V E L I E S D F A S D F
D C K F B H F N T Y I G T P O A B K Z Z
B E O F F D M W E R Q A O Z H P Q H G O
G C Y M W O L X L E H P J C V N K Z L S
G Y L E P G T D Y L U X L U S O Q R K G
D G U Q N R D L Z L B F L G P P I J G I
V U E S A K P L A E A V H U M M U L S A
T K M D A I C R A W B A H V L G G T I B
P N I B T X I A K E E H T Y M V U Y V Y
C T E L N T K X H J S E K B N N C O M P
E Y U M Y E X K E P E D O M B D Q H P W
S M D T T W S L M X F D T F I D K J O H
I D T H S O X S P D J F C G Q O G Y L S
Q I H X M T L L T H N Z N L F U O H I E
B G S U J L Z L Y I J U N O X I O U S L
D N A E T B J A A X E Y T E Q K P Y H Q
S J B Z I C O U M O N X A R R M K D E R
X F U K O M H G N G K E J I I F I Z R B
S I F M F M F Y M A O W H K A E L U W K
K K P L O O F B Z J X D X A W V N R W H
S L N X H N U N Y W T J I U W Z J T P N
Y S E H D S X A W Q G E Y M F D S A P M

There are 15 read keywords from the file:
- ALLOTMENT
- BASH
- BITTY
- COMPLY
- DUMBNESS
- EMPTY
- EXTRADITE
- FOOL
- HACKNEYED
- JEWELLERY
- MULTIPLY
- NOXIOUS
- NUTRIENT
- POLISHER
- POPULARITY
Press any key to start searching!
```

Gambar 3.5.2 Hasil pembacaan file masukan



```
Keyword 'ALLOTMENT' found diagonally! (left upper)
Comparison: 373 time(s) | 141700 ns (0.142 ms)

Keyword 'BASH' found vertically upper!
Comparison: 414 time(s) | 228200 ns (0.228 ms)

Keyword 'BITTY' found diagonally! (right upper)
Comparison: 353 time(s) | 190700 ns (0.191 ms)

Keyword 'COMPLY' found diagonally! (left lower)
Comparison: 375 time(s) | 243800 ns (0.244 ms)

Keyword 'DUMBNESS' found diagonally! (right lower)
Comparison: 126 time(s) | 212500 ns (0.213 ms)

Keyword 'EMPTY' found vertically lower!
Comparison: 310 time(s) | 184900 ns (0.185 ms)

Keyword 'EXTRADITE' found diagonally! (left lower)
Comparison: 77 time(s) | 36100 ns (0.036 ms)

Keyword 'FOOL' found horizontally left!
Comparison: 504 time(s) | 230000 ns (0.230 ms)

Keyword 'HACKNEYED' found diagonally! (left upper)
Comparison: 233 time(s) | 35900 ns (0.036 ms)

Keyword 'JEWELLERY' found vertically upper!
Comparison: 212 time(s) | 89300 ns (0.089 ms)

Keyword 'MULTIPLY' found diagonally! (right upper)
Comparison: 271 time(s) | 38900 ns (0.039 ms)

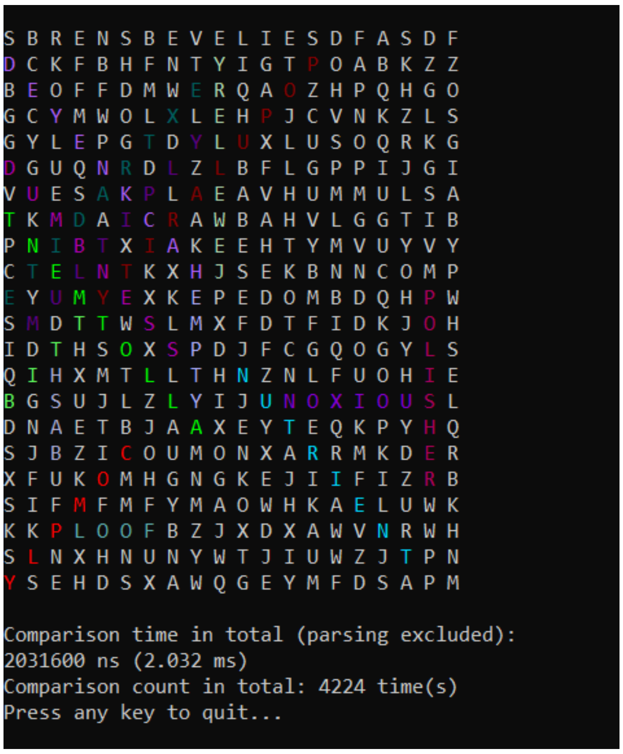
Keyword 'NOXIOUS' found horizontally right!
Comparison: 351 time(s) | 250600 ns (0.251 ms)

Keyword 'NUTRIENT' found diagonally! (right lower)
Comparison: 313 time(s) | 69600 ns (0.070 ms)

Keyword 'POLISHER' found vertically lower!
Comparison: 268 time(s) | 54400 ns (0.054 ms)

Keyword 'POPULARITY' found diagonally! (left lower)
Comparison: 44 time(s) | 25000 ns (0.025 ms)
```

Gambar 3.5.3 Informasi hasil eksekusi per kata

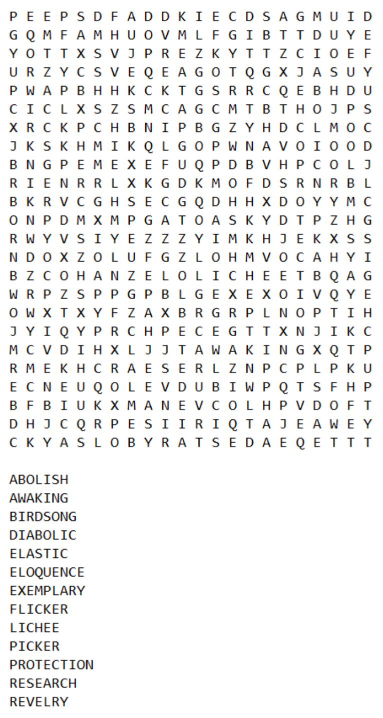


```
S B R E N S B E V E L I E S D F A S D F
D C K F B H F N T Y I G T P O A B K Z Z
B E O F F D M W E R Q A O Z H P Q H G O
G C Y M W O L X L E H P J C V N K Z L S
G Y L E P G T D Y L U X L U S O Q R K G
D G U Q N R D L Z L B F L G P P I J G I
V U E S A K P L A E A V H U M M U L S A
T K M D A I C R A W B A H V L G G T I B
P N I B T X I A K E E H T Y M V U Y V Y
C T E L N T K X H J S E K B N N C O M P
E Y U M Y E X K E P E D O M B D Q H P W
S M D T T W S L M X F D T F I D K J O H
I D T H S O X S P D J F C G Q O G Y L S
Q I H X M T L L T H N Z N L F U O H I E
B G S U J L Z L Y I J U N O X I O U S L
D N A E T B J A A X E Y T E Q K P Y H Q
S J B Z I C O U M O N X A R R M K D E R
X F U K O M H G N G K E J I I F I Z R B
S I F M F M F Y M A O W H K A E L U W K
K K P L O O F B Z J X D X A W V N R W H
S L N X H N U N Y W T J I U W Z J T P N
Y S E H D S X A W Q G E Y M F D S A P M

Comparison time in total (parsing excluded):
2031600 ns (2.032 ms)
Comparison count in total: 4224 time(s)
Press any key to quit...
```

Gambar 3.5.4 Matriks akhir dan informasi waktu eksekusi & banyak perbandingan

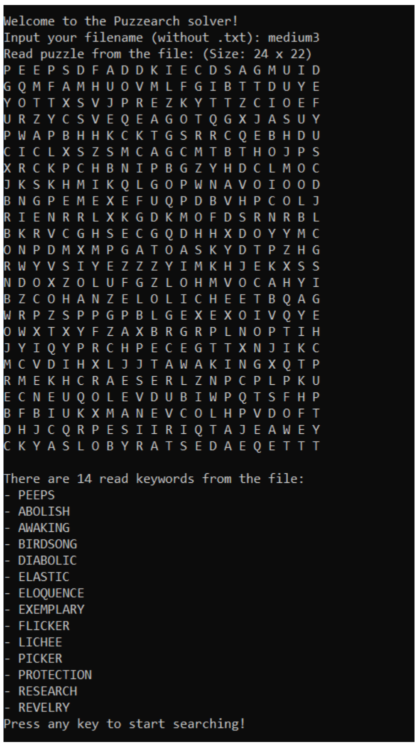
3.6 Pengujian terhadap file medium3.txt (ukuran 24 x 22)



```
P E E P S D F A D D K I E C D S A G M U I D
G Q M F A M H U O V M L F G I B T T D U Y E
Y O T T X S V J P R E Z K Y T T Z C I O E F
U R Z Y C S V E Q E A G O T Q G X J A S U Y
P W A P B H H K C K T G S R R C Q E B H D U
C I C L X S Z S M C A G C M T B T H O J P S
X R C K P C H B N I P B G Z Y H D C L M O C
J K S K H M I K Q L G O P W N A V O I O O D
B N G P E M E X E F U Q P D B V H P C O L J
R I E N R R L X K G D K M O F D S R N R B L
B K R V C G H S E C G Q D H H X D O Y Y M C
O N P D M X M P G A T O A S K Y D T P Z H G
R W Y V S I Y E Z Z Z Y I M K H J E K X S S
N D O X Z O L U F G Z L O H M V O C A H Y I
B Z C O H A N Z E L O L I C H E E T B Q A G
W R P Z S P P G P B L G E X E X O I V Q Y E
O W X T X Y F Z A X B R G R P L N O P T I H
J Y I Q Y P R C H P E C E G T T X N J I K C
M C V D I H X L J J T A W A K I N G X Q T P
R M E K H C R A E S E R L Z N P C P L P K U
E C N E U Q O L E V D U B I W P Q T S F H P
B F B I U K X M A N E V C O L H P V D O F T
D H J C Q R P E S I I R I Q T A J E A W E Y
C K Y A S L O B Y R A T S E D A E Q E T T T

ABOLISH
AWAKING
BIRDSONG
DIABOLIC
ELASTIC
ELOQUENCE
EXEMPLARY
FLICKER
LICHEE
PICKER
PROTECTION
RESEARCH
REVELRY
```

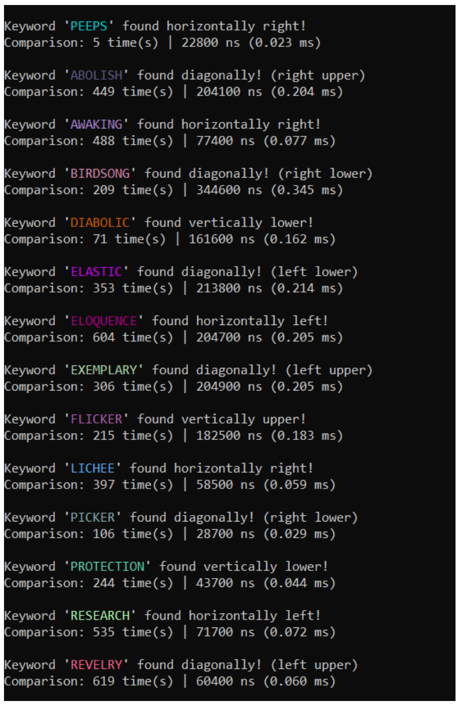
Gambar 3.6.1 Isian berkas medium3.txt



```
Welcome to the Puzzearch solver!
Input your filename (without .txt): medium3
Read puzzle from the file: (Size: 24 x 22)
P E E P S D F A D D K I E C D S A G M U I D
G Q M F A M H U O V M L F G I B T T D U Y E
Y O T T X S V J P R E Z K Y T T Z C I O E F
U R Z Y C S V E Q E A G O T Q G X J A S U Y
P W A P B H H K C K T G S R R C Q E B H D U
C I C L X S Z S M C A G C M T B T H O J P S
X R C K P C H B N I P B G Z Y H D C L M O C
J K S K H M I K Q L G O P W N A V O I O O D
B N G P E M E X E F U Q P D B V H P C O L J
R I E N R R L X K G D K M O F D S R N R B L
B K R V C G H S E C G Q D H H X D O Y Y M C
O N P D M X M P G A T O A S K Y D T P Z H G
R W Y V S I Y E Z Z Z Y I M K H J E K X S S
N D O X Z O L U F G Z L O H M V O C A H Y I
B Z C O H A N Z E L O L I C H E E T B Q A G
W R P Z S P P G P B L G E X E X O I V Q Y E
O W X T X Y F Z A X B R G R P L N O P T I H
J Y I Q Y P R C H P E C E G T T X N J I K C
M C V D I H X L J J T A W A K I N G X Q T P
R M E K H C R A E S E R L Z N P C P L P K U
E C N E U Q O L E V D U B I W P Q T S F H P
B F B I U K X M A N E V C O L H P V D O F T
D H J C Q R P E S I I R I Q T A J E A W E Y
C K Y A S L O B Y R A T S E D A E Q E T T T

There are 14 read keywords from the file:
- PEEPS
- ABOLISH
- AWAKING
- BIRDSONG
- DIABOLIC
- ELASTIC
- ELOQUENCE
- EXEMPLARY
- FLICKER
- LICHEE
- PICKER
- PROTECTION
- RESEARCH
- REVELRY
Press any key to start searching!
```

Gambar 3.6.2 Hasil pembacaan file masukan



```
Keyword 'PEEPS' found horizontally right!
Comparison: 5 time(s) | 22800 ns (0.023 ms)

Keyword 'ABOLISH' found diagonally! (right upper)
Comparison: 449 time(s) | 204100 ns (0.204 ms)

Keyword 'AWAKING' found horizontally right!
Comparison: 488 time(s) | 77400 ns (0.077 ms)

Keyword 'BIRDSONG' found diagonally! (right lower)
Comparison: 209 time(s) | 344600 ns (0.345 ms)

Keyword 'DIABOLIC' found vertically lower!
Comparison: 71 time(s) | 161600 ns (0.162 ms)

Keyword 'ELASTIC' found diagonally! (left lower)
Comparison: 353 time(s) | 213800 ns (0.214 ms)

Keyword 'ELOQUENCE' found horizontally left!
Comparison: 604 time(s) | 204700 ns (0.205 ms)

Keyword 'EXEMPLARY' found diagonally! (left upper)
Comparison: 306 time(s) | 204900 ns (0.205 ms)

Keyword 'FLICKER' found vertically upper!
Comparison: 215 time(s) | 182500 ns (0.183 ms)

Keyword 'LICHEE' found horizontally right!
Comparison: 397 time(s) | 58500 ns (0.059 ms)

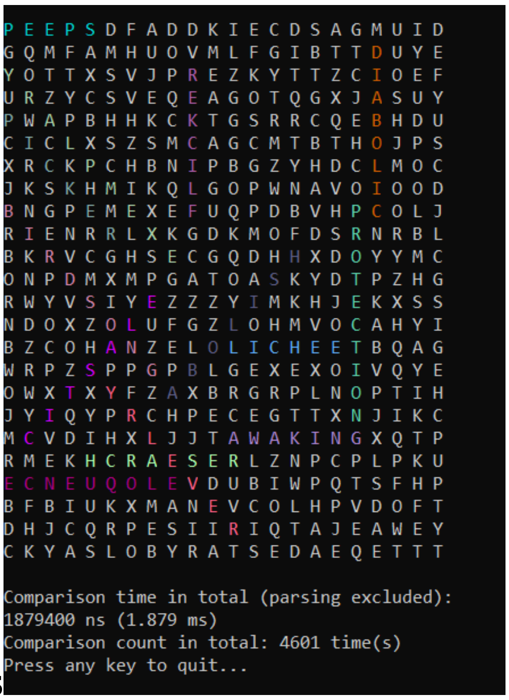
Keyword 'PICKER' found diagonally! (right lower)
Comparison: 106 time(s) | 28700 ns (0.029 ms)

Keyword 'PROTECTION' found vertically lower!
Comparison: 244 time(s) | 43700 ns (0.044 ms)

Keyword 'RESEARCH' found horizontally left!
Comparison: 535 time(s) | 71700 ns (0.072 ms)

Keyword 'REVELRY' found diagonally! (left upper)
Comparison: 619 time(s) | 60400 ns (0.060 ms)
```

Gambar 3.6.3 Informasi hasil eksekusi per kata



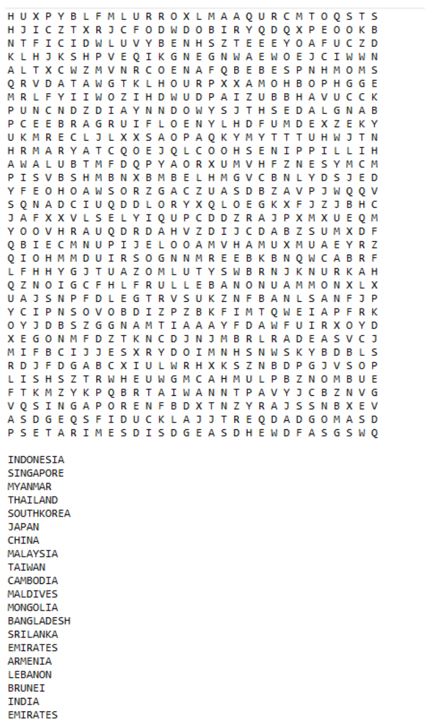
```
P E E P S D F A D D K I E C D S A G M U I D
G Q M F A M H U O V M L F G I B T T D U Y E
Y O T T X S V J P R E Z K Y T T Z C I O E F
U R Z Y C S V E Q E A G O T Q G X J A S U Y
P W A P B H H K C K T G S R R C Q E B H D U
C I C L X S Z S M C A G C M T B T H O J P S
X R C K P C H B N I P B G Z Y H D C L M O C
J K S K H M I K Q L G O P W N A V O I O O D
B N G P E M E X E F U Q P D B V H P C O L J
R I E N R R L X K G D K M O F D S R N R B L
B K R V C G H S E C G Q D H H X D O Y Y M C
O N P D M X M P G A T O A S K Y D T P Z H G
R W Y V S I Y E Z Z Z Y I M K H J E K X S S
N D O X Z O L U F G Z L O H M V O C A H Y I
B Z C O H A N Z E L O L I C H E E T B Q A G
W R P Z S P P G P B L G E X E X O I V Q Y E
O W X T X Y F Z A X B R G R P L N O P T I H
J Y I Q Y P R C H P E C E G T T X N J I K C
M C V D I H X L J J T A W A K I N G X Q T P
R M E K H C R A E S E R L Z N P C P L P K U
E C N E U Q O L E V D U B I W P Q T S F H P
B F B I U K X M A N E V C O L H P V D O F T
D H J C Q R P E S I I R I Q T A J E A W E Y
C K Y A S L O B Y R A T S E D A E Q E T T T

Comparison time in total (parsing excluded):
1879400 ns (1.879 ms)
Comparison count in total: 4601 time(s)
Press any key to quit...
```

S

Gambar 3.6.4 Matriks akhir dan informasi waktu eksekusi & banyak perbandingan

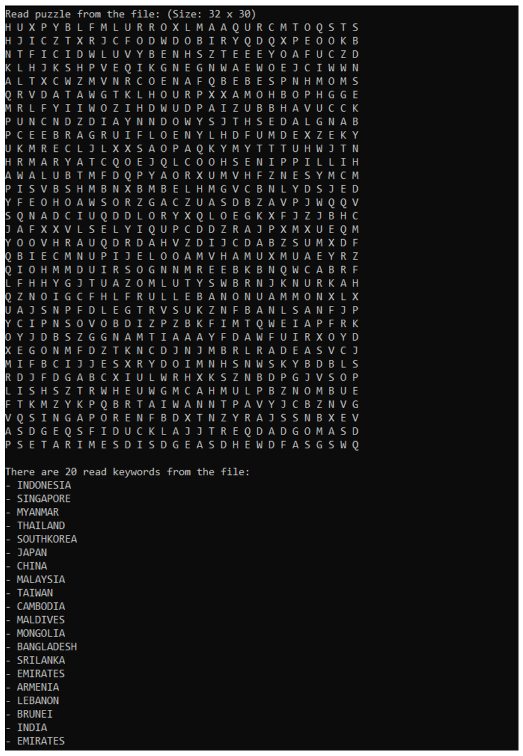
3.7 Pengujian terhadap file large1.txt (ukuran 32 x 30)



```
H U X P Y B L F M L U R R O X L M A A Q U R C M T O Q S T S
H J I C Z T X R J C F O D W D O B I R Y Q D Q X P E O O K B
N T F I C I D W L U V Y B E N H S Z T E E E Y O A F U C Z D
K L H J K S H P V E Q I K G N E G N W A E W O E J C I W W N
A L T X C W Z M V N R C O E N A F Q B E B E S P N H M O M S
Q R V D A T A W G T K L H O U R P X X A M O H B O P H G G E
M R L F Y I I W O Z I H D W U D P A I Z U B B H A V U C C K
P U N C N D Z D I A Y N N D O W Y S J T H S E D A L G N A B
P C E E B R A G R U I F L O E N Y L H D F U M D E X Z E K Y
U K M R E C L J L X X S A O P A Q K Y M Y T T T U H W J T N
H R M A R Y A T C Q O E J Q L C O O H S E N I P P I L L I H
A W A L U B T M F D Q P Y A O R X U M V H F Z N E S Y M C M
P I S V B S H M B N X B M B E L H M G V C B N L Y D S J E D
Y F E O H O A W S O R Z G A C Z U A S D B Z A V P J W Q Q V
S Q N A D C I U Q D D L O R Y X Q L O E G K X F J Z J B H C
J A F X X V L S E L Y I Q U P C D D Z R A J P X M X U E Q M
Y O O V H R A U Q D R D A H V Z D I J C D A B Z S U M X D F
Q B I E C M N U P I J E L O O A M V H A M U X M U A E Y R Z
Q I O H M M D U I R S O G N N M R E E B K B N Q W C A B R F
L F H H Y G J T U A Z O M L U T Y S W B R N J K N U R K A H
Q Z N O I G C F H L F R U L L E B A N O N U A M M O N X L X
U A J S N P F D L E G T R V S U K Z N F B A N L S A N F J P
Y C I P N S O V O B D I Z P Z B K F I M T Q W E I A P F R K
O Y J D B S Z G G N A M T I A A A Y F D A W F U I R X O Y D
X E G O N M F D Z T K N C D J N J M B R L R A D E A S V C J
M I F B C I J J E S X R Y D O I M N H S N W S K Y B D B L S
R D J F D G A B C X I U L W R H X K S Z N B D P G J V S O P
L I S H S Z T R W H E U W G M C A H M U L P B Z N O M B U E
F T K M Z Y K P Q B R T A I W A N N T P A V Y J C B Z N V G
V Q S I N G A P O R E N F B D X T N Z Y R A J S S N B X E V
A S D G E Q S F I D U C K L A J J T R E Q D A D G O M A S D
P S E T A R I M E S D I S D G E A S D H E W D F A S G S W Q

INDONESIA
SINGAPORE
MYANMAR
THAILAND
SOUTHKOREA
JAPAN
CHINA
MALAYSIA
TAIWAN
CAMBODIA
MALDIVES
MONGOLIA
BANGLADESH
SRILANKA
EMIRATES
ARMENIA
LEBANON
BRUNEI
INDIA
EMIRATES
```

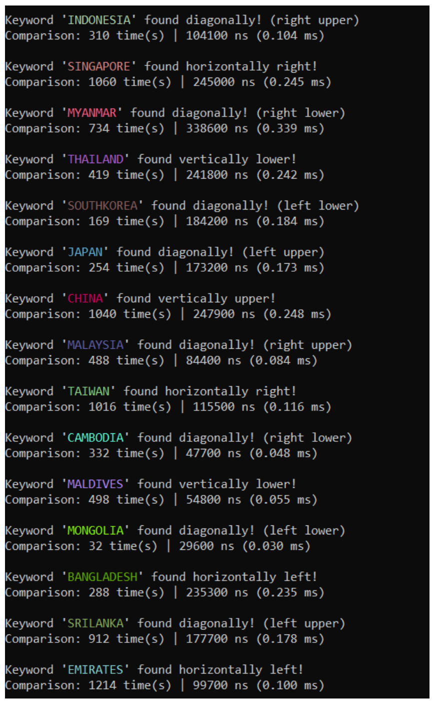
Gambar 3.7.1 Isian berkas large1.txt



```
Read puzzle from the file: (Size: 32 x 30)
H U X P Y B L F M L U R R O X L M A A Q U R C M T O Q S T S
H J I C Z T X R J C F O D W D O B I R Y Q D Q X P E O O K B
N T F I C I D W L U V Y B E N H S Z T E E E Y O A F U C Z D
K L H J K S H P V E Q I K G N E G N W A E W O E J C I W W N
A L T X C W Z M V N R C O E N A F Q B E B E S P N H M O M S
Q R V D A T A W G T K L H O U R P X X A M O H B O P H G G E
M R L F Y I I W O Z I H D W U D P A I Z U B B H A V U C C K
P U N C N D Z D I A Y N N D O W Y S J T H S E D A L G N A B
P C E E B R A G R U I F L O E N Y L H D F U M D E X Z E K Y
U K M R E C L J L X X S A O P A Q K Y M Y T T T U H W J T N
H R M A R Y A T C Q O E J Q L C O O H S E N I P P I L L I H
A W A L U B T M F D Q P Y A O R X U M V H F Z N E S Y M C M
P I S V B S H M B N X B M B E L H M G V C B N L Y D S J E D
Y F E O H O A W S O R Z G A C Z U A S D B Z A V P J W Q Q V
S Q N A D C I U Q D D L O R Y X Q L O E G K X F J Z J B H C
J A F X X V L S E L Y I Q U P C D D Z R A J P X M X U E Q M
Y O O V H R A U Q D R D A H V Z D I J C D A B Z S U M X D F
Q B I E C M N U P I J E L O O A M V H A M U X M U A E Y R Z
Q I O H M M D U I R S O G N N M R E E B K B N Q W C A B R F
L F H H Y G J T U A Z O M L U T Y S W B R N J K N U R K A H
Q Z N O I G C F H L F R U L L E B A N O N U A M M O N X L X
U A J S N P F D L E G T R V S U K Z N F B A N L S A N F J P
Y C I P N S O V O B D I Z P Z B K F I M T Q W E I A P F R K
O Y J D B S Z G G N A M T I A A A Y F D A W F U I R X O Y D
X E G O N M F D Z T K N C D J N J M B R L R A D E A S V C J
M I F B C I J J E S X R Y D O I M N H S N W S K Y B D B L S
R D J F D G A B C X I U L W R H X K S Z N B D P G J V S O P
L I S H S Z T R W H E U W G M C A H M U L P B Z N O M B U E
F T K M Z Y K P Q B R T A I W A N N T P A V Y J C B Z N V G
V Q S I N G A P O R E N F B D X T N Z Y R A J S S N B X E V
A S D G E Q S F I D U C K L A J J T R E Q D A D G O M A S D
P S E T A R I M E S D I S D G E A S D H E W D F A S G S W Q

There are 20 read keywords from the file:
- INDONESIA
- SINGAPORE
- MYANMAR
- THAILAND
- SOUTHKOREA
- JAPAN
- CHINA
- MALAYSIA
- TAIWAN
- CAMBODIA
- MALDIVES
- MONGOLIA
- BANGLADESH
- SRILANKA
- EMIRATES
- ARMENIA
- LEBANON
- BRUNEI
- INDIA
- EMIRATES
```

Gambar 3.7.2 Hasil pembacaan file masukan



```
Keyword 'INDONESIA' found diagonally! (right upper)
Comparison: 310 time(s) | 104100 ns (0.104 ms)

Keyword 'SINGAPORE' found horizontally right!
Comparison: 1060 time(s) | 245000 ns (0.245 ms)

Keyword 'MYANMAR' found diagonally! (right lower)
Comparison: 734 time(s) | 338600 ns (0.339 ms)

Keyword 'THAILAND' found vertically lower!
Comparison: 419 time(s) | 241800 ns (0.242 ms)

Keyword 'SOUTHKOREA' found diagonally! (left lower)
Comparison: 169 time(s) | 184200 ns (0.184 ms)

Keyword 'JAPAN' found diagonally! (left upper)
Comparison: 254 time(s) | 173200 ns (0.173 ms)

Keyword 'CHINA' found vertically upper!
Comparison: 1040 time(s) | 247900 ns (0.248 ms)

Keyword 'MALAYSIA' found diagonally! (right upper)
Comparison: 488 time(s) | 84400 ns (0.084 ms)

Keyword 'TAIWAN' found horizontally right!
Comparison: 1016 time(s) | 115500 ns (0.116 ms)

Keyword 'CAMBODIA' found diagonally! (right lower)
Comparison: 332 time(s) | 47700 ns (0.048 ms)

Keyword 'MALDIVES' found vertically lower!
Comparison: 498 time(s) | 54800 ns (0.055 ms)

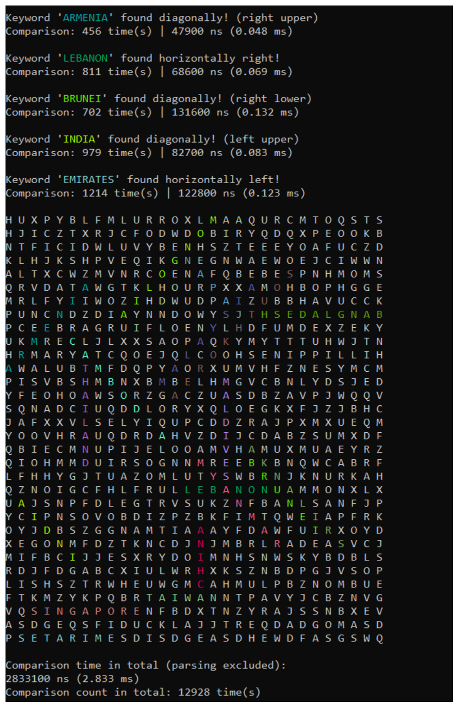
Keyword 'MONGOLIA' found diagonally! (left lower)
Comparison: 32 time(s) | 29600 ns (0.030 ms)

Keyword 'BANGLADESH' found horizontally left!
Comparison: 288 time(s) | 235300 ns (0.235 ms)

Keyword 'SRILANKA' found diagonally! (left upper)
Comparison: 912 time(s) | 177700 ns (0.178 ms)

Keyword 'EMIRATES' found horizontally left!
Comparison: 1214 time(s) | 99700 ns (0.100 ms)
```

Gambar 3.7.3 Informasi hasil eksekusi per kata



```
Keyword 'ARMENIA' found diagonally! (right upper)
Comparison: 456 time(s) | 47900 ns (0.048 ms)

Keyword 'LEBANON' found horizontally right!
Comparison: 811 time(s) | 68600 ns (0.069 ms)

Keyword 'BRUNEI' found diagonally! (right lower)
Comparison: 702 time(s) | 131600 ns (0.132 ms)

Keyword 'INDIA' found diagonally! (left upper)
Comparison: 979 time(s) | 82700 ns (0.083 ms)

Keyword 'EMIRATES' found horizontally left!
Comparison: 1214 time(s) | 122800 ns (0.123 ms)

H U X P Y B L F M L U R R O X L M A A Q U R C M T O Q S T S
H J I C Z T X R J C F O D W D O B I R Y Q D Q X P E O O K B
N T F I C I D W L U V Y B E N H S Z T E E E Y O A F U C Z D
K L H J K S H P V E Q I K G N E G N W A E W O E J C I W W N
A L T X C W Z M V N R C O E N A F Q B E B E S P N H M O M S
Q R V D A T A W G T K L H O U R P X X A M O H B O P H G G E
M R L F Y I I W O Z I H D W U D P A I Z U B B H A V U C C K
P U N C N D Z D I A Y N N D O W Y S J T H S E D A L G N A B
P C E E B R A G R U I F L O E N Y L H D F U M D E X Z E K Y
U K M R E C L J L X X S A O P A Q K Y M Y T T T U H W J T N
H R M A R Y A T C Q O E J Q L C O O H S E N I P P I L L I H
A W A L U B T M F D Q P Y A O R X U M V H F Z N E S Y M C M
P I S V B S H M B N X B M B E L H M G V C B N L Y D S J E D
Y F E O H O A W S O R Z G A C Z U A S D B Z A V P J W Q Q V
S Q N A D C I U Q D D L O R Y X Q L O E G K X F J Z J B H C
J A F X X V L S E L Y I Q U P C D D Z R A J P X M X U E Q M
Y O O V H R A U Q D R D A H V Z D I J C D A B Z S U M X D F
Q B I E C M N U P I J E L O O A M V H A M U X M U A E Y R Z
Q I O H M M D U I R S O G N N M R E E B K B N Q W C A B R F
L F H H Y G J T U A Z O M L U T Y S W B R N J K N U R K A H
Q Z N O I G C F H L F R U L L E B A N O N U A M M O N X L X
U A J S N P F D L E G T R V S U K Z N F B A N L S A N F J P
Y C I P N S O V O B D I Z P Z B K F I M T Q W E I A P F R K
O Y J D B S Z G G N A M T I A A A Y F D A W F U I R X O Y D
X E G O N M F D Z T K N C D J N J M B R L R A D E A S V C J
M I F B C I J J E S X R Y D O I M N H S N W S K Y B D B L S
R D J F D G A B C X I U L W R H X K S Z N B D P G J V S O P
L I S H S Z T R W H E U W G M C A H M U L P B Z N O M B U E
F T K M Z Y K P Q B R T A I W A N N T P A V Y J C B Z N V G
V Q S I N G A P O R E N F B D X T N Z Y R A J S S N B X E V
A S D G E Q S F I D U C K L A J J T R E Q D A D G O M A S D
P S E T A R I M E S D I S D G E A S D H E W D F A S G S W Q

Comparison time in total (parsing excluded):
2833100 ns (2.833 ms)
Comparison count in total: 12928 time(s)
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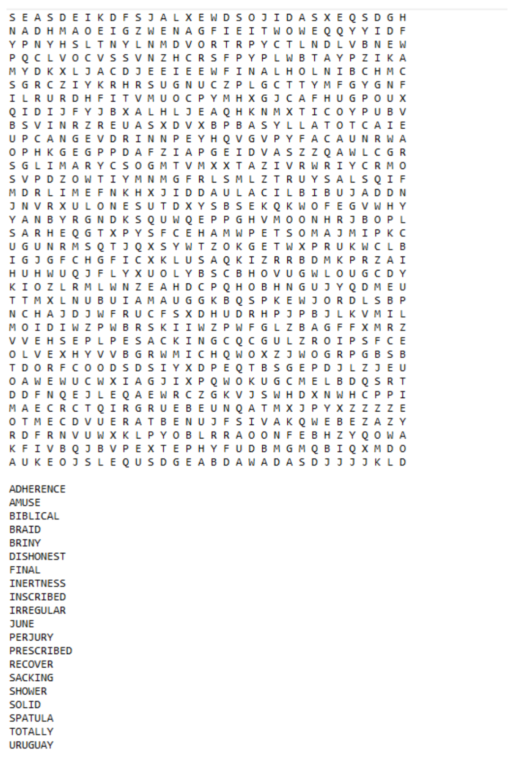
Gambar 3.7.4 Matriks akhir dan informasi waktu eksekusi & banyak perbandingan

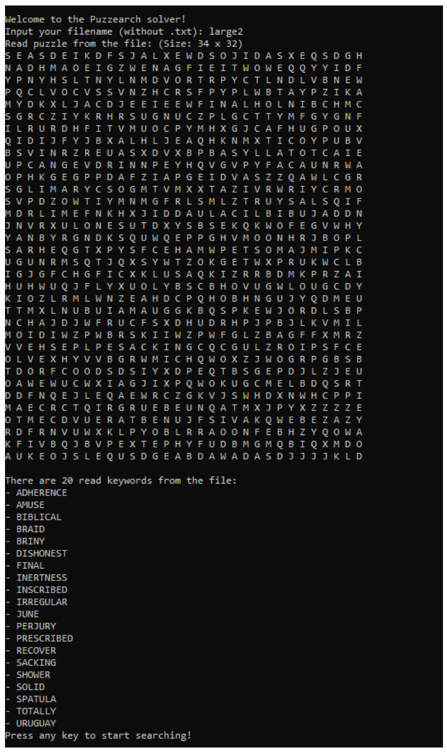
3.8 Pengujian terhadap file large2.txt (ukuran 34 x 32)



```
S E A S D E I K D F S J A L X E W D S O J I D A S X E Q S D G H
N A D H M A O E I G Z W E N A G F I E I T W O W E Q Q Y Y I D F
Y P N Y H S L T N Y L N M D V O R T R P Y C T L N D L V B N E W
P Q C L V O C V S S V N Z H C R S F P Y P L W B T A Y P Z I K A
M Y D K X L J A C D J E E I E E W F I N A L H O L N I B C H M C
S G R C Z I Y K R H R S U G N U C Z P L G C T T Y M F G Y G N F
I L R U R D H F I T V M U O C P Y M H X G J C A F H U G P O U X
Q I D I J F Y J B X A L H L J E A Q H K N M X T I C O Y P U B V
B S V I N R Z R E U A S X D V X B P B A S Y L L A T O T C A I E
U P C A N G E V D R I N N P E Y H Q V G V P Y F A C A U N R W A
O P H K G E G P P D A F Z I A P G E I D V A S Z Z Q A W L C G R
S G L I M A R Y C S O G M T V M X X T A Z I V R W R I Y C R M O
S V P D Z O W T I Y M N M G F R L S M L Z T R U Y S A L S Q I F
M D R L I M E F N K H X J I D D A U L A C I L B I B U J A D D N
J N V R X U L O N E S U T D X Y S B S E K Q K W O F E G V W H Y
Y A N B Y R G N D K S Q U W Q E P P G H V M O O N H R J B O P L
S A R H E Q G T X P Y S F C E H A M W P E T S O M A J M I P K C
U G U N R M S Q T J Q X S Y W T Z O K G E T W X P R U K W C L B
I G J G F C H G F I C X K L U S A Q K I Z R R B D M K P R Z A I
H U H W U Q J F L Y X U O L Y B S C B H O V U G W L O U G C D Y
K I O Z L R M L W N Z E A H D C P Q H O B H N G U J Y Q D M E U
T T M X L N U B U I A M A U G G K B Q S P K E W J O R D L S B P
N C H A J D J W F R U C F S X D H U D R H P J P B J L K V M I L
M O I D I W Z P W B R S K I I W Z P W F G L Z B A G F F X M R Z
V V E H S E P L P E S A C K I N G C Q C G U L Z R O I P S F C E
O L V E X H Y V V B G R W M I C H Q W O X Z J W O G R P G B S B
T D O R F C O O D S D S I Y X D P E Q T B S G E P D J L Z J E U
O A W E W U C W X I A G J I X P Q W O K U G C M E L B D Q S R T
D D F N Q E J L E Q A E W R C Z G K V J S W H D X N W H C P P I
M A E C R C T Q I R G R U E B E U N Q A T M X J P Y X Z Z Z Z E
O T M E C D V U E R A T B E N U J F S I V A K Q W E B E Z A Z Y
R D F R N V U W X K L P Y O B L R R A O O N F E B H Z Y Q O W A
K F I V B Q J B V P E X T E P H Y F U D B M G M Q B I Q X M D O
A U K E O J S L E Q U S D G E A B D A W A D A S D J J J J K L D

ADHERENCE
AMUSE
BIBLICAL
BRAID
BRINY
DISHONEST
FINAL
INERTNESS
INSCRIBED
IRREGULAR
JUNE
PERJURY
PRESCRIBED
RECOVER
SACKING
SHOWER
SOLID
SPATULA
TOTALLY
URUGUAY
```

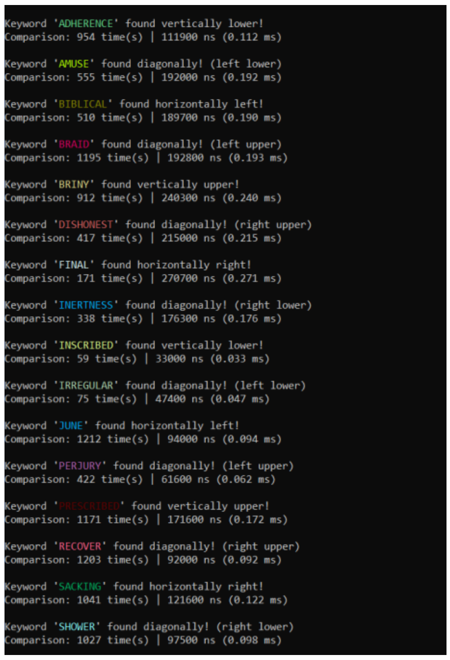
Gambar 3.8.1 Isian berkas large2.txt



```
Welcome to the Puzzearch solver!
Input your filename (without .txt): large2
Read puzzle from the file: (Size: 34 x 32)
S E A S D E I K D F S J A L X E W D S O J I D A S X E Q S D G H
N A D H M A O E I G Z W E N A G F I E I T W O W E Q Q Y Y I D F
Y P N Y H S L T N Y L N M D V O R T R P Y C T L N D L V B N E W
P Q C L V O C V S S V N Z H C R S F P Y P L W B T A Y P Z I K A
M Y D K X L J A C D J E E I E E W F I N A L H O L N I B C H M C
S G R C Z I Y K R H R S U G N U C Z P L G C T T Y M F G Y G N F
I L R U R D H F I T V M U O C P Y M H X G J C A F H U G P O U X
Q I D I J F Y J B X A L H L J E A Q H K N M X T I C O Y P U B V
B S V I N R Z R E U A S X D V X B P B A S Y L L A T O T C A I E
U P C A N G E V D R I N N P E Y H Q V G V P Y F A C A U N R W A
O P H K G E G P P D A F Z I A P G E I D V A S Z Z Q A W L C G R
S G L I M A R Y C S O G M T V M X X T A Z I V R W R I Y C R M O
S V P D Z O W T I Y M N M G F R L S M L Z T R U Y S A L S Q I F
M D R L I M E F N K H X J I D D A U L A C I L B I B U J A D D N
J N V R X U L O N E S U T D X Y S B S E K Q K W O F E G V W H Y
Y A N B Y R G N D K S Q U W Q E P P G H V M O O N H R J B O P L
S A R H E Q G T X P Y S F C E H A M W P E T S O M A J M I P K C
U G U N R M S Q T J Q X S Y W T Z O K G E T W X P R U K W C L B
I G J G F C H G F I C X K L U S A Q K I Z R R B D M K P R Z A I
H U H W U Q J F L Y X U O L Y B S C B H O V U G W L O U G C D Y
K I O Z L R M L W N Z E A H D C P Q H O B H N G U J Y Q D M E U
T T M X L N U B U I A M A U G G K B Q S P K E W J O R D L S B P
N C H A J D J W F R U C F S X D H U D R H P J P B J L K V M I L
M O I D I W Z P W B R S K I I W Z P W F G L Z B A G F F X M R Z
V V E H S E P L P E S A C K I N G C Q C G U L Z R O I P S F C E
O L V E X H Y V V B G R W M I C H Q W O X Z J W O G R P G B S B
T D O R F C O O D S D S I Y X D P E Q T B S G E P D J L Z J E U
O A W E W U C W X I A G J I X P Q W O K U G C M E L B D Q S R T
D D F N Q E J L E Q A E W R C Z G K V J S W H D X N W H C P P I
M A E C R C T Q I R G R U E B E U N Q A T M X J P Y X Z Z Z Z E
O T M E C D V U E R A T B E N U J F S I V A K Q W E B E Z A Z Y
R D F R N V U W X K L P Y O B L R R A O O N F E B H Z Y Q O W A
K F I V B Q J B V P E X T E P H Y F U D B M G M Q B I Q X M D O
A U K E O J S L E Q U S D G E A B D A W A D A S D J J J J K L D

There are 20 read keywords from the file:
- ADHERENCE
- AMUSE
- BIBLICAL
- BRAID
- BRINY
- DISHONEST
- FINAL
- INERTNESS
- INSCRIBED
- IRREGULAR
- JUNE
- PERJURY
- PRESCRIBED
- RECOVER
- SACKING
- SHOWER
- SOLID
- SPATULA
- TOTALLY
- URUGUAY
Press any key to start searching!
```

Gambar 3.8.2 Hasil pembacaan file masukan



```
Keyword 'ADHERENCE' found vertically lower!
Comparison: 954 time(s) | 111900 ns (0.112 ms)

Keyword 'AMUSE' found diagonally! (left lower)
Comparison: 555 time(s) | 192000 ns (0.192 ms)

Keyword 'BIBLICAL' found horizontally left!
Comparison: 510 time(s) | 189700 ns (0.190 ms)

Keyword 'BRAID' found diagonally! (left upper)
Comparison: 1195 time(s) | 192800 ns (0.193 ms)

Keyword 'BRINY' found vertically upper!
Comparison: 912 time(s) | 240300 ns (0.240 ms)

Keyword 'DISHONEST' found diagonally! (right upper)
Comparison: 417 time(s) | 215000 ns (0.215 ms)

Keyword 'FINAL' found horizontally right!
Comparison: 171 time(s) | 270700 ns (0.271 ms)

Keyword 'INERTNESS' found diagonally! (right lower)
Comparison: 338 time(s) | 176300 ns (0.176 ms)

Keyword 'INSCRIBED' found vertically lower!
Comparison: 59 time(s) | 33000 ns (0.033 ms)

Keyword 'IRREGULAR' found diagonally! (left lower)
Comparison: 75 time(s) | 47400 ns (0.047 ms)

Keyword 'JUNE' found horizontally left!
Comparison: 1212 time(s) | 94000 ns (0.094 ms)

Keyword 'PERJURY' found diagonally! (left upper)
Comparison: 422 time(s) | 61600 ns (0.062 ms)

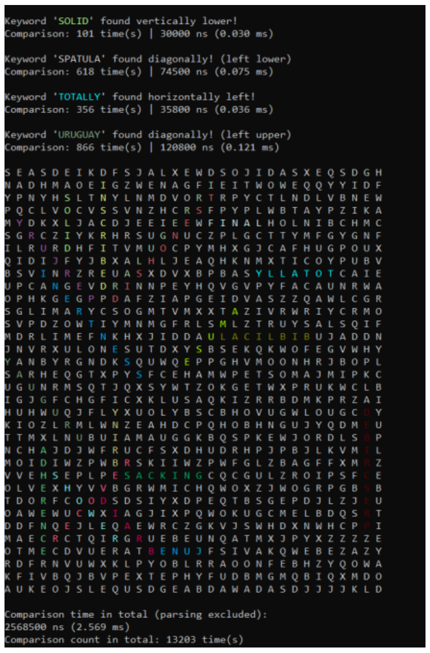
Keyword 'PRESCRIBED' found vertically upper!
Comparison: 1171 time(s) | 171600 ns (0.172 ms)

Keyword 'RECOVER' found diagonally! (right upper)
Comparison: 1203 time(s) | 92000 ns (0.092 ms)

Keyword 'SACKING' found horizontally right!
Comparison: 1041 time(s) | 121600 ns (0.122 ms)

Keyword 'SHOWER' found diagonally! (right lower)
Comparison: 1027 time(s) | 97500 ns (0.098 ms)
```

Gambar 3.8.3 Informasi hasil eksekusi per kata



```
Keyword 'SOLID' found vertically lower!
Comparison: 101 time(s) | 30000 ns (0.030 ms)

Keyword 'SPATULA' found diagonally! (left lower)
Comparison: 618 time(s) | 74500 ns (0.075 ms)

Keyword 'TOTALLY' found horizontally left!
Comparison: 356 time(s) | 35800 ns (0.036 ms)

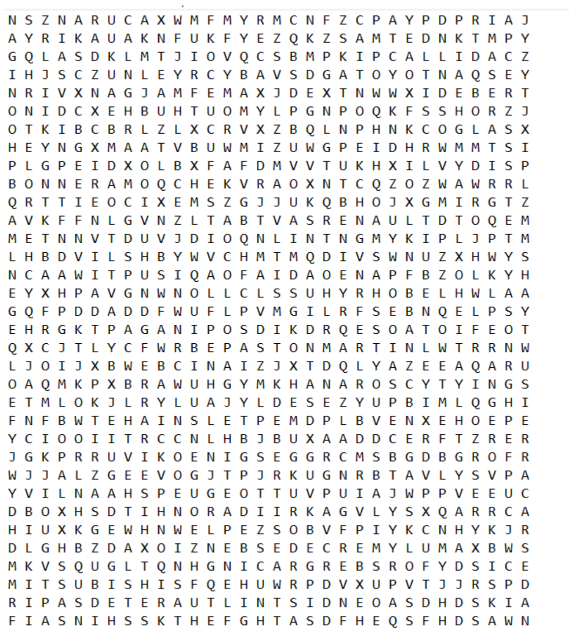
Keyword 'URUGUAY' found diagonally! (left upper)
Comparison: 866 time(s) | 120800 ns (0.121 ms)

S E A S D E I K D F S J A L X E W D S O J I D A S X E Q S D G H
N A D H M A O E I G Z W E N A G F I E I T W O W E Q Q Y Y I D F
Y P N Y H S L T N Y L N M D V O R T R P Y C T L N D L V B N E W
P Q C L V O C V S S V N Z H C R S F P Y P L W B T A Y P Z I K A
M Y D K X L J A C D J E E I E E W F I N A L H O L N I B C H M C
S G R C Z I Y K R H R S U G N U C Z P L G C T T Y M F G Y G N F
I L R U R D H F I T V M U O C P Y M H X G J C A F H U G P O U X
Q I D I J F Y J B X A L H L J E A Q H K N M X T I C O Y P U B V
B S V I N R Z R E U A S X D V X B P B A S Y L L A T O T C A I E
U P C A N G E V D R I N N P E Y H Q V G V P Y F A C A U N R W A
O P H K G E G P P D A F Z I A P G E I D V A S Z Z Q A W L C G R
S G L I M A R Y C S O G M T V M X X T A Z I V R W R I Y C R M O
S V P D Z O W T I Y M N M G F R L S M L Z T R U Y S A L S Q I F
M D R L I M E F N K H X J I D D A U L A C I L B I B U J A D D N
J N V R X U L O N E S U T D X Y S B S E K Q K W O F E G V W H Y
Y A N B Y R G N D K S Q U W Q E P P G H V M O O N H R J B O P L
S A R H E Q G T X P Y S F C E H A M W P E T S O M A J M I P K C
U G U N R M S Q T J Q X S Y W T Z O K G E T W X P R U K W C L B
I G J G F C H G F I C X K L U S A Q K I Z R R B D M K P R Z A I
H U H W U Q J F L Y X U O L Y B S C B H O V U G W L O U G C D Y
K I O Z L R M L W N Z E A H D C P Q H O B H N G U J Y Q D M E U
T T M X L N U B U I A M A U G G K B Q S P K E W J O R D L S B P
N C H A J D J W F R U C F S X D H U D R H P J P B J L K V M I L
M O I D I W Z P W B R S K I I W Z P W F G L Z B A G F F X M R Z
V V E H S E P L P E S A C K I N G C Q C G U L Z R O I P S F C E
O L V E X H Y V V B G R W M I C H Q W O X Z J W O G R P G B S B
T D O R F C O O D S D S I Y X D P E Q T B S G E P D J L Z J E U
O A W E W U C W X I A G J I X P Q W O K U G C M E L B D Q S R T
D D F N Q E J L E Q A E W R C Z G K V J S W H D X N W H C P P I
M A E C R C T Q I R G R U E B E U N Q A T M X J P Y X Z Z Z Z E
O T M E C D V U E R A T B E N U J F S I V A K Q W E B E Z A Z Y
R D F R N V U W X K L P Y O B L R R A O O N F E B H Z Y Q O W A
K F I V B Q J B V P E X T E P H Y F U D B M G M Q B I Q X M D O
A U K E O J S L E Q U S D G E A B D A W A D A S D J J J J K L D

Comparison time in total (parsing excluded):
2568500 ns (2.569 ms)
Comparison count in total: 13203 time(s)
```

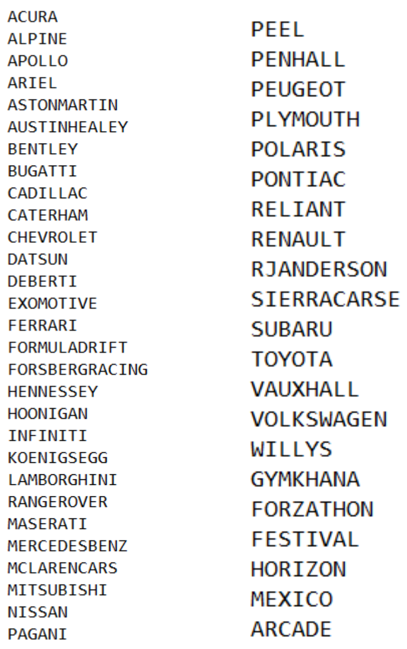
Gambar 3.8.4 Matriks akhir dan informasi waktu eksekusi & banyak perbandingan

3.9 Pengujian terhadap file large3.txt (ukuran 36 x 34)



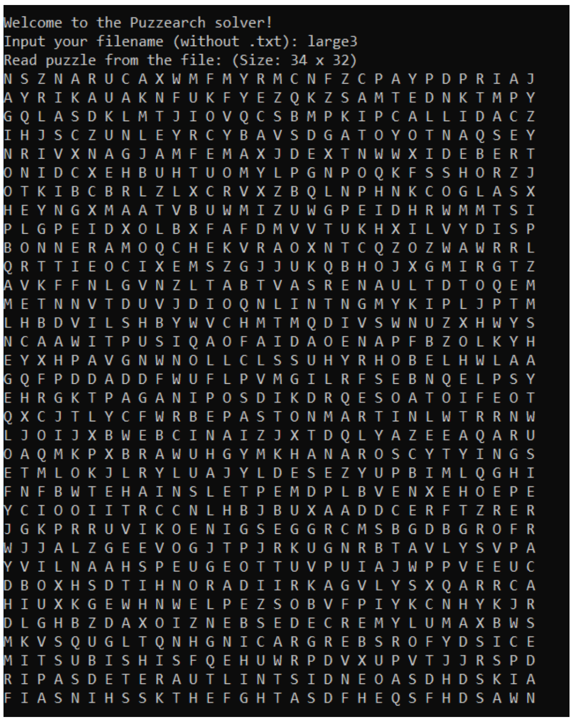
```
N S Z N A R U C A X W M F M Y R M C N F Z C P A Y P D P R I A J
A Y R I K A U A K N F U K F Y E Z Q K Z S A M T E D N K T M P Y
G Q L A S D K L M T J I O V Q C S B M P K I P C A L L I D A C Z
I H J S C Z U N L E Y R C Y B A V S D G A T O Y O T N A Q S E Y
N R I V X N A G J A M F E M A X J D E X T N W W X I D E B E R T
O N I D C X E H B U H T U O M Y L P G N P O Q K F S S H O R Z J
O T K I B C B R L Z L X C R V X Z B Q L N P H N K C O G L A S X
H E Y N G X M A A T V B U W M I Z U W G P E I D H R W M M T S I
P L G P E I D X O L B X F A F D M V V T U K H X I L V Y D I S P
B O N N E R A M O Q C H E K V R A O X N T C Q Z O Z W A W R R L
Q R T T I E O C I X E M S Z G J J U K Q B H O J X G M I R G T Z
A V K F F N L G V N Z L T A B T V A S R E N A U L T D T O Q E M
M E T N N V T D U V J D I O Q N L I N T N G M Y K I P L J P T M
L H B D V I L S H B Y W V C H M T M Q D I V S W N U Z X H W Y S
N C A A W I T P U S I Q A O F A I D A O E N A P F B Z O L K Y H
E Y X H P A V G N W N O L L C L S S U H Y R H O B E L H W L A A
G Q F P D D A D D F W U F L P V M G I L R F S E B N Q E L P S Y
E H R G K T P A G A N I P O S D I K D R Q E S O A T O I F E O T
Q X C J T L Y C F W R B E P A S T O N M A R T I N L W T R R N W
L J O I J X B W E B C I N A I Z J X T D Q L Y A Z E E A Q A R U
O A Q M K P X B R A W U H G Y M K H A N A R O S C Y T Y I N G S
E T M L O K J L R Y L U A J Y L D E S E Z Y U P B I M L Q G H I
F N F B W T E H A I N S L E T P E M D P L B V E N X E H O E P E
Y C I O O I I T R C C N L H B J B U X A A D D C E R F T Z R E R
J G K P R R U V I K O E N I G S E G G R C M S B G D B G R O F R
W J J A L Z G E E V O G J T P J R K U G N R B T A V L Y S V P A
Y V I L N A A H S P E U G E O T T U V P U I A J W P P V E E U C
D B O X H S D T I H N O R A D I I R K A G V L Y S X Q A R R C A
H I U X K G E W H N W E L P E Z S O B V F P I Y K C N H Y K J R
D L G H B Z D A X O I Z N E B S E D E C R E M Y L U M A X B W S
M K V S Q U G L T Q N H G N I C A R G R E B S R O F Y D S I C E
M I T S U B I S H I S F Q E H U W R P D V X U P V T J J R S P D
R I P A S D E T E R A U T L I N T S I D N E O A S D H D S K I A
F I A S N I H S S K T H E F G H T A S D F H E Q S F H D S A W N
```

Gambar 3.9.1 Isian berkas large3.txt (Puzzle)



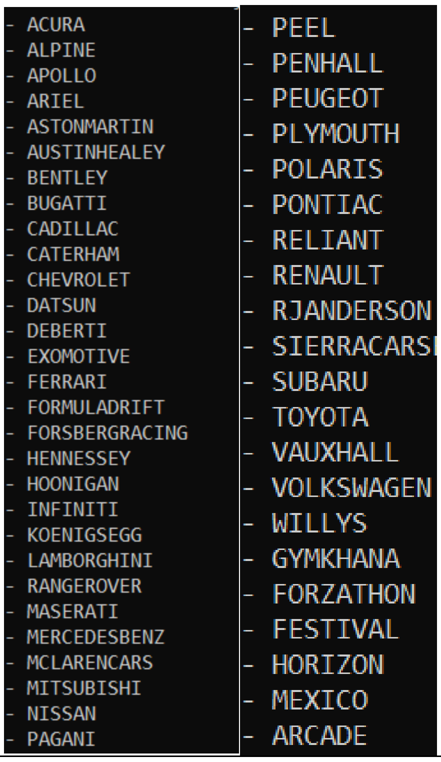
```
ACURA                PEEL
ALPINE               PENHALL
APOLLO               PEUGEOT
ARIEL                PLYMOUTH
ASTONMARTIN          POLARIS
AUSTINHEALEY         PONTIAC
BENTLEY              RELIANT
BUGATTI              RENAULT
CADILLAC             RJANDERSON
CATERHAM             SIERRACARSE
CHEVROLET            SUBARU
DATSUN               TOYOTA
DEBERTI              VAUXHALL
EXOMOTIVE            VOLKSWAGEN
FERRARI              WILLYS
FORMULADRIFT         GYMKHANA
FORSBERGRACING       FORZATHON
HENNESSEY            FESTIVAL
HOONIGAN             HORIZON
INFINITI             MEXICO
KOENIGSEGG           ARCADE
LAMBORGHINI
RANGEROVER
MASERATI
MERCEDESBENZ
MCLARENCARS
MITSUBISHI
NISSAN
PAGANI
```

Gambar 3.9.2 Isian berkas large3.txt (Kata kunci)



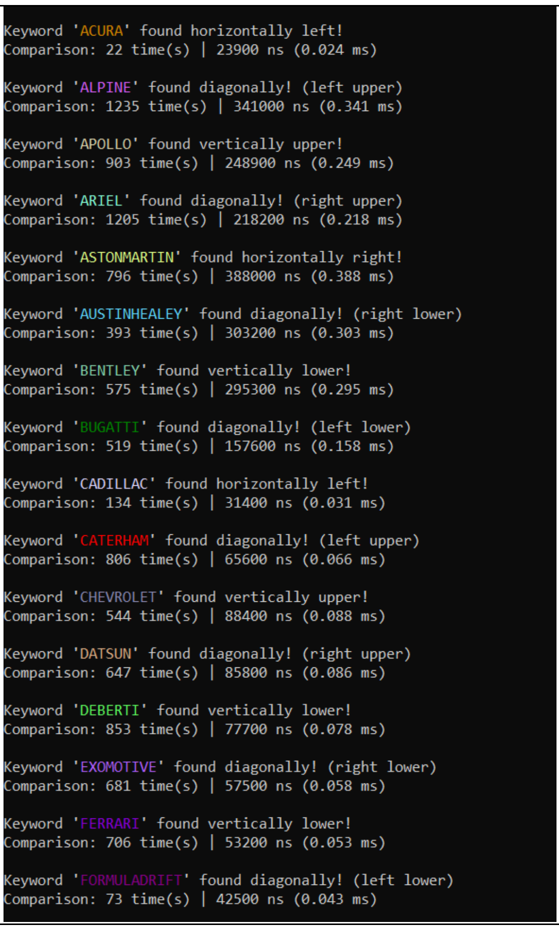
```
Welcome to the Puzzearch solver!
Input your filename (without .txt): large3
Read puzzle from the file: (Size: 34 x 32)
N S Z N A R U C A X W M F M Y R M C N F Z C P A Y P D P R I A J
A Y R I K A U A K N F U K F Y E Z Q K Z S A M T E D N K T M P Y
G Q L A S D K L M T J I O V Q C S B M P K I P C A L L I D A C Z
I H J S C Z U N L E Y R C Y B A V S D G A T O Y O T N A Q S E Y
N R I V X N A G J A M F E M A X J D E X T N W W X I D E B E R T
O N I D C X E H B U H T U O M Y L P G N P O Q K F S S H O R Z J
O T K I B C B R L Z L X C R V X Z B Q L N P H N K C O G L A S X
H E Y N G X M A A T V B U W M I Z U W G P E I D H R W M M T S I
P L G P E I D X O L B X F A F D M V V T U K H X I L V Y D I S P
B O N N E R A M O Q C H E K V R A O X N T C Q Z O Z W A W R R L
Q R T T I E O C I X E M S Z G J J U K Q B H O J X G M I R G T Z
A V K F F N L G V N Z L T A B T V A S R E N A U L T D T O Q E M
M E T N N V T D U V J D I O Q N L I N T N G M Y K I P L J P T M
L H B D V I L S H B Y W V C H M T M Q D I V S W N U Z X H W Y S
N C A A W I T P U S I Q A O F A I D A O E N A P F B Z O L K Y H
E Y X H P A V G N W N O L L C L S S U H Y R H O B E L H W L A A
G Q F P D D A D D F W U F L P V M G I L R F S E B N Q E L P S Y
E H R G K T P A G A N I P O S D I K D R Q E S O A T O I F E O T
Q X C J T L Y C F W R B E P A S T O N M A R T I N L W T R R N W
L J O I J X B W E B C I N A I Z J X T D Q L Y A Z E E A Q A R U
O A Q M K P X B R A W U H G Y M K H A N A R O S C Y T Y I N G S
E T M L O K J L R Y L U A J Y L D E S E Z Y U P B I M L Q G H I
F N F B W T E H A I N S L E T P E M D P L B V E N X E H O E P E
Y C I O O I I T R C C N L H B J B U X A A D D C E R F T Z R E R
J G K P R R U V I K O E N I G S E G G R C M S B G D B G R O F R
W J J A L Z G E E V O G J T P J R K U G N R B T A V L Y S V P A
Y V I L N A A H S P E U G E O T T U V P U I A J W P P V E E U C
D B O X H S D T I H N O R A D I I R K A G V L Y S X Q A R R C A
H I U X K G E W H N W E L P E Z S O B V F P I Y K C N H Y K J R
D L G H B Z D A X O I Z N E B S E D E C R E M Y L U M A X B W S
M K V S Q U G L T Q N H G N I C A R G R E B S R O F Y D S I C E
M I T S U B I S H I S F Q E H U W R P D V X U P V T J J R S P D
R I P A S D E T E R A U T L I N T S I D N E O A S D H D S K I A
F I A S N I H S S K T H E F G H T A S D F H E Q S F H D S A W N
```

Gambar 3.9.3 Hasil pembacaan file masukan (Puzzle)



```
- ACURA              - PEEL
- ALPINE             - PENHALL
- APOLLO             - PEUGEOT
- ARIEL              - PLYMOUTH
- ASTONMARTIN        - POLARIS
- AUSTINHEALEY       - PONTIAC
- BENTLEY            - RELIANT
- BUGATTI            - RENAULT
- CADILLAC           - RJANDERSON
- CATERHAM           - SIERRACARS
- CHEVROLET          - SUBARU
- DATSUN             - TOYOTA
- DEBERTI            - VAUXHALL
- EXOMOTIVE          - VOLKSWAGEN
- FERRARI            - WILLYS
- FORMULADRIFT       - GYMKHANA
- FORSBERGRACING     - FORZATHON
- HENNESSEY          - FESTIVAL
- HOONIGAN           - HORIZON
- INFINITI           - MEXICO
- KOENIGSEGG         - ARCADE
- LAMBORGHINI
- RANGEROVER
- MASERATI
- MERCEDESBENZ
- MCLARENCARS
- MITSUBISHI
- NISSAN
- PAGANI
```

Gambar 3.9.4 Hasil pembacaan file masukan (Kata kunci)



```
Keyword 'ACURA' found horizontally left!
Comparison: 22 time(s) | 23900 ns (0.024 ms)

Keyword 'ALPINE' found diagonally! (left upper)
Comparison: 1235 time(s) | 341000 ns (0.341 ms)

Keyword 'APOLLO' found vertically upper!
Comparison: 903 time(s) | 248900 ns (0.249 ms)

Keyword 'ARIEL' found diagonally! (right upper)
Comparison: 1205 time(s) | 218200 ns (0.218 ms)

Keyword 'ASTONMARTIN' found horizontally right!
Comparison: 796 time(s) | 388000 ns (0.388 ms)

Keyword 'AUSTINHEALEY' found diagonally! (right lower)
Comparison: 393 time(s) | 303200 ns (0.303 ms)

Keyword 'BENTLEY' found vertically lower!
Comparison: 575 time(s) | 295300 ns (0.295 ms)

Keyword 'BUGATTI' found diagonally! (left lower)
Comparison: 519 time(s) | 157600 ns (0.158 ms)

Keyword 'CADILLAC' found horizontally left!
Comparison: 134 time(s) | 31400 ns (0.031 ms)

Keyword 'CATERHAM' found diagonally! (left upper)
Comparison: 806 time(s) | 65600 ns (0.066 ms)

Keyword 'CHEVROLET' found vertically upper!
Comparison: 544 time(s) | 88400 ns (0.088 ms)

Keyword 'DATSUN' found diagonally! (right upper)
Comparison: 647 time(s) | 85800 ns (0.086 ms)

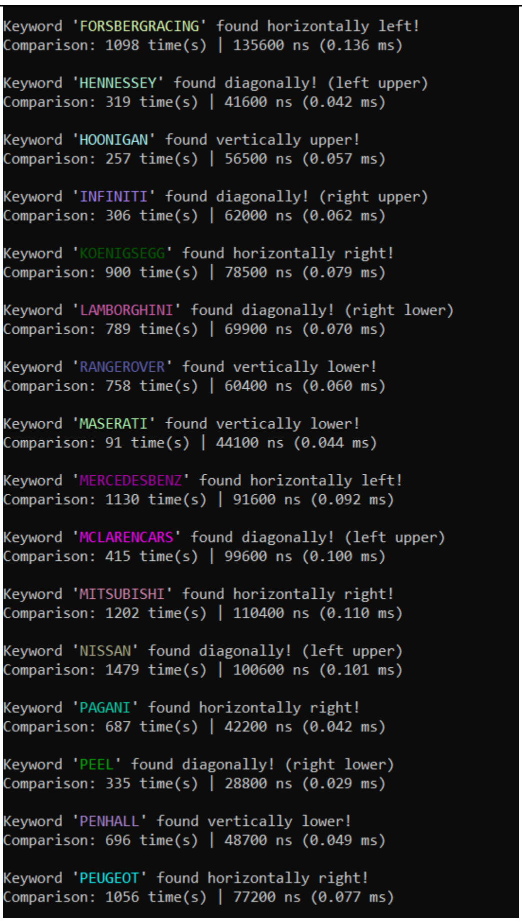
Keyword 'DEBERTI' found vertically lower!
Comparison: 853 time(s) | 77700 ns (0.078 ms)

Keyword 'EXOMOTIVE' found diagonally! (right lower)
Comparison: 681 time(s) | 57500 ns (0.058 ms)

Keyword 'FERRARI' found vertically lower!
Comparison: 706 time(s) | 53200 ns (0.053 ms)

Keyword 'FORMULADRIFT' found diagonally! (left lower)
Comparison: 73 time(s) | 42500 ns (0.043 ms)
```

Gambar 3.9.5 Informasi hasil eksekusi per kata (1)



```
Keyword 'FORSBERGRACING' found horizontally left!
Comparison: 1098 time(s) | 135600 ns (0.136 ms)

Keyword 'HENNESSEY' found diagonally! (left upper)
Comparison: 319 time(s) | 41600 ns (0.042 ms)

Keyword 'HOONIGAN' found vertically upper!
Comparison: 257 time(s) | 56500 ns (0.057 ms)

Keyword 'INFINITI' found diagonally! (right upper)
Comparison: 306 time(s) | 62000 ns (0.062 ms)

Keyword 'KOENIGSEGG' found horizontally right!
Comparison: 900 time(s) | 78500 ns (0.079 ms)

Keyword 'LAMBORGHINI' found diagonally! (right lower)
Comparison: 789 time(s) | 69900 ns (0.070 ms)

Keyword 'RANGEROVER' found vertically lower!
Comparison: 758 time(s) | 60400 ns (0.060 ms)

Keyword 'MASERATI' found vertically lower!
Comparison: 91 time(s) | 44100 ns (0.044 ms)

Keyword 'MERCEDESBENZ' found horizontally left!
Comparison: 1130 time(s) | 91600 ns (0.092 ms)

Keyword 'MCLARENCARS' found diagonally! (left upper)
Comparison: 415 time(s) | 99600 ns (0.100 ms)

Keyword 'MITSUBISHI' found horizontally right!
Comparison: 1202 time(s) | 110400 ns (0.110 ms)

Keyword 'NISSAN' found diagonally! (left upper)
Comparison: 1479 time(s) | 100600 ns (0.101 ms)

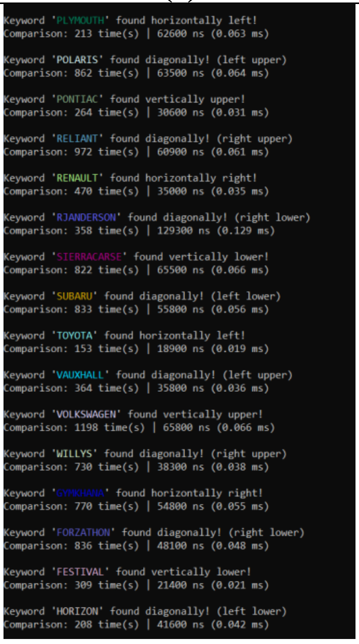
Keyword 'PAGANI' found horizontally right!
Comparison: 687 time(s) | 42200 ns (0.042 ms)

Keyword 'PEEL' found diagonally! (right lower)
Comparison: 335 time(s) | 28800 ns (0.029 ms)

Keyword 'PENHALL' found vertically lower!
Comparison: 696 time(s) | 48700 ns (0.049 ms)

Keyword 'PEUGEOT' found horizontally right!
Comparison: 1056 time(s) | 77200 ns (0.077 ms)
```

Gambar 3.9.6 Informasi hasil eksekusi per kata (2)



```
Keyword 'PLYMOUTH' found horizontally left!
Comparison: 213 time(s) | 62600 ns (0.063 ms)

Keyword 'POLARIS' found diagonally! (left upper)
Comparison: 862 time(s) | 63500 ns (0.064 ms)

Keyword 'PONTIAC' found vertically upper!
Comparison: 264 time(s) | 30600 ns (0.031 ms)

Keyword 'RELIANT' found diagonally! (right upper)
Comparison: 972 time(s) | 60900 ns (0.061 ms)

Keyword 'RENAULT' found horizontally right!
Comparison: 470 time(s) | 35000 ns (0.035 ms)

Keyword 'RJANDERSON' found diagonally! (right lower)
Comparison: 358 time(s) | 129300 ns (0.129 ms)

Keyword 'SIERRACARSE' found vertically lower!
Comparison: 822 time(s) | 65500 ns (0.066 ms)

Keyword 'SUBARU' found diagonally! (left lower)
Comparison: 833 time(s) | 55800 ns (0.056 ms)

Keyword 'TOYOTA' found horizontally left!
Comparison: 153 time(s) | 18900 ns (0.019 ms)

Keyword 'VAUXHALL' found diagonally! (left upper)
Comparison: 364 time(s) | 35800 ns (0.036 ms)

Keyword 'VOLKSWAGEN' found vertically upper!
Comparison: 1198 time(s) | 65800 ns (0.066 ms)

Keyword 'WILLYS' found diagonally! (right upper)
Comparison: 730 time(s) | 38300 ns (0.038 ms)

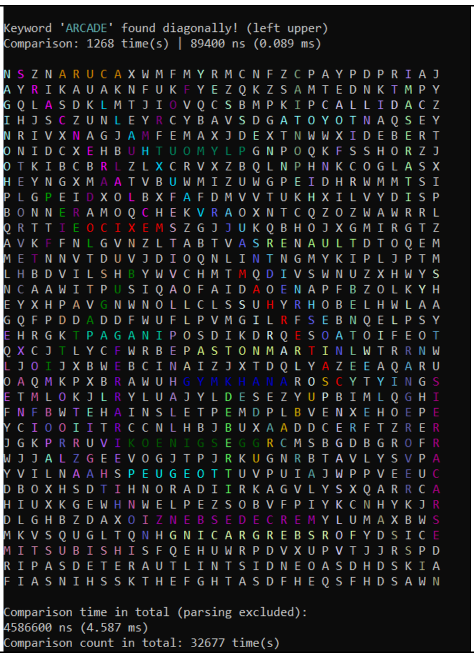
Keyword 'GYMKHANA' found horizontally right!
Comparison: 770 time(s) | 54800 ns (0.055 ms)

Keyword 'FORZATHON' found diagonally! (right lower)
Comparison: 836 time(s) | 48100 ns (0.048 ms)

Keyword 'FESTIVAL' found vertically lower!
Comparison: 309 time(s) | 21400 ns (0.021 ms)

Keyword 'HORIZON' found diagonally! (left lower)
Comparison: 208 time(s) | 41600 ns (0.042 ms)
```

Gambar 3.9.7 Informasi hasil eksekusi per kata (3)



```
Keyword 'ARCADE' found diagonally! (left upper)
Comparison: 1268 time(s) | 89400 ns (0.089 ms)

N S Z N A R U C A X W M F M Y R M C N F Z C P A Y P D P R I A J
A Y R I K A U A K N F U K F Y E Z Q K Z S A M T E D N K T M P Y
G Q L A S D K L M T J I O V Q C S B M P K I P C A L L I D A C Z
I H J S C Z U N L E Y R C Y B A V S D G A T O Y O T N A Q S E Y
N R I V X N A G J A M F E M A X J D E X T N W W X I D E B E R T
O N I D C X E H B U H T U O M Y L P G N P O Q K F S S H O R Z J
O T K I B C B R L Z L X C R V X Z B Q L N P H N K C O G L A S X
H E Y N G X M A A T V B U W M I Z U W G P E I D H R W M M T S I
P L G P E I D X O L B X F A F D M V V T U K H X I L V Y D I S P
B O N N E R A M O Q C H E K V R A O X N T C Q Z O Z W A W R R L
Q R T T I E O C I X E M S Z G J J U K Q B H O J X G M I R G T Z
A V K F F N L G V N Z L T A B T V A S R E N A U L T D T O Q E M
M E T N N V T D U V J D I O Q N L I N T N G M Y K I P L J P T M
L H B D V I L S H B Y W V C H M T M Q D I V S W N U Z X H W Y S
N C A A W I T P U S I Q A O F A I D A O E N A P F B Z O L K Y H
E Y X H P A V G N W N O L L C L S S U H Y R H O B E L H W L A A
G Q F P D D A D D F W U F L P V M G I L R F S E B N Q E L P S Y
E H R G K T P A G A N I P O S D I K D R Q E S O A T O I F E O T
Q X C J T L Y C F W R B E P A S T O N M A R T I N L W T R R N W
L J O I J X B W E B C I N A I Z J X T D Q L Y A Z E E A Q A R U
O A Q M K P X B R A W U H G Y M K H A N A R O S C Y T Y I N G S
E T M L O K J L R Y L U A J Y L D E S E Z Y U P B I M L Q G H I
F N F B W T E H A I N S L E T P E M D P L B V E N X E H O E P E
Y C I O O I I T R C C N L H B J B U X A A D D C E R F T Z R E R
J G K P R R U V I K O E N I G S E G G R C M S B G D B G R O F R
W J J A L Z G E E V O G J T P J R K U G N R B T A V L Y S V P A
Y V I L N A A H S P E U G E O T T U V P U I A J W P P V E E U C
D B O X H S D T I H N O R A D I I R K A G V L Y S X Q A R R C A
H I U X K G E W H N W E L P E Z S O B V F P I Y K C N H Y K J R
D L G H B Z D A X O I Z N E B S E D E C R E M Y L U M A X B W S
M K V S Q U G L T Q N H G N I C A R G R E B S R O F Y D S I C E
M I T S U B I S H I S F Q E H U W R P D V X U P V T J J R S P D
R I P A S D E T E R A U T L I N T S I D N E O A S D H D S K I A
F I A S N I H S S K T H E F G H T A S D F H E Q S F H D S A W N

Comparison time in total (parsing excluded):
4586600 ns (4.587 ms)
Comparison count in total: 32677 time(s)
```

Gambar 3.9.8 Matriks akhir dan informasi waktu eksekusi & banyak perbandingan

Poin	Ya	Tidak
1. Program berhasil dikompilasi tanpa kesalahan (no syntax error)	√	
2. Program berhasil running	√	
3. Program dapat membaca file masukan dan menuliskan luaran	√	
4. Program berhasil menemukan semua kata di dalam puzzle	√	

IV. *REPOSITORY*

Repository dapat diakses via `https://github.com/clumsyyyy/TucilStima1` (branch main)