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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BAB I. ALGORITMA BRUTE FORCE

Dalam tugas kecil ini, algoritma *brute force* diimplementasikan dalam pencarian katakata 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.

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. 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. 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*.

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, fungsi-fungsi tersebut akan dipanggil. 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. Dengan menggunakan skema pencarian menggunakan *boolean*, fungsi akan melakukan pencocokan per karakter sampai *out of bounds*. 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.

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

```
public class CharObj{

String oriChar;
String colorChar;

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

2.2 Exec.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++){</pre>
           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++){</pre>
```

```
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){
        boolean flag = true;
        int compCount = 0;
        Exec tempExec;
        if (j + 1 - keyword.length < 0){
            flag = false;
        } else {
            while (count < keyword.length && flag){</pre>
                compCount++;
                if (!m.buffer[i][j - count].oriChar.equals(keyword[count])){
                    flag = false;
                    count++;
        if(flag){
            int a = 0;
            while (a < keyword.length){</pre>
                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){
       boolean flag = true;
       int compCount = 0;
       Exec tempExec;
        if (j + keyword.length > m.cols){
            flag = false;
            int count = 1;
            while (count < keyword.length && flag){</pre>
                                            if (!m.buffer[i][j +
                compCount++;
count].oriChar.equals(keyword[count])){
                    flag = false;
                    count++;
        if(flag){
            int a = 0;
            while (a < keyword.length){</pre>
                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){</pre>
```

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

```
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;
            int count = 1;
           while (count < keyword.length && flag){</pre>
                compCount++;
               if (!m.buffer[i - count][j -
count].oriChar.equals(keyword[count])){
                    flag = false;
                    count++;
        if(flag){
            int a = 0;
           while (a < keyword.length){</pre>
               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){
       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){</pre>
                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){</pre>
                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){</pre>
            flag = false;
            int count = 1;
            while (count < keyword.length && flag){</pre>
                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){</pre>
                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";
        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;
            int count = 1;
            while (count < keyword.length && flag){</pre>
                compCount++;
                if (!m.buffer[i + count][j +
count].oriChar.equals(keyword[count])){
                    flag = false;
                    count++;
        if(flag){
            int a = 0;
            while (a < keyword.length){</pre>
                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[][];
    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++){</pre>
             for(int j = 0; j < this.cols; <math>j++){
                 this.buffer[i][j] = new CharObj(" ");
    public void printOriMatrix(){
        for(int i = 0; i < this.rows; i++){</pre>
             for(int j = 0; j < this.cols; j++){</pre>
                 System.out.print(this.buffer[i][j].oriChar + " ");
            System.out.println();
    public void printColorMatrix(){
        for(int i = 0; i < this.rows; i++){</pre>
            for(int j = 0; j < this.cols; <math>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){</pre>
            while (j < m.cols && !found){</pre>
                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 \'" +
\u0001B[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;
```

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();
            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){</pre>
                        m.cols = rows.length;
                    for(int j = 0; j < rows.length; j++){</pre>
                        m.buffer[i][j] = new CharObj(rows[j]);
                    if (rows.length < m.cols){</pre>
                        for(int j = rows.length + 1; j < m.cols; j++){</pre>
                            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)

```
NATSHKAZAKBA
                                                                                         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 U 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
                                                                                           Velcome to the Puzzearch solver!
              OIIVFRSKUDEI
              LMPBUUEXBTLV
              USYHRITALYGT
              XPAAKERLAAIA
              ETLNQZSIIIUL
              мехомвккстмв
              BBULGARIAALT
              0 T O K V O R C H O X Y
              UEEOWWUIRRUV
              RZLXRTLJNCFT
              GSLYAINEVOLS
              ASDGEDASGEWD
              SASDEWKCDSUD
              BELARUS
                                                                                          There are 12 read keywords from the file:
- BELARUS
              ITALY
              SANMARINO
                                                                                            ITALY
SANMARINO
              BELGIUM
                                                                                           BELGIUM
KAZAKHSTAN
              KAZAKHSTAN
              SERBIA
                                                                                            SERBIA
              LATVIA
                                                                                            LATVIA
              SLOVAKIA
                                                                                            SLOVAKIA
BULGARIA
              BULGARIA
              SLOVENIA
                                                                                            CROATIA
              CROATTA
              LUXEMBOURG
                                                                                            ress any key to start searching!
       Gambar 3.1.1 Isian berkas small1.txt
                                                                                  Gambar 3.1.2 Hasil pembacaan file masukan
Keyword 'BELARUS' found diagonally! (right upper)
Comparison: 116 time(s) | 43500 ns (0.044 ms)
                                                                                       SHKAZAKBA
                                                                                IIVFRSKUDEI
Keyword 'ITALY' found horizontally right!
Comparison: 55 time(s) | 218500 ns (0.219 ms)
                                                                               MPBUUEXBTLV
                                                                                SYHRITALYGT
Keyword 'SANMARINO' found diagonally! (right lower)
Comparison: 51 time(s) | 254700 ns (0.255 ms)
                                                                             X P A A K E R L A A I A
                                                                                TLNQZSIIIU
Keyword 'BELGIUM' found vertically lower!
Comparison: 17 time(s) | 272400 ns (0.272 ms)
                                                                               EXQMBKKC
                                                                              BBULGARIAALT
                                                                                TOKVORCHOXY
Keyword 'KAZAKHSTAN' found horizontally left!
Comparison: 22 time(s) | 143800 ns (0.144 ms)
                                                                             UEEOWWUIRRUV
                                                                             RZLXRTLJNCFT
Keyword 'SERBIA' found diagonally! (left upper)
Comparison: 89 time(s) | 219300 ns (0.219 ms)
                                                                             ASDGEDASGEWD
Keyword 'LATVIA' found vertically upper!
Comparison: 103 time(s) | 242000 ns (0.242 ms)
                                                                                ASDEWKCDSUD
Keyword 'SLOVAKIA' found diagonally! (right upper)
Comparison: 152 time(s) | 31500 ns (0.032 ms)
                                                                              Comparison time in total (parsing excluded):
                                                                              1586400 ns (1.586 ms)
                                                                              Comparison count in total: 1067 time(s)
Keyword 'BULGARIA' found horizontally right!
Comparison: 110 time(s) | 34200 ns (0.034 ms)
                                                                               ress any key to quit...
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 3.1.4 Matriks akhir dan informasi waktu
  Gambar 3.1.3 Informasi hasil eksekusi per
                                                                                           eksekusi & banyak perbandingan
                                 kata
```

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

```
JUCMIRAURBEFLN
                                                             Welcome to the Puzzearch solver!
                                                             Input your filename (without .txt): small2
Read puzzle from the file: (Size: 16 x 14)
 PANVDDPLRFTIOL
 YKNAGUSTUSPVUQ
                                                             SYLUVJQKZIEJKX
 AETFALSVZMVSCC
 NMPJKREZBIBIUF
 WXLTMQIEZNUDOG
                                                             A E I 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
 F H X A E X R V J U L I K A
 MVRZNMQXLJKKTX
 KEEDMABSYXDEOK
 TIBNUJYEYVOTBD
                                                              CEEDMABSYXDEOK
 MUECFIQRRNOFEY
                                                               IBNUJYEYVOTBD
                                                             MUECFIQRRNOFEY
 REBMESEDMLYDRK
 PPRESDKCQEDLSI
                                                             REBMESĒDMLYDRK
                                                              PRESDKCQEDLSI
 ZOWKLDLIRPAXBK
                                                              OWKLDLIRPAXBK
 ASDUDSAJKSLOES
                                                              SDUDSAJKSLOES
 JANUARI
                                                             There are 12 read keywords from the file:
 FEBRUARI
                                                               JANUARI
 MARET
                                                               FEBRUARI
 APRTI
                                                               MARFT
                                                               APRIL
 MET
                                                               MEI
 JUNT
                                                               JUNI
 JULI
                                                               JULT
 AGUSTUS
                                                               AGUSTUS
 SEPTEMBER
                                                               SEPTEMBER
 OKTOBER
                                                               OKTOBER
                                                               NOVEMBER
 NOVEMBER
                                                               DESEMBER
 DESEMBER
                                                              ress any key to start searching!
   Gambar 3.2.1 Isian berkas small2.txt
                                                            Gambar 3.2.2 Hasil pembacaan file masukan
  eyword 'JANUARI' found diagonally! (right lower)
omparison: 8 time(s) | 24100 ns (0.024 ms)
                                                            UCMIRAURBEFLN
                                                            ANVDDPLRFTIOL
 eyword 'FEBRUARI' found horizontally left!
omparison: 21 time(s) | 163800 ns (0.164 ms)
                                                                   GUSTUSPVUQ
                                                            K N A
                                                            YLUVJQKZIE
 Keyword 'MARET' found diagonally! (left lower)
Comparison: 112 time(s) | 167600 ns (0.168 ms)
                                                                                      J K X
                                                            ETFALSVZMVSCC
                                                          NMPJKREZBIBIUF
 eyword 'APRIL' found horizontally left!
omparison: 254 time(s) | 46300 ns (0.046 ms)
                                                          W X L T M Q I E Z N U D O G
 Keyword 'MEI' found diagonally! (left upper)
Comparison: 239 time(s) | 160900 ns (0.161 ms)
                                                          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
 Reyword 'JUNI' found vertically upper!
comparison: 166 time(s) | 308800 ns (0.309 ms)
                                                          KEEDMABSYXDEOK
                                                            IBNUJYEYVOTBD
 Seyword 'JULI' found horizontally right!
comparison: 136 time(s) | 265300 ns (0.265 ms)
                                                          MUECFIQRRNOF
                                                              BMESEDMLYDRK
 eyword 'AGUSTUS' found horizontally right!
omparison: 46 time(s) | 31100 ns (0.031 ms)
                                                         P P R E S D K C Q E D L S I
                                                         ZOWKLDLIRPAXBK
 Keyword 'SEPTEMBER' found diagonally! (right lower)
Comparison: 56 time(s) | 31400 ns (0.031 ms)
                                                          ASDUDSAJKSLOES
 (eyword 'OKTOBER' found vertically lower!
comparison: 106 time(s) | 156600 ns (0.157 ms)
                                                          Comparison time in total (parsing excluded):
 Geyword 'NOVEMBER' found diagonally! (left lower)
comparison: 22 time(s) | 25800 ns (0.026 ms)
                                                          1414300 ns (1.414 ms)
                                                          Comparison count in total: 1367 time(s)
  yword 'DESEMBER' found horizontally left!
mparison: 201 time(s) | 32600 ns (0.033 ms)
                                                          Press any key to quit...
Gambar 3.2.3 Informasi hasil eksekusi per
                                                          Gambar 3.2.4 Matriks akhir dan informasi waktu
                                                                   eksekusi & banyak perbandingan
```

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

```
Welcome to the Puzzearch solver!
    IVWYPSYOOMDSUVIV
                                                                 Input your filename (without .txt): small3
Read puzzle from the file: (Size: 18 x 16)
    RRYPWRXTOHTDIHWG
    TJVRZOOKBRTATSBO
    VIRAIMGWARVTPRXA
                                                                 R N 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
/ I R A I M G W A R V T P R X A
) R V K A O V T S Z A A A N Y K
    ORVKAOVTSZAAANYK
    TVJTLLIQWDKDLVUV
    PPAIBMIZBFRSSBDG
                                                                  V J T L L I Q W D K D L V U V
P A I B M I Z B F R S S B D G
     \verb"URWKAKCNLYNATCAX" \\
    WOTUMRCZGDPBRRAT
                                                                 J R W K A K C N L Y N A T C A X
    G B M M F O B M Z E G F U U W N
                                                                  1 O T U M R C Z G D P B R R A T
    P S M K Q A K Q H Y O B K T M G
                                                                  I B M M F O B M Z E G F U U W N
    V T P E F F R I J P I Q D F G U
                                                                 PSMKQAKQHYOBKTMG
TPEFFRIJPIQDFGU
    MATDISQQSYIRALGE
                                                                 MATDISQQSYIRALGE
NTSARXTTYRXITPPI
    WTSARXTTYRXITPPI
    TCBIKCZQCKAJZPJM
                                                                  СВІКСХОСКАЈХРЈМ
    MFKGUZXBFXVBAWCW
                                                                 ZKCAJELISDEGHSZS
    ATURNSEWAXFWERTS
                                                                 There are 10 read keywords from the file:
    PRAKTTKUM
                                                                  PRAKTIKUM
    STRATIMA
                                                                  STRATTMA
    PROBSTAT
                                                                  PROBSTAT
    ARSIKOM
                                                                  ARSTKOM
    BASDAT
                                                                  BASDAT
                                                                  LOGKOM
    LOGKOM
                                                                  MATDIS
    MATDIS
                                                                  ALINGEO
    ALINGEO
                                                                  ALSTRUKDAT
    ALSTRUKDAT
                                                                  OTOMATA
    OTOMATA
                                                                  ress any key to start searching!
    Gambar 3.3.1 Isian berkas small3.txt
                                                            Gambar 3.3.2 Hasil pembacaan file masukan
Keyword 'PRAKTIKUM' found vertically lower!
Comparison: 34 time(s) | 33400 ns (0.033 ms)
                                                            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
                                                              J V R Z Q O K B R T A T S B O
Keyword 'STRATIMA' found diagonally! (left lower)
Comparison: 23 time(s) | 165300 ns (0.165 ms)
                                                              IRAIMGWARVTPRXA
                                                            0 R V K A 0 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
Keyword 'PROBSTAT' found vertically lower!
Comparison: 123 time(s) | 40400 ns (0.040 ms)
                                                             P P A I B M I Z B F R S S B D G
                                                             URWKAKCNLYNATCAX
Keyword 'ARSIKOM' found diagonally! (left upper)
Comparison: 315 time(s) | 237300 ns (0.237 ms)
                                                             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
Keyword 'BASDAT' found vertically upper!
Comparison: 178 time(s) | 254900 ns (0.255 ms)
                                                              SMKQAKQHYOBKTMG
                                                              TPEFFRIJPIQDFGU
                                                              A T D I S Q Q S Y I R A L G E
T S A R X T T Y R X I T P P I
                                                              Α
Keyword 'LOGKOM' found diagonally! (right upper)
Comparison: 94 time(s) | 238400 ns (0.238 ms)
                                                             ТСВІКСХQСКАЈZРЈМ
                                                             ' found horizontally right!
Comparison: 253 time(s) | 181100 ns (0.181 ms)
                                                             ATURNSEWAXFWERTS
Keyword 'ALINGEO' found diagonally! (right lower)
 omparison: 90 time(s) | 157500 ns (0.158 ms)
                                                             Comparison time in total (parsing excluded):
Keyword 'ALSTRUKDAT' found vertically lower!
                                                            1372500 ns (1.373 ms)
 omparison: 107 time(s) | 37900 ns (0.038 ms)
                                                             Comparison count in total: 1241 time(s)
                                                             Press any key to quit...
Keyword 'OTOMATA' found diagonally! (left lower)
Comparison: 24 time(s) | 26300 ns (0.026 ms)
Gambar 3.3.3 Informasi hasil eksekusi per
                                                          Gambar 3.3.4 Matriks akhir dan informasi waktu
                                                                   eksekusi & banyak perbandingan
                       kata
```

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

```
Relcome to the Puzzearch solver!
Input your filename (without .txt): medium1
Read puzzle from the file: (Size: 20 x 18)
IT B AB D B J Y N V R P G G D M
IT B AB D B J Y N V R P G G D M
I C N A L G E T O H O H B L N E M S
I T V G W F C T F W U T I S V S
I I G H T E I S O E M I L S T P O E
I S G Q L S W N N M Z X V S R I G L
I A R P E D O U D E P D C E E S O E
I E L S I U S R U E W R H E S I S C
I X K Z E N A P H S Z S E L S N C R
D N U B G S S R U H U H Q L S Y R O
I C Z H S T U J N M A A H J A S O S
I T 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
I L H O I C Z F B X H W E C D Q A L
I T I M S A N W H O O V Y N H J O J
I W W J I O N W Q G C L O X F N Q V
I W W J I O N W Q G C L O X F N Q V
I W W J I O N W Q G C L O X F N Q V
I B E N L Z W Q A E F I D M Y T B S
A S E Q D H E D S O A J D U G D S A
      OTBARDRIYNVRPGGDMP
     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
      IRFECUCTFZOWTKWBYK
      YTIMSANWHOOVYNHJOJ
      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
          MAWSDHEQUDKCDSDGA
      ASEODHEDSOAJDUGDSA
                                                                                                                                                                                                                            here are 20 read keywords from the file:
      ASSERTING
                                                                                                                                                                                                                            ASSERTING
ASTHMA
CELSIUS
      ASTHMA
      CELSTUS
      DESPISING
                                                                                                                                                                                                                             DESPISING
      DRAUGHT
                                                                                                                                                                                                                             GLANCE
LAUGH
LEES
LEFTY
      GLANCE
       LAUGH
      LEES
      LEFTY
                                                                                                                                                                                                                             MIGHT
      MIGHT
                                                                                                                                                                                                                             NEWSFLASH
OSCAR
PASSPORT
SLIME
      NEWSEL ASH
      OSCAR
      PASSPORT
                                                                                                                                                                                                                              SMUG
SOURCELESS
      SMUG
      SOURCELESS
                                                                                                                                                                                                                              WARPED
ess any key to start searching!
      THESAURUS
                                                                                                                                                                                         Gambar 3.4.2 Hasil pembacaan file masukan
     Gambar 3.4.1 Isian berkas medium1.txt
                     word 'ABASH' found diagonally! (left upper)
parison: 356 time(s) | 61600 ns (0.062 ms)
                                                                                                                                                                                                           eyword 'SMUG' found diagonally! (left upper)
omparison: 373 time(s) | 50500 ns (0.051 ms)
                     word 'ASSERTING' found vertically upper!
parison: 191 time(s) | 318800 ns (0.319 ms)
                                                                                                                                                                                                            eyword 'SOURCELESS' found vertically upper!
omparison: 292 time(s) | 47400 ns (0.047 ms)
                     word 'ASTHMA' found diagonally! (right upper)
parison: 385 time(s) | 310400 ns (0.310 ms)
                                                                                                                                                                                                             eyword 'THESAURUS' found diagonally! (right upper)
omparison: 338 time(s) | 48400 ns (0.048 ms)
                      word 'CELSIUS' found horizontally right!
parison: 126 time(s) | 167600 ns (0.168 ms)
                                                                                                                                                                                                            eyword 'WARPED' found horizontally right!
omparison: 112 time(s) | 38700 ns (0.039 ms)
                     word 'DECOMPRESS' found diagonally! (right lower)
parison: 16 time(s) | 141800 ns (0.142 ms)
                                                                                                                                                                                                           OMPARISON: 112 time(s) | 38700 ns (6
T B A B D B J Y N V R P G G D M P
C N A L G E T O H O H B L N E M S
I T V G W F F C T F W U T I S V S
I G H T E I S O E M I L S T P O E
E L S I U S R U E W R H E S I S C
X K Z E N A P H S Z S E L S N C R
IN M Z R U A G U G Z T F S A G A U
C Z H S T U J N M A A H J A S O S
P T P U A R G C M S A L S O S Q N
C Z H S T U J N M A A H J A S O S
P T P U A R G C M S A L S O S Q N
C Z H S T U J N M O O V Y N H J O J
W M J I O S Z B X H W E C D Q A L
T I M S A N W H O O V Y N H J O J
W M J I O N W Q G C L O X F N Q V
B E N L Z W Q A E F I D M Y T B S
M A W S D H E Q U D K C D S D G A
S E Q D H E D S O A J D U G D S A
                           d 'DESPISING' found vertically lower!
ison: 28 time(s) | 168600 ns (0.169 ms)
                        ord 'DRAUGHT' found diagonally! (left lower)
arison: 117 time(s) | 207700 ns (0.208 ms)
                      word 'GLANCE' found horizontally left!
parison: 41 time(s) | 125000 ns (0.125 ms)
                           d 'LAUGH' found diagonally! (left upper)
ison: 274 time(s) | 55500 ns (0.056 ms)
                       ord 'LEES' found vertically upper!
arison: 190 time(s) | 70600 ns (0.071 ms)
                        ord 'LEFTY' found diagonally! (right upper)
arison: 104 time(s) | 32900 ns (0.033 ms)
                           d 'NEWSFLASH' found diagonally! (right lower)
ison: 104 time(s) | 34400 ns (0.034 ms)
                        ord 'OSCAR' found vertically lower!
urison: 143 time(s) | 34000 ns (0.034 ms)
                                                                                                                                                                                                            omparison time in total (parsing excluded):
309500 ns (2.910 ms)
omparison count in total: 3506 time(s)
ress any key to quit...
                         rd 'PASSPORT' found diagonally! (left lower)
rison: 161 time(s) | 47200 ns (0.047 ms)
                       ord 'SLIME' found horizontally left!
arison: 90 time(s) | 25300 ns (0.025 ms)
                                                                                                                                                                                 Gambar 3.4.4 Matriks akhir dan informasi waktu
Gambar 3.4.3 Informasi hasil eksekusi per
                                                                                                                                                                                                               eksekusi & banyak perbandingan
```

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

```
$ 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 O Y M K Z L S G Y L E P G T O Y M V 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 V H 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 M 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 I 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 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 X F U K O M H G N G K E J I I F I Z R B X F U K O M H G N G K E J I I F I Z R B X F U K O M H G N G K E J I I F I Z R B X F U K O M H G N G K E J I I F I Z R B X F U K O M 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
                      BASH
BITTY
                                                                                                                                              mere are 15 read keywords from the file:
                      DUMBNESS
                      EXTRADITE
FOOL
HACKNEYED
                                                                                                                                              COMPLY
DUMBNESS
EMPTY
EXTRADITE
                       JEWELLERY
                      MULTIPLY
                       NOXIOUS
                       NUTRIENT
                                                                                                                                                ss any key to start searching!
        Gambar 3.5.1 Isian berkas medium1.txt
                                                                                                                              Gambar 3.5.2 Hasil pembacaan file masukan
          yword 'ALLOTMENT' found diagonally! (left upper)
mparison: 373 time(s) | 141700 ns (0.142 ms)
                                                                                                                     SBRENSBEVELIESDFASDF
                                                                                                                     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
        eyword 'BASH' found vertically upper!
omparison: 414 time(s) | 228200 ns (0.228 ms)
        (eyword 'BITTY' found diagonally! (right upper)
Comparison: 353 time(s) | 190700 ns (0.191 ms)
                                                                                                                     G Y L E P G T D Y L U X L U S O Q R K G
        eyword 'COMPLY' found diagonally! (left lower) comparison: 375 time(s) | 243800 ns (0.244 ms)
                                                                                                                     K M D A I C R A W B A H V L G G T I B
N I B T X I A K E E H T Y M V U Y V Y
        eyword 'DUMBNESS' found diagonally! (right lower) comparison: 126 time(s) | 212500 ns (0.213 ms)
                                                                                                                         T E L N T K X H J S E K B N N C O M P
         eyword 'EMPTY' found vertically lower!
omparison: 310 time(s) | 184900 ns (0.185 ms)
                                                                                                                                          EXKEPEDOMBDQHPW
         eyword 'EXTRADITE' found diagonally! (left lower)
omparison: 77 time(s) | 36100 ns (0.036 ms)
                                                                                                                         M D T T W S L M X F D T F I D K J 0
                                                                                                                     eyword 'FOOL' found horizontally left!
omparison: 504 time(s) | 230000 ns (0.230 ms)
                                                                                                                     BGSUJLZLYIJUN
        Teyword 'HACKNEYED' found diagonally! (left upper) comparison: 233 time(s) | 35900 ns (0.036 ms)
                                                                                                                     D N A E T B J A A X E Y T E Q K P Y H
                                                                                                                        J B Z I C O U M O N X A R R M K D E
                                                                                                                     X F U K O M H G N G K E J I I F I Z R
        Keyword 'JEWELLERY' found vertically upper!
Comparison: 212 time(s) | 89300 ns (0.089 ms)
                                                                                                                     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
          eyword 'MULTIPLY' found diagonally! (right upper)
mparison: 271 time(s) | 38900 ns (0.039 ms)
                                                                                                                         LNXHNUNYWTJIUWZJTPN
        Teyword 'NOXIOUS' found horizontally right!
Comparison: 351 time(s) | 250600 ns (0.251 ms)
                                                                                                                         SEHDSXAWQGEYMFDSAPM
         eyword 'NUTRIENT' found diagonally! (right lower) omparison: 313 time(s) | 69600 ns (0.070 ms)
                                                                                                                     Comparison time in total (parsing excluded):
                                                                                                                     2031600 ns (2.032 ms)
                                                                                                                     Comparison count in total: 4224 time(s)
         eyword 'POLISHER' found vertically lower!
omparison: 268 time(s) | 54400 ns (0.054 ms)
                                                                                                                     Press any key to quit...
         eyword 'POPULARITY' found diagonally! (left lower)
omparison: 44 time(s) | 25000 ns (0.025 ms)
                                                                                                                         Gambar 3.5.4 Matriks akhir dan informasi waktu
Gambar 3.5.3 Informasi hasil eksekusi per kata
                                                                                                                                           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
              D N Z Y C S V E Q E A G O I 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
              CKYASLOBYRATSEDAEQETTT
                                                                                                                                                         nere are 14 read keywords from the file:
PEEPS
ABOLISH
              ABOLISH
               AWAKING
              BIRDSONG
              DIABOLIC
                                                                                                                                                          AWAKING
BIRDSONG
              FLASTIC
               ELOQUENCE
              EXEMPLARY
FLICKER
              LICHEE
                                                                                                                                                          LICHEE
PICKER
PROTECTION
RESEARCH
              PROTECTION
              REVELRY
                                                                                                                                                          REVELRY
                                                                                                                                                            ss any key to start searching!
         Gambar 3.6.1 Isian berkas medium3.txt
                                                                                                                                          Gambar 3.6.2 Hasil pembacaan file masukan
                                                                                                                                                 E E P S D F A D D K I E C D S A G M U I D Q M F A M H U O V M L F G I B T T D U Y E O T T X S V J P R E Z K Y T T Z C I O E F R Z Y C S V E Q E A G O T Q G X J A S U Y W A P B H H K C K T G S R R C Q E B H D U I C L X S Z S M C A G C M T B T H O J P S
             eyword 'PEEPS' found horizontally right!
omparison: 5 time(s) | 22800 ns (0.023 ms)
             eyword 'ABOLISH' found diagonally! (right upper)
omparison: 449 time(s) | 204100 ns (0.204 ms)
             eyword 'AWAKING' found horizontally right!
omparison: 488 time(s) | 77400 ns (0.077 ms)
                                                                                                                                                   RCKPCHBNIPBGZYHDCLMOC
             eyword 'BIRDSONG' found diagonally! (right lower)
omparison: 209 time(s) | 344600 ns (0.345 ms)
                                                                                                                                                  K S K H M I K Q L G O P W N A V O I O O D
N G P E M E X E F U Q P D B V H P C O L J
             eyword 'DIABOLIC' found vertically lower!
omparison: 71 time(s) | 161600 ns (0.162 ms)
                                                                                                                                                   I E N R R L X K G D K M O F D S R N R B L
                                                                                                                                                   \mathsf{K}\;\mathsf{R}\;\mathsf{V}\;\mathsf{C}\;\mathsf{G}\;\mathsf{H}\;\mathsf{S}\;\mathsf{E}\;\mathsf{C}\;\mathsf{G}\;\mathsf{Q}\;\mathsf{D}\;\mathsf{H}\;\mathsf{H}\;\mathsf{X}\;\mathsf{D}\;\mathsf{O}
             eyword 'ELASTIC' found diagonally! (left lower)
omparison: 353 time(s) | 213800 ns (0.214 ms)
                                                                                                                                                  N P D M X M P G A T O A S K Y D T P Z H G
                                                                                                                                                       YVSIYEZZZYIMKHJE
              yword 'ELOQUENCE' found horizontally left!
mparison: 604 time(s) | 204700 ns (0.205 ms)
                                                                                                                                                  D O X Z O L U F G Z L O H M V O C A H Y
                                                                                                                                                  ZCOHANZELOLICHEETBQAG
             eyword 'EXEMPLARY' found diagonally! (left upper)
omparison: 306 time(s) | 204900 ns (0.205 ms)
                                                                                                                                                  RPZSPPGPBLGEXEXOIVQYE
                                                                                                                                                  WXTXYFZAXBRGRPLNOP
             eyword 'FLICKER' found vertically upper!
omparison: 215 time(s) | 182500 ns (0.183 ms)
                                                                                                                                                       I Q Y P R C H P E C E G T T X N J I K C
                                                                                                                                                 I 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
             eyword 'LICHEE' found horizontally right!
omparison: 397 time(s) | 58500 ns (0.059 ms)
                                                                                                                                                               U Q O L E V D U B I W P Q T S F
                                                                                                                                               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
             eyword 'PICKER' found diagonally! (right lower)
omparison: 106 time(s) | 28700 ns (0.029 ms)
             eyword 'PROTECTION' found vertically lower!
omparison: 244 time(s) | 43700 ns (0.044 ms)
                                                                                                                                                 Comparison time in total (parsing excluded):
              eyword 'RESEARCH' found horizontally left!
omparison: 535 time(s) | 71700 ns (0.072 ms)
                                                                                                                                               1879400 ns (1.879 ms)
                                                                                                                                                Comparison count in total: 4601 time(s)
               oword 'REVELRY' found diagonally! (left upper)
uparison: 619 time(s) | 60400 ns (0.060 ms)
                                                                                                                                                 ress any key to quit...
Gambar 3.6.3 Informasi hasil eksekusi per kata
                                                                                                                                     Gambar 3.6.4 Matriks akhir dan informasi waktu
                                                                                                                                                         eksekusi & banyak perbandingan
```

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

```
Gambar 3.7.1 Isian berkas large1.txt
                                                                                                                                           Gambar 3.7.2 Hasil pembacaan file masukan
                  yword 'INDONESIA' found diagonally! (right upper)
mparison: 310 time(s) | 104100 ns (0.104 ms)
                                                                                                                                                           ord 'ARMENIA' found diagonally! (right upp
urison: 456 time(s) | 47900 ns (0.048 ms)
                  yword 'SINGAPORE' found horizontally right!
mparison: 1060 time(s) | 245000 ns (0.245 ms)
                 eyword 'MYANMAR' found diagonally! (right lower)
umparison: 734 time(s) | 338600 ns (0.339 ms)
                                                                                                                                                          ord 'INDIA' found diagonally! (left upper
arison: 979 time(s) | 82700 ns (0.083 ms)
                  nword 'THAILAND' found vertically lower!
aparison: 419 time(s) | 241800 ns (0.242 ms)
                                                                                                                                                            rd 'EMIRATES' found horizontally left!
rison: 1214 time(s) | 122800 ns (0.123 ms)
                 eyword 'CHINA' found vertically upper!
omparison: 1040 time(s) | 247900 ns (0.248 ms)
                 eyword 'MALAYSIA' found diagonally! (right upper)
umparison: 488 time(s) | 84400 ns (0.084 ms)
                  yword 'TAIWAN' found horizontally right!
mparison: 1016 time(s) | 115500 ns (0.116 ms)
                  yword 'CAMBODIA' found diagonally! (right lower)
mparison: 332 time(s) | 47700 ns (0.048 ms)
                 eyword 'MALDIVES' found vertically lower!
omparison: 498 time(s) | 54800 ns (0.055 ms)
                 yword 'MONGOLIA' found diagonally! (left lower)
mparison: 32 time(s) | 29600 ns (0.030 ms)
                  word 'BANGLADESH' found horizontally left!
parison: 288 time(s) | 235300 ns (0.235 ms)
                   word 'SRILANKA' found diagonally! (left upper)
parison: 912 time(s) | 177700 ns (0.178 ms)
                                                                                                                                      Gambar 3.7.4 Matriks akhir dan informasi waktu
Gambar 3.7.3 Informasi hasil eksekusi per kata
                                                                                                                                                          eksekusi & banyak perbandingan
```

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

```
ADHERENCE
AMUSE
BIBLICAL
BRAID
BRINY
DISHONEST
FINAL
INERTNESS
INSCRIBED
IRREGULAR
JUNE
     RECOVER
SACKING
SHOWER
SOLID
SPATULA
          Gambar 3.8.1 Isian berkas large2.txt
                                                                                                              Gambar 3.8.2 Hasil pembacaan file masukan
               ord 'ADHERENCE' found vertically lower!
rison: 954 time(s) | 111900 ns (0.112 ms)
                     USE' found diagonally! (left lower)
555 time(s) | 192000 ns (0.192 ms)
              ord 'SHOWER' found diagonally! (right lower)
arison: 1027 time(s) | 97500 ns (0.098 ms)
Gambar 3.8.3 Informasi hasil eksekusi per kata
                                                                                                         Gambar 3.8.4 Matriks akhir dan informasi waktu
                                                                                                                         eksekusi & banyak perbandingan
```

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

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 ET N N V T D U Y J D I 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 Y L O 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 D Y V I L N A A H S P E U G G 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 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 S C F H D S A W N	ACURA ALPINE APOLLO PENHALL ARIEL PEUGEOT ASTONMARTIN AUSTINHEALEY BENTLEY BENTLEY BUGATTI CADILLAC CATERHAM CHEVROLET DATSUN DEBERTI EXOMOTIVE FERRARI FORMULADRIFT FORSBERGRACING HENNESSEY HOONIGAN INFINITI KOENIGSEGG LAMBORGHINI RANGEROVER MASERATI MERCEDESBENZ MILLYS MILLYS MILLYS MILLYS MASCAN MISSAN PAGANI MEXICO MEXI		
Gambar 3.9.1 Isian berkas large3.txt (Puzzle)	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) NSZNARUCAXWMFMYRMCNFZCPAYPDPRIAJ AYRIKAUAKNFUKFYEZQKZSAMTEDNKTMPY GQLASDKLMTJIOVQCSBMPKIPCALLIDACZ IHJSCZUNLEYRCYBAVSDGATOYOTNAQSEY NRIVXNAGJAMFEMAXJDEXTNWWXIDEBERT ONIDCXEHBUHTUOMYLPGNPOQKFSSHORZJ OTKIBCBRLZLXCRVXZBQLNPHNKCOGLASX HEYNGXMAATVBUWMIZUWGPEIDHRWMMTSI PLGPEIDXOLBXFAFDMVVTUKHXILVYDISP BONNERAMOQCHEKVRAOXNTCQZOZWAWRRL QRTTIEOCIXEMSZGJJUKQBHOJXGMIRGTZ AVKFFNLGVNZLTABTVASRENAULTDTOQEM METNNVTDUVJDIOQNLINTNGMYKIPLJPTM LHBDVILSHBYWVCHMTMQDIVSWNUZXHWYS NCAAWITPUSIQAOFAIDAOENAPFBZOLKYH EYXHPAVGNWNOLLCLSSUHYRHOBELHWLAA GQFPDDADDFWUFLPVMGILRFSEBNQELPSY EHRGKTPAGANIPOSDIKDRQESOATOIFEOT QXCJTLYCFWRBEPASTONMARTINLWTRNW LJOIJXBWEBCINAIZJXTDQLYAZEEAQARU OAQMKPXBRAWUHGYMKHANAROSCYTYINGS ETMLOKJLRYLUAJYLDESEZYUPBIMLQGHI FNFBWTEHAINSLETPEMDPLBVENXEHOEPE YCIOOIITRCCNLHBJBUXAADDCERFTZRER WJJALZGEEVOGJTPJRKUGNRBTAVLYSVPA YVILNAAHSPEUGEOTTUVPUIAJWPPVEEUC DBOXHSDTIHNORADIIRKAGVLYSXQARRCA HIUXKGEWHNWELPEZSOBVFPIYKCNHYKJR DLGHBZDAXOIZNEBSEDECREMYLUMAXBWS MKVSQUGLTQNHGNICARGREBSROFYDSICE MITSUBISHISFQEHUWRPDVXUPVTJJRSPD RIPASDETERAUTLINTSIDNEOASDHDSKIA FIASNIHSSKTHEFGHTASDFHEQSFHDSAWN	- ACURA - ALPINE - APOLLO - ARIEL - ASTONMARTIN - AUSTINHEALEY - BENTLEY - BUGATTI - CADILLAC - CATERHAM - CHEVROLET - DATSUN - DEBERTI - EXOMOTIVE - FERRARI - FORSBERGRACING - HENNESSEY - HOONIGAN - INFINITI - KOENIGSEGG - LAMBORGHINI - RANGEROVER - MASERATI - MERCEDESBENZ - MITSUBISHI - NISSAN - PAGANI - GRELIANT - PONTIAC - RELIANT - RENAULT - RJANDERSON - SIERRACARSI - TOYOTA - VOUKSWAGEN - VOUKSWAGEN - WILLYS - GYMKHANA - FORZATHON - FESTIVAL - MCLARENCARS - HORIZON - MITSUBISHI - NISSAN - PAGANI - ARCADE Gambar 3.9.4 Hasil pembacaan file masukan (Kata kunci)		

```
eyword 'ACURA' found horizontally left!
omparison: 22 time(s) | 23900 ns (0.024 ms)
                                                                                                                                                                                                                     (eyword '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)
  (eyword 'ALPINE' found diagonally! (left upper)
Comparison: 1235 time(s) | 341000 ns (0.341 ms)
                                                                                                                                                                                                                    Keyword 'HOONIGAN' found vertically upper!
Comparison: 257 time(s) | 56500 ns (0.057 ms)
  (eyword 'APOLLO' found vertically upper!
Comparison: 903 time(s) | 248900 ns (0.249 ms)
                                                                                                                                                                                                                  Keyword 'INFINITI' found diagonally! (right upper)
Comparison: 306 time(s) | 62000 ns (0.062 ms)
  (eyword 'ARIEL' found diagonally! (right upper)
Comparison: 1205 time(s) | 218200 ns (0.218 ms)
                                                                                                                                                                                                                   Keyword 'KOENIGSEGG' found horizontally right!
  (eyword 'ASTONMARTIN' found horizontally right!
Comparison: 796 time(s) | 388000 ns (0.388 ms)
                                                                                                                                                                                                                    Comparison: 900 time(s) | 78500 ns (0.079 ms)
                                                                                                                                                                                                                   Keyword 'LAMBORGHINI' found diagonally! (right lower)
Comparison: 789 time(s) | 69900 ns (0.070 ms)
  (eyword 'AUSTINHEALEY' found diagonally! (right lower)
Comparison: 393 time(s) | 303200 ns (0.303 ms)
                                                                                                                                                                                                                   Keyword 'RANGEROVER' found vertically lower!
Comparison: 758 time(s) | 60400 ns (0.060 ms)
  Keyword 'BENTLEY' found vertically lower!
Comparison: 575 time(s) | 295300 ns (0.295 ms)
                                                                                                                                                                                                                    Keyword 'MASERATI' found vertically lower!
Comparison: 91 time(s) | 44100 ns (0.044 ms)
   eyword 'BUGATTI' found diagonally! (left lower) omparison: 519 time(s) | 157600 ns (0.158 ms)
                                                                                                                                                                                                                   Keyword 'MERCEDESBENZ' found horizontally left!
Comparison: 1130 time(s) | 91600 ns (0.092 ms)
  (eyword 'CADILLAC' found horizontally left!
Comparison: 134 time(s) | 31400 ns (0.031 ms)
  (eyword 'CATERHAM' found diagonally! (left upper)
comparison: 806 time(s) | 65600 ns (0.066 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)
  Geyword 'CHEVROLET' found vertically upper!
Comparison: 544 time(s) | 88400 ns (0.088 ms)
                                                                                                                                                                                                                   Keyword 'NISSAN' found diagonally! (left upper)
Comparison: 1479 time(s) | 100600 ns (0.101 ms)
   eyword 'DATSUN' found diagonally! (right upper)
omparison: 647 time(s) | 85800 ns (0.086 ms)
  (eyword 'DEBERTI' found vertically lower!
Comparison: 853 time(s) | 77700 ns (0.078 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)
   eyword 'EXOMOTIVE' found diagonally! (right lower) omparison: 681 time(s) | 57500 ns (0.058 ms)
  (eyword 'FERRARI' found vertically lower!
comparison: 706 time(s) | 53200 ns (0.053 ms)
                                                                                                                                                                                                                    Keyword 'PENHALL' found vertically lower!
Comparison: 696 time(s) | 48700 ns (0.049 ms)
   Teyword 'FORMULADRIFT' found diagonally! (left lower) omparison: 73 time(s) | 42500 ns (0.043 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)
Gambar 3.9.5 Informasi hasil eksekusi per kata
                                   eyword 'PLYMOUTH' found horizontally left!
omparison: 213 time(s) | 62600 ns (0.063 ms)
                                                                                                                                                                                                                               eyword 'ARCADE' found diagonally! (left upper)
omparison: 1268 time(s) | 89400 ns (0.089 ms)
                                                                                                                                                                                                                               yword 'ARCADE' found diagonally! (left upper)
mparison: 1268 time(s) | 89400 ns (0.089 ms)

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
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
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
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
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
N I D C X E H B U H T U O M Y L P B N P O Q K F S S H O R Z J
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
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
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
S 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 T S I
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
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
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
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
E T N N V T D V J D I O Q N L I N T N G M Y K I P L J P T M
H B D V I L S H B Y W V C H M T M Q D I V S M N U Z X H W Y S
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
Q F P D D A D D F W U F I P Y M G I L R F S E B N Q E L P S Y
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
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 I N G G
G K P A G A W I T D S L G A R C W S G G G G C M S G D B G R O F R
Y L C I S U 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
G K P R R U V I K O E H I G S E G G R C M S B G D B G R O F R
Y S L G E V O G J T P J R K U G N R B T A V L Y S V P A
V I N A A H S P E U G E O T I U V P U I A J W P V E E U C
I S L I N A A H S P E U G E O T I U R P U I A J W P V E E U C
I L U X K G E W I N W E L P E Z S O B V F P I Y K C N H Y K J R
U I N K S E W I S C I I R I I R S C E O T Y I N G S
I S S C 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
V I N A S S C T T N I S F Q E H U W R P D V X U P V T J R S P D
I D A S D E T E R A U T L I N T S I D N E O S S T D N S D I C
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 R S 
                                      nword 'POLARIS' found diagonally! (left upper)
uparison: 862 time(s) | 63500 ns (0.064 ms)
                                    yword 'PONTIAC' found vertically upper!
mparison: 264 time(s) | 30600 ns (0.031 ms)
                                      nword 'RELIANT' found diagonally! (right upper)
uparison: 972 time(s) | 60900 ns (0.061 ms)
                                      nword 'RENAULT' found horizontally right!
mparison: 470 time(s) | 35000 ns (0.035 ms)
                                      nword 'SIERRACARSE' found vertically lower!
mparison: 822 time(s) | 65500 ns (0.066 ms)
                                       word 'SUBARU' found diagonally! (left lower)
parison: 833 time(s) | 55800 ns (0.056 ms)
                                     yword 'TOYOTA' found horizontally left!
mparison: 153 time(s) | 18900 ns (0.019 ms)
                                       word 'VAUXHALL' found diagonally! (left upper)
parison: 364 time(s) | 35800 ns (0.036 ms)
                                      nword 'VOLKSWAGEN' found vertically upper!
mparison: 1198 time(s) | 65800 ns (0.066 ms)
                                       word 'WILLYS' found diagonally! (right upper)
parison: 730 time(s) | 38300 ns (0.038 ms)
                                        ord 'FORZATHON' found diagonally! (right lower)
arison: 836 time(s) | 48100 ns (0.048 ms)
                                       word 'FESTIVAL' found vertically lower!
parison: 309 time(s) | 21400 ns (0.021 ms)
                                                                                                                                                                                                                                mparison time in total (parsing excluded):
86600 ns (4.587 ms)
mparison count in total: 32677 time(s)
                                       word 'HORIZON' found diagonally! (left lower)
parison: 208 time(s) | 41600 ns (0.042 ms)
Gambar 3.9.7 Informasi hasil eksekusi per kata
                                                                                                                                                                                                         Gambar 3.9.8 Matriks akhir dan informasi waktu
                                                                                                                                                                                                                                       eksekusi & banyak perbandingan
                                                                                   (3)
```

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

IV. REPOSITORY

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