LAPORAN TUGAS KECIL 01

IF2211 STRATEGI ALGORITMA

"Penyelesaian *Minigame* Cyberpunk 2077 *Breach Protocol* dengan Algoritma *Brute Force*"

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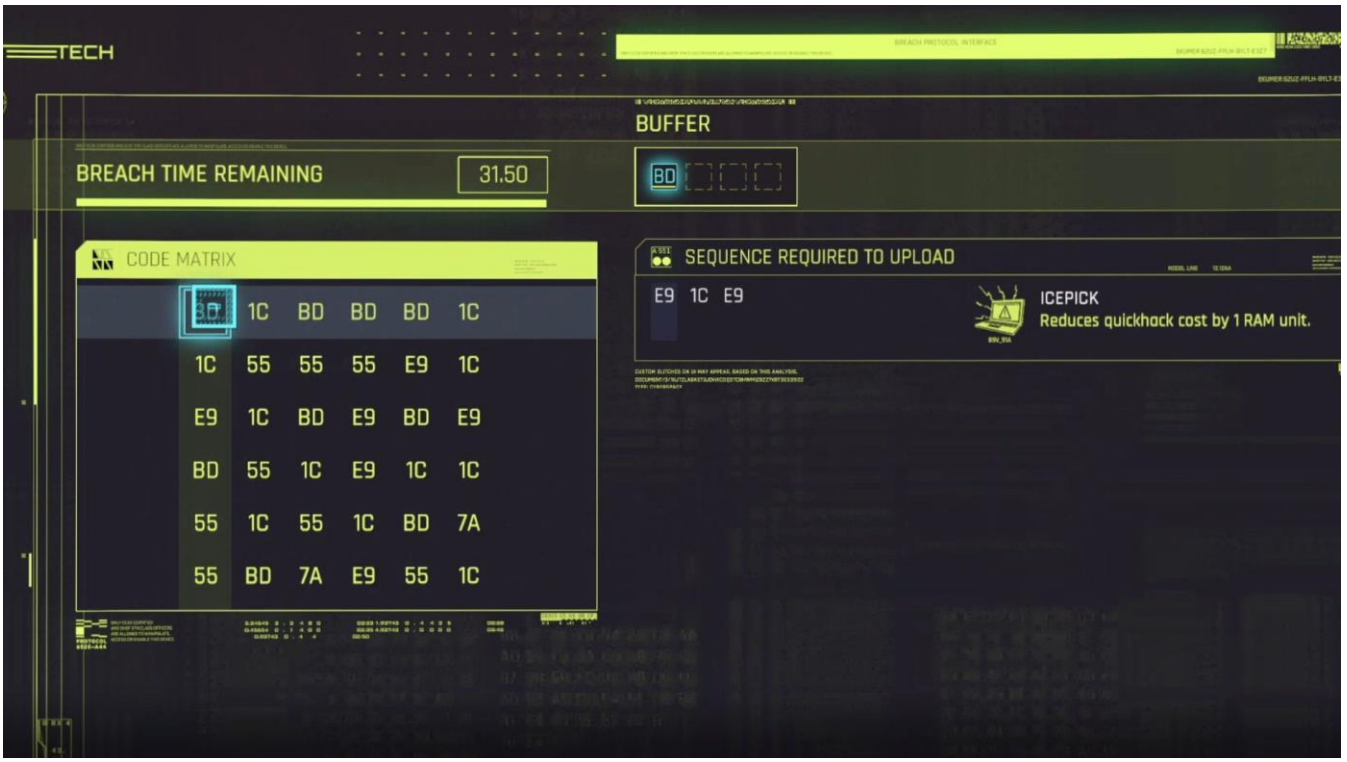
DAFTAR ISI

BAB 1

DESKRIPSI MASALAH

Breach Protocol adalah sebuah *hacking minigame* pada *Videogame* Cyberpunk 2077. Jika pemain bisa menyelesaikan *minigame* ini, pemain akan memperoleh berbagai benefit selama permainannya, seperti *in-game currency* atau peningkatan atribut yang bisa digunakan ketika berhadapan dengan musuh.

Saat awal permainan, pemain akan diberikan sebuah matriks dan *sequence* yang berisi token dengan pola tertentu. Pemain diminta untuk mencari pola ini pada matriks yang diberikan dengan hanya bisa bergerak secara horizontal atau vertikal dan setiap elemen pada matriks hanya bisa digunakan satu kali. Permainan selalu dimulai dari baris atas matriks dan pemain diminta untuk memilih salah satu elemen dari sana. Kemudian, pemain akan memilih salah satu elemen lainnya dari kolom yang sama dengan elemen yang dipilih pertama kali. Selanjutnya, pemain akan diminta untuk memilih elemen matriks pada baris yang sama dengan elemen yang dipilih sebelumnya dan seterusnya - selalu bergantian antara kolom dan baris.



Gambar 1.1 Tampilan *Minigame* Breach Protocol

BAB 2
TEORI SINGKAT

2.1 Algoritma Brute Force

Algoritma yang digunakan untuk menyelesaikan permasalahan ini adalah Algoritma *Brute Force*. Program akan mencari semua jenis kombinasi yang setidaknya mengandung salah satu dari semua *sequence.* Kemudian, program akan mencari salah satu kombinasi yang memiliki skor tertinggi.

Langkah-langkah algoritma yang digunakan dalam menyelesaikan permainan tersebut adalah sebagai berikut:

1. **Permutasi susunan *buffer***

   Program menghasilkan semua kombinasi susunan dari matriks yang diberikan. Kombinasi ini dipastikan memiliki panjang yang sama dengan panjang maksimal *buffer* dan semua kombinasi ini pasti mengandung setidaknya satu *sequence* yang diberikan. Pencarian kombinasi dimulai dari salah satu elemen pada baris pertama matriks. Kemudian, dilanjutkan dengan bergerak secara vertikal dan horizontal secara bergantian tanpa mengunjungi elemen yang sama untuk kedua kalinya. Selain itu, program juga akan mencatat setiap *path* yang telah dilalui suatu kombinasi. Semua kombinasi yang memenuhi akan disimpan dalam *Array of Pair* dengan Pair adalah sebuah *class* yang berisi suatu kombinasi yang memenuhi aturan serta *path* yang telah dilaluinya.

2. **Solusi**

   Setelah program menghasilkan seluruh kombinasi yang memenuhi dan menyimpannya dalam *Array of Pair,* program akan melakukan *looping* untuk setiap Pair dalam *Array of Pair* dengan semua sequence yang diberikan sebelumnya. Skor maksimal akan diinisialisasi dengan 0. Jika suatu Pair mengandung lebih dari satu *sequence*, skor untuk Pair tersebut akan ditambah sebanyak skor yang dimiliki oleh *sequence* yang bersangkutan. Terakhir, akan dilakukan pengecekan apakah skor untuk Pair saat ini lebih besar dari skor maksimal sebelumnya. Jika iya, skor maksimal akan diperbarui dan program akan menyimpan Pair saat ini sebagai Pair yang memiliki skor tertinggi. Kemudian, program akan mengirimkan skor tertinggi, kombinasi, serta path yang dilalui kombinasi tersebut. Namun, jika nilai maksimal tetap 0, program tidak mengembalikan apapun karena tidak ada solusi yang memenuhi.

BAB 3
IMPLEMENTASI PROGRAM

3.1 FOLDER PRIMITIF (src)

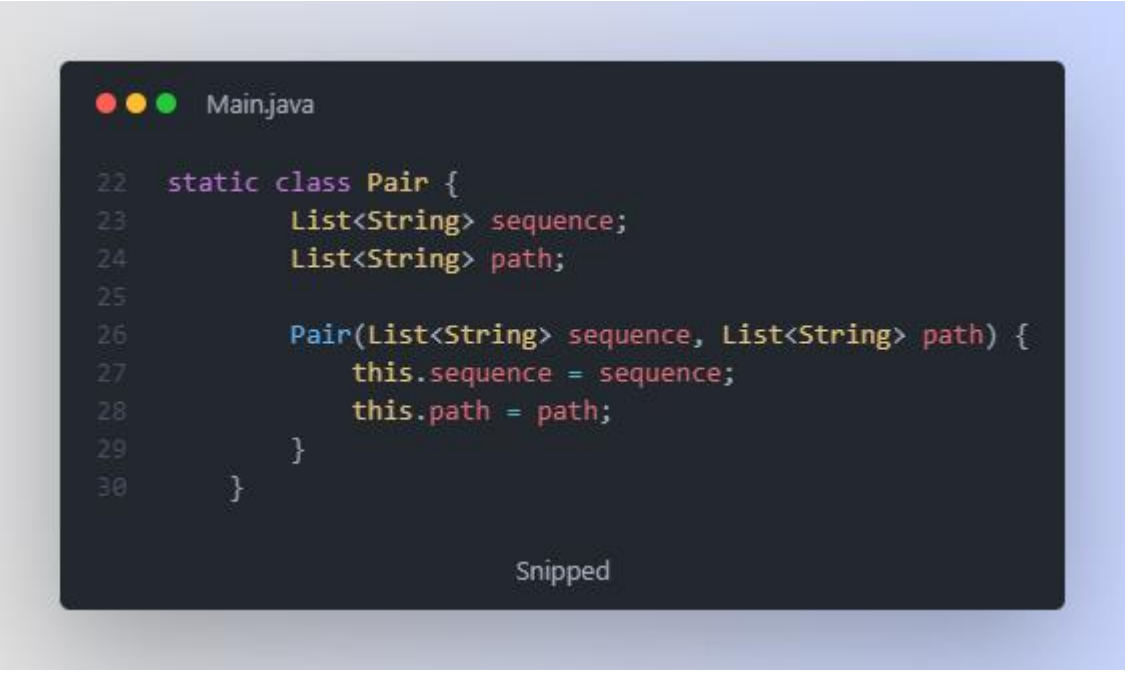
a. Main.java

File *Main.java* terdiri dari beberapa *class* :

1. Sequence
   Class ini memiliki *member* tokens yang berisi kumpulan token dari suatu *sequence* serta skor yang dimilikinya.

Gambar 2.1 *Class* Sequence

2. Pair
   Class ini memiliki *member* sequence yang berisi kombinasi yang memenuhi aturan serta *path* yang dilaluinya.



Gambar 2.2 *Class* Pair

Selain kedua *class* tersebut, file ini juga memiliki beberapa *method*, diantaranya:

1. Main
   Ini adalah fungsi utama, yaitu fungsi yang dijalankan ketika program pertama kali dieksekusi. Fungsi ini berperan dalam mengolah input, baik dari file .txt maupun CLI. Selain itu, fungsi ini juga berperan dalam men-*generate* matriks serta *sequence random* pada input CLI dan juga mencari kombinasi yang memiliki skor tertinggi pada kedua metode input.

Main.java

```java
public static void main(String[] args) {
        System.out.println("\n\n /$$$$$$ /$$     /$$/$$$$$$$ /$$$$$$$$/$$$$$$$ /$$$$$$$ /$$   /$$/$$   /$$/$$   /$$       /$$$$$$  /$$$$$$ /$$$$$$$$/$$$$$$$          \r\n" + //
                        " /$$__  $|  $$   /$$| $$__  $| $$_____| $$__  $| $$__  $| $$  | $| $$$ | $| $$  /$$/       /$$__  $$/$$$_  $|_____ $$|_____ $$/          \r\n" + //
                        "| $$  \\__/\\  $$ /$$/| $$  \\ $| $$     | $$  \\ $| $$  \\ $| $$  | $| $$$$| $| $$ /$$/       |__/  \\ $| $$$$\\ $$    /$$/     /$$/        /$$\r\n" + //
                        "| $$       \\  $$$$/ | $$$$$$$| $$$$$  | $$$$$$$| $$$$$$$| $$  | $| $$ $$ $| $$$$$/          /$$$$$$| $$ $$ $$   /$$/     /$$/       |__/\r\n" + //
                        "| $$        \\  $$/  | $$__  $| $$__/  | $$__  $| $$____/| $$  | $| $$  $$$| $$  $$/          /$$____/| $$\\ $$$$  /$$/     /$$/            \r\n" + //
                        "| $$    $$   | $$   | $$  \\ $| $$     | $$  \\ $| $$     | $$  | $| $$\\  $$| $$\\  $$         | $$     | $$ \\ $$$ /$$/     /$$/          /$$\r\n" + //
                        "|  $$$$$$/   | $$   | $$$$$$$| $$$$$$$| $$  | $| $$     |  $$$$$$| $$ \\  $| $$ \\  $$       | $$$$$$$|  $$$$$//$$/     /$$/          |__/\r\n" + //
                        " \\______/    |__/   |_______/|________|__/  |__|__/      \\______/|__/  \\__|__/  \\__/       |________/\\______/|__/     |__/                \r\n" + //
                        "                                                                                                                                          \r\n" + //
                        "                                                                                                                                          \r\n" + //
                        "                                                                                                                                          \r\n" + //
                        " /$$$$$$$ /$$$$$$$ /$$$$$$$$ /$$$$$$  /$$$$$$ /$$   /$$       /$$$$$$$ /$$$$$$$  /$$$$$$ /$$$$$$$$/$$$$$$  /$$$$$$  /$$$$$$ /$$          \r\n" + //
                        "| $$__  $| $$__  $| $$_____//$$__  $$/$$__  $| $$  | $$      | $$__  $| $$__  $$/$$__  $|__  $$__/$$__  $$/$$__  $$| $$          \r\n" + //
                        "| $$  \\ $| $$  \\ $| $$     | $$  \\ $| $$  \\__| $$  | $$      | $$  \\ $| $$  \\ $| $$  \\ $$  | $$  | $$  \\ $| $$  \\ $$| $$  \\ $| $$          \r\n" + //
                        "| $$$$$$$| $$$$$$$| $$$$$  | $$$$$$$| $$     | $$$$$$$$      | $$$$$$$| $$$$$$$| $$  | $$  | $$  | $$$$$$$| $$$$$$$$| $$          \r\n" + //
                        "| $$__  $| $$__  $| $$__/  | $$__  $| $$     | $$__  $$      | $$____/| $$__  $| $$  | $$  | $$  | $$__  $| $$__  $$| $$          \r\n" + //
                        "| $$  \\ $| $$  \\ $| $$     | $$  | $| $$    $| $$  | $$      | $$     | $$  \\ $| $$  | $$  | $$  | $$  | $| $$  | $$| $$          \r\n" + //
                        "| $$$$$$$| $$  | $| $$$$$$$| $$  | $|  $$$$$$| $$  | $$      | $$     | $$  | $|  $$$$$$/  | $$  | $$  | $| $$  | $$| $$$$$$$$    \r\n" + //
                        "|_______/|__/  |__|________|__/  |__/\\______/|__/  |__/      |__/     |__/  |__/\\______/   |__/  \\______/ \\______/ \\______/|________/    \r\n" + //
                        "                                                                                                                                          \r\n" + //
                        "                                                                                                                                          \r\n" + //
                        "                                                                                                                                          \r\n" + //
                        "");
        System.out.println("Please choose one input method : ");
        System.out.println("1. Via .txt");
        System.out.println("2. Via CLI");
        System.out.println("3. Exit");
        Integer choice = Integer.parseInt(input.nextLine());
        while (choice != 1 && choice != 2 && choice != 3) {
            System.out.println("Please choose only 1 or 2 or 3 : ");
            choice = Integer.parseInt(input.nextLine());
        }
        while (choice != 3) {
            if (choice == 1) {
                try {
                    // Input file .txt
                    System.out.println("Input filename : ");
                    String location = input.nextLine();
                    File file = new File("../test/" + location + ".txt");
                    input = new Scanner(file);

                    // Read file
                    Integer bufferLength = Integer.parseInt(input.nextLine());
                    String[] matrixSize = input.nextLine().split(" ");
                    Integer matrixCol = Integer.parseInt(matrixSize[0]);
                    Integer matrixRow = Integer.parseInt(matrixSize[1]);
                    String[][] matrix = new String[matrixRow][matrixCol];
                    for (int i = 0; i < matrixRow; i++) {
                        String[] matrixTxT = input.nextLine().split(" ");
                        for (int j = 0; j < matrixCol; j++) {
                            matrix[i][j] = matrixTxT[j];
                        }
                    }
                    Integer numberOfSequence = Integer.parseInt(input.nextLine());
                    List<Sequence> sequences = new ArrayList<Sequence>();
                    while (input.hasNextLine()) {
                        String[] tokens = input.nextLine().split(" ");
                        String score = input.nextLine();
                        sequences.add(new Sequence(tokens, Integer.parseInt(score)));
                    }
```

Snipped

Gambar 2.3 Main Function (bagian 1)

Main.java

```
100                     // Brute forcce all possbile combinations
101                     long startTime = System.currentTimeMillis(); // Start timer for execution time
102                     boolean visited[][] = new boolean[matrix.length][matrix[0].length];
103                     List<Pair> result = new ArrayList<Pair>();
104
105                     if (bufferLength > matrix[0].length * matrix.length) {
106                         bufferLength = matrix[0].length * matrix.length;
107                     }
108
109                     // For each column in the first row of the matrix, find all possible
110                     // combinations
111                     for (int i = 0; i < matrix[0].length; i++) {
112                         bruteForcePossibleCombination(matrix, bufferLength, sequences, result, new ArrayList<>(), 0, i,
113                                 true,
114                                 visited, new ArrayList<>());
115                     }
116
117                     // Find one combination that has the highest score
118                     int maxScore = 0;
119                     Pair highestScorePair = null;
120                     for (Pair res : result) {
121                         int score = 0;
122                         for (Sequence sequence : sequences) {
123                             if (String.join("", res.sequence).contains(String.join("", sequence.tokens))) {
124                                 score += sequence.score;
125                             }
126                         }
127                         if (score > maxScore) {
128                             maxScore = score;
129                             highestScorePair = res;
130                         }
131                     }
132
133                     if (maxScore == 0) {
134                         System.out.println("There is no buffer that satisfies the condition");
135                     } else {
136                         System.out.println("Highest score : " + maxScore);
137                         System.out.println("Buffer : ");
138                         for (String s : highestScorePair.sequence) {
139                             System.out.print(s + " ");
140                         }
141                         System.out.println("\nPath : ");
142                         for (String p : highestScorePair.path) {
143                             System.out.println(p);
144                         }
145                     }
146                     long endTime = System.currentTimeMillis();
147                     long timeElapsed = endTime - startTime;
148                     System.out.println("Time elapsed : " + timeElapsed + " ms\n");
149
150                     System.out.println("Do you wish to save the output? (Y/N)");
151                     input = new Scanner(System.in);
152                     String save = input.nextLine();
153                     if (save.toLowerCase().equals("y")) {
154                         saveFile(maxScore, highestScorePair, timeElapsed);
155                     }
156
157                 } catch (FileNotFoundException e) {
158                     System.out.println("File doesn't exist : " + e.getMessage());
159                 }
160             }
```

Snipped

Gambar 2.4 Main Function (bagian 2)

Main.java

```java
else if (choice == 2) {

                System.out.println("Input number of unique tokens : ");
                Integer numberOfUniqueToken = Integer.parseInt(input.nextLine());
                while (numberOfUniqueToken < 2) {
                    System.out.println("Number of unique tokens must be at least 2. Please input again :");
                    numberOfUniqueToken = Integer.parseInt(input.nextLine());
                }
                System.out.println();

                System.out.println("Input token, each of them must be separated with a space : ");
                String tokens = input.nextLine();
                String[] token = tokens.split(" ");
                while (!isUnique(token) || token.length != numberOfUniqueToken) {
                    System.out.println(
                            "Number of tokens that has been input doesn't equal with the number of unique tokens or the tokens aren't unique. Please input again : ");
                    tokens = input.nextLine();
                    token = tokens.split(" ");
                }
                System.out.println();

                System.out.println("Input the length of buffer : ");
                Integer bufferLength = Integer.parseInt(input.nextLine());
                while (bufferLength < 2) {
                    System.out.println("Length of buffer must be at least 2");
                    bufferLength = Integer.parseInt(input.nextLine());
                }
                System.out.println();

                System.out.println(
                        "Input length of column and row of a matrix, each of them must be separated with a space : ");
                String matrixSize = input.nextLine();

                while (matrixSize.split(" ").length != 2 || Integer.parseInt(matrixSize.split(" ")[0]) < 1
                        || Integer.parseInt(matrixSize.split(" ")[1]) < 1) {
                    if (matrixSize.split(" ").length != 2) {
                        System.out.println("Input must be two numbers separated by a space");
                    } else {
                        System.out.println("Input must be higher than 0");
                    }
                    matrixSize = input.nextLine();
                }

                String[] matrixSizeArr = matrixSize.split(" ");
                Integer matrixCol = Integer.parseInt(matrixSizeArr[0]);
                Integer matrixRow = Integer.parseInt(matrixSizeArr[1]);
                System.out.println();

                System.out.println("Input maximum length of a sequence : ");
                Integer maxSequenceLength = Integer.parseInt(input.nextLine());
                while (maxSequenceLength < 2) {
                    System.out.println("Maximum length of a sequence must be at least 2");
                    maxSequenceLength = Integer.parseInt(input.nextLine());
                }

                System.out.println();

                System.out.println("Input number of sequence : ");
                Integer numberOfSequence = Integer.parseInt(input.nextLine());
                while (numberOfSequence < 1) {
                    System.out.println("Number of sequence must be at least 1. Please input again :");
                    numberOfSequence = Integer.parseInt(input.nextLine());
                }
                System.out.println();

                // Generate matrix
                String[][] matrix = new String[matrixRow][matrixCol];
                for (int i = 0; i < matrixRow; i++) {
                    for (int j = 0; j < matrixCol; j++) {
                        matrix[i][j] = token[(int) (Math.random() * numberOfUniqueToken)];
                    }
                }
```

Snipped

Gambar 2.5 Main Function (bagian 3)

Main.java

```
233                 System.out.println("Here are the generated matrix : ");
234                 for (String[] row : matrix) {
235                     for (String elm : row) {
236                         System.out.print(elm + " ");
237                     }
238                     System.out.println();
239                 }
240                 System.out.println();
241
242                 // Generate sequences
243                 Set<String> uniqueSequences = new HashSet<String>();
244                 List<Sequence> sequences = new ArrayList<Sequence>();
245
246                 for (int i = 0; i < numberOfSequence; i++) {
247                     int sequenceLength = (int) (Math.random() * maxSequenceLength + 1);
248                     while (sequenceLength < 2) {
249                         sequenceLength = (int) (Math.random() * maxSequenceLength + 1);
250                     }
251                     String[] sequence = new String[sequenceLength];
252                     for (int j = 0; j < sequence.length; j++) {
253                         sequence[j] = token[(int) (Math.random() * numberOfUniqueToken)];
254                     }
255
256                     int score = (int) (Math.random() * 100);
257
258                     // Convert sequence to string
259                     String sequenceStr = Arrays.toString(sequence);
260
261                     // Cek whether sequence is already in set
262                     while (uniqueSequences.contains(sequenceStr)) {
263                         sequence = new String[sequenceLength];
264                         for (int j = 0; j < sequence.length; j++) {
265                             sequence[j] = token[(int) (Math.random() * numberOfUniqueToken)];
266                         }
267                         // Update sequence string, convert sequence to string ([a, b, c] -> "[a,b,c]")
268                         sequenceStr = Arrays.toString(sequence);
269                     }
270
271                     // Add sequence to set unique so that there is no duplicate sequence
272                     uniqueSequences.add(sequenceStr);
273
274                     // Add sequence to list
275                     sequences.add(new Sequence(sequence, score));
276                 }
277
278                 System.out.println(
279                         "Here are the generated sequences and their score : ");
280                 for (Sequence sequence : sequences) {
281                     String[] sequenceToken = sequence.tokens;
282                     for (int i = 0; i < sequenceToken.length; i++) {
283                         System.out.print(sequenceToken[i] + " ");
284                     }
285                     System.out.println();
286                     System.out.println(sequence.score + "\n\n");
287                 }
288
```

Snipped

Gambar 2.6 Main Function (bagian 4)

Main.java

```
                // Brute forcce all combinatio
                long startTime = System.currentTimeMillis();
                boolean visited[][] = new boolean[matrix.length][matrix[0].length];
                List<Pair> result = new ArrayList<Pair>();

                if (bufferLength > matrix[0].length * matrix.length) {
                    bufferLength = matrix[0].length * matrix.length;
                }

                for (int i = 0; i < matrix[0].length; i++) {
                    bruteForcePossibleCombination(matrix, bufferLength, sequences, result, new ArrayList<String>(), 0,
                            i,
                            true,
                            visited, new ArrayList<String>());
                }

                // Find one combination that has the highest score
                int maxScore = 0;
                Pair highestScorePair = null;
                for (Pair res : result) {
                    int score = 0;
                    for (Sequence sequence : sequences) {
                        if (String.join("", res.sequence).contains(String.join("", sequence.tokens))) {
                            score += sequence.score;
                        }
                    }
                    if (score > maxScore) {
                        maxScore = score;
                        highestScorePair = res;
                    }
                }

                if (maxScore == 0) {
                    System.out.println("There is no buffer that satisfies the condition");
                } else {
                    System.out.println("Highest score : " + maxScore);
                    System.out.println("Buffer : ");
                    for (String s : highestScorePair.sequence) {
                        System.out.print(s + " ");
                    }
                    System.out.println("\nPath : ");
                    for (String p : highestScorePair.path) {
                        System.out.println(p);
                    }
                }
                long endTime = System.currentTimeMillis();
                long timeElapsed = endTime - startTime;
                System.out.println("Time elapsed : " + timeElapsed + " ms\n");

                System.out.println("Do you wish to save the output? (Y/N)");
                input = new Scanner(System.in);
                String save = input.nextLine();
                if (save.toLowerCase().equals("y")) {
                    saveFile(maxScore, highestScorePair, timeElapsed);
                }
            }
            System.out.println("\nPlease choose one input method : ");
            System.out.println("1. Via .txt");
            System.out.println("2. Via CLI");
            System.out.println("3. Exit");
            choice = Integer.parseInt(input.nextLine());
            while (choice != 1 && choice != 2 && choice != 3) {
                System.out.println("Please choose only 1 or 2 or 3 : ");
                choice = Integer.parseInt(input.nextLine());
            }
        }
        input.close();
    }

```

Snipped

Gambar 2.7 Main Function (bagian 5)

2. bruteForcePossibleCombination
   Ini adalah *method* yang digunakan untuk men-*generate* semua kombinasi yang memenuhi aturan dari permainan, yaitu semua kombinasi yang bisa dicapai hanya dengan bergerak secara vertikala tau horizontal, tidak mengunjungi elemen matriks lebih dari satu kali, dan mengandung setidaknya satu *sequence*.

Main.java

```
358     static void bruteForcePossibleCombination(String matrix[][], int bufferLength, List<Sequence> sequences,
359             List<Pair> result, List<String> temp, int row, int col, boolean isHorizontal, boolean visited[][],
360             List<String> tempPath) {
361
362         // Find all valid coordinates (Not out of bound and haven't been visited yet)
363         if (row < 0 || row >= matrix.length || col < 0 || col >= matrix[0].length || visited[row][col]) {
364             return;
365         }
366
367         // If valid, add token to temporary sequence (temp) and mark the coordinate as
368         // visited and add the path to temporary path (tempPath)
369         temp.add(matrix[row][col]);
370         visited[row][col] = true;
371         tempPath.add(Integer.toString(col + 1) + " " + Integer.toString(row + 1));
372
373         // If the length of sequence (temp) is less than the buffer length, find all
374         // possible combinations recursively based on the direction until the length of
375         // sequence (temp) is equal to the buffer length
376         if (temp.size() < bufferLength) {
377             isHorizontal = !isHorizontal;
378             if (isHorizontal) {
379                 for (int j = 0; j < matrix[0].length; j++) {
380                     if (j != col && !visited[row][j]) {
381                         bruteForcePossibleCombination(matrix, bufferLength, sequences, result, temp, row, j,
382                                 isHorizontal,
383                                 visited, tempPath);
384                     }
385                 }
386             } else {
387                 for (int i = 0; i < matrix.length; i++) {
388                     if (i != row && !visited[i][col]) {
389                         bruteForcePossibleCombination(matrix, bufferLength, sequences, result, temp, i, col,
390                                 isHorizontal,
391                                 visited, tempPath);
392                     }
393                 }
394             }
395         }
```

Snipped

Gambar 2.8 bruteForcePossibleCombination (bagian 1)

Main.java

```
396  // If the length of sequence (temp) is equal to the buffer length, check whether
397          // the sequence contains any of the sequences
398          else if (temp.size() == bufferLength) {
399              String tempString = String.join("", temp);
400              for (Sequence sequence : sequences) {
401                  if (tempString.contains(String.join("", sequence.tokens))) {
402                      // If it contains, add the sequence and the path to the result
403                      result.add(new Pair(new ArrayList<String>(temp), new ArrayList<String>(tempPath)));
404                      break;
405                  }
406              }
407          }
408
409          // After the sequence has been checked, remove the last token from the sequence
410          // and mark the coordinate as unvisited and remove the last path from the path
411          visited[row][col] = false;
412          temp.remove(temp.size() - 1);
413          tempPath.remove(tempPath.size() - 1);
414      }
```

Snipped

Gambar 2.9 bruteForcePossibleCombination (bagian 2)

3. saveFile
   Ini adalah *method* yang digunakan untuk menyimpan hasil *output* dalam format .txt.

Main.java

```
416      static void saveFile(int maxScore, Pair highestScore, long timeElapsed) {
417          System.out.println("Input file name: ");
418          String saveLocation = input.nextLine();
419          File saveFile = new File("../test/" + saveLocation + ".txt");
420          while (saveFile.exists()) {
421              System.out.println("File already exist, please use another name : ");
422              saveLocation = input.nextLine();
423              saveFile = new File("../test/" + saveLocation + ".txt");
424          }
```

Snipped

Gambar 2.10 saveFile (bagian 1)

Main.java

```
425  try {
426              saveFile.createNewFile();
427              FileWriter writer = new FileWriter(saveFile);
428              writer.write(maxScore + "\n");
429              if (highestScore == null) {
430                  writer.write("There is no buffer that satisfies the condition\n");
431              } else {
432                  for (String s : highestScore.sequence) {
433                      writer.write(s + " ");
434                  }
435                  for (String p : highestScore.path) {
436                      writer.write(p + "\n");
437                  }
438              }
439              writer.write("\n" + timeElapsed + " ms");
440              writer.close();
441              System.out.println("File has been saved : " + saveFile.getName());
442
443          } catch (Exception e) {
444              System.out.println("An error occured :" + e.getMessage());
445              e.printStackTrace();
446          }
447      }
```

Snipped

Gambar 2.11 saveFile (bagian 2)

4. Unique
   Ini adalah *method* yang digunakan untuk mengecek apakah token yang di input pada CLI sudah unik atau belum.

Main.java

```
449       static boolean isUnique(String[] token) {
450           // Check whether a token is unique or not
451           Set<String> uniqueTokens = new HashSet<String>(Arrays.asList(token));
452           return uniqueTokens.size() == token.length;
453       }
```

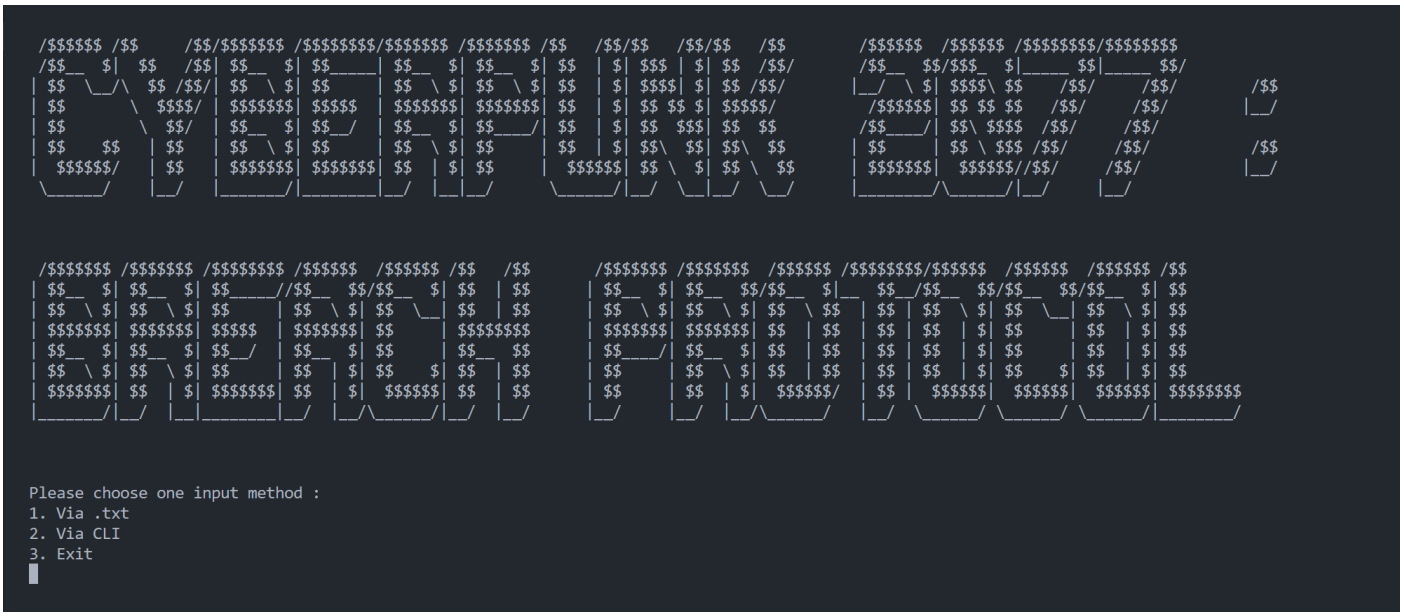
Snipped

Gambar 2.12 isUnique

BAB 4

EKSPERIMEN

Initialize Program



Gambar 3.1 Tampilan awal program

Input dari File .txt (Opsi 1)

```
Please choose one input method :
1. Via .txt
2. Via CLI
3. Exit
1
Input filename :
soal1
Highest score : 50
Sequence :
7A BD 7A BD 1C BD 55
Path :
1 1
1 4
3 4
3 5
6 5
6 3
1 3
Time elapsed : 83 ms

Do you wish to save the output? (Y/N)
N
```

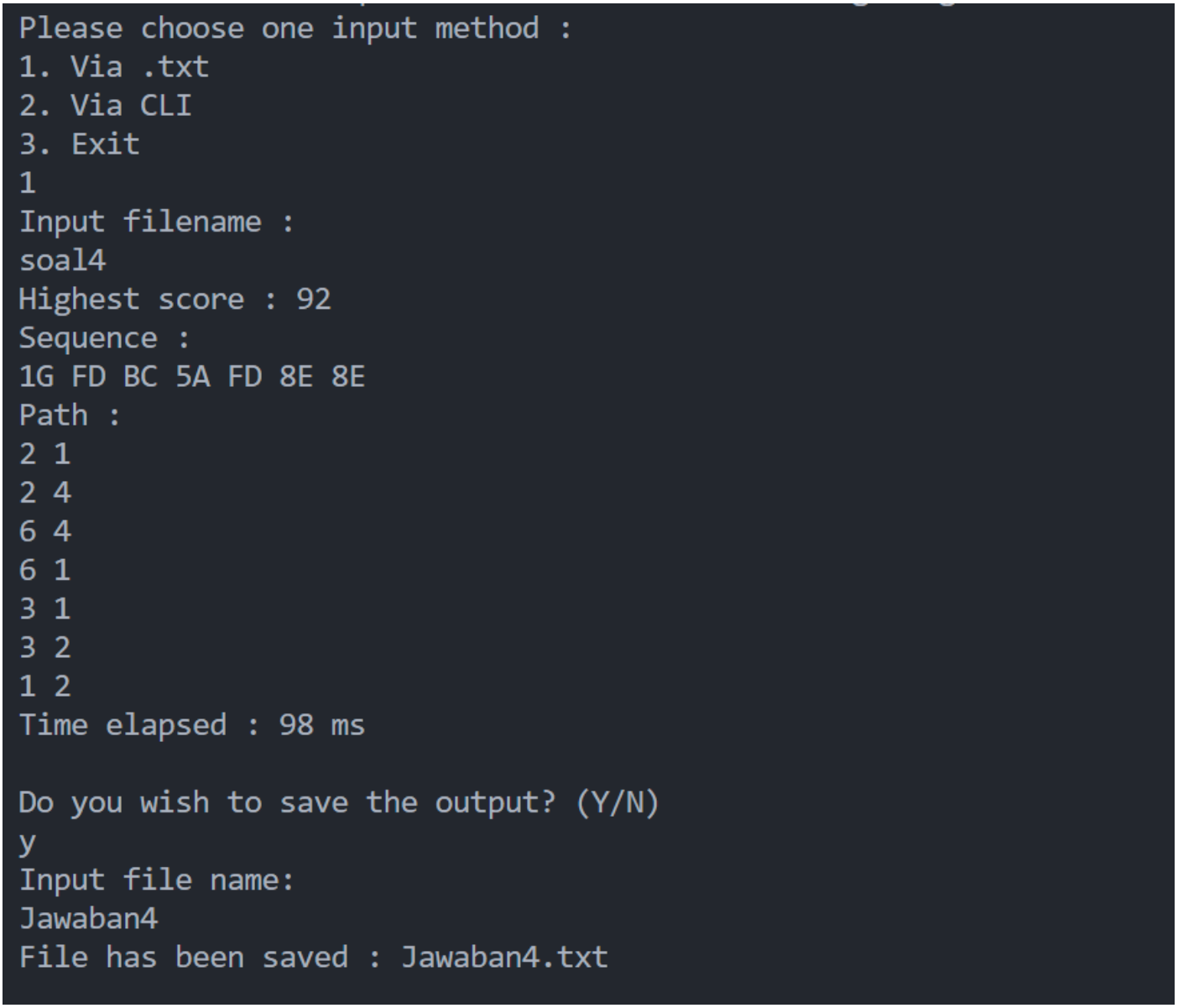
Gambar 3.2 Output dari Soal1.txt

```
Please choose one input method :
1. Via .txt
2. Via CLI
3. Exit
1
Input filename :
soal2
Highest score : 10
Sequence :
1C E9 55 BD 7A E9 7A BD 55 55 7A BD E9 E9 1C 1C 7A 55 1C
Path :
2 1
2 10
1 10
1 2
2 2
2 9
1 9
1 3
2 3
2 8
1 8
1 4
2 4
2 7
1 7
1 5
2 5
2 6
1 6
Time elapsed : 553 ms

Do you wish to save the output? (Y/N)
n
```

Gambar 3.3 Output dari Soal2.txt

```
Please choose one input method :
1. Via .txt
2. Via CLI
3. Exit
1
Input filename :
soal3
Highest score : 10
Sequence :
E9 BD E9 55 7A 55 7A 1C BD E9 55 E9 55 7A 1C 7A 1C BD E9 BD
Path :
10 1
10 2
9 2
9 1
8 1
8 2
7 2
7 1
1 1
1 2
5 2
5 1
4 1
4 2
3 2
3 1
2 1
2 2
6 2
6 1
Time elapsed : 2119 ms

Do you wish to save the output? (Y/N)
y
Input file name:
Jawaban3
File has been saved : Jawaban3.txt
```

Gambar 3.4 Output dari Soal3.txt



Gambar 3.5 Output dari Soal4.txt

Input dari CLI (Opsi 2)

```
Please choose one input method :
1. Via .txt
2. Via CLI
3. Exit
2
Input number of unique tokens :
5

Input token, each of them must be separated with a space :
A1 B2 C3 D4 E5

Input the length of buffer :
6

Input length of column and row of a matrix, each of them must be separated with a space :
5 8

Input maximum length of a sequence :
5

Input number of sequence :
5

Here are the generated matrix :
E5 C3 B2 A1 E5
B2 E5 E5 D4 C3
B2 B2 D4 E5 E5
B2 D4 E5 B2 A1
C3 B2 B2 E5 B2
C3 D4 C3 C3 C3
C3 E5 A1 D4 C3
D4 E5 E5 D4 E5

Here are the generated sequences and their score :
C3 B2 A1
22


E5 B2
18
```

Gambar 3.6 Input dari input melalui CLI (bagian 1)

```
C3 C3
53


D4 C3 D4
68


B2 A1 E5
9


Highest score : 121
Buffer :
E5 C3 C3 D4 C3 D4
Path :
1 1
1 6
4 6
4 7
1 7
1 8
Time elapsed : 80 ms

Do you wish to save the output? (Y/N)
Y
Input file name:
Jawaban5
File has been saved : Jawaban5.txt
```

Gambar 3.7 Output dari input melalui CLI (bagian 2)
Output disimpan pada Jawaban5.txt

```
Please choose one input method :
1. Via .txt
2. Via CLI
3. Exit
2
Input number of unique tokens :
3

Input token, each of them must be separated with a space :
AA BB CC

Input the length of buffer :
7

Input length of column and row of a matrix, each of them must be separated with a space :
8 9

Input maximum length of a sequence :
8

Input number of sequence :
12

Here are the generated matrix :
BB BB CC BB BB CC BB BB
AA CC BB AA CC BB BB CC
AA CC BB CC AA CC CC AA
BB CC AA BB CC CC AA CC
AA CC AA AA AA CC BB CC
CC CC BB BB BB CC BB BB
BB CC AA BB BB BB CC AA
CC AA CC CC CC CC AA AA
CC AA AA AA CC CC BB CC
```

Gambar 3.8 Input dari CLI (bagian 1)

```
Here are the generated sequences and their score :
CC AA CC BB
73


CC AA BB CC CC CC AA
69


CC AA
40


CC BB AA CC
1


AA CC CC CC AA CC
90


AA CC AA BB CC AA
57


BB BB BB CC AA BB BB AA
80


BB AA AA BB
66


AA CC
99


AA BB BB CC
25
```

Gambar 3.9 Input dari CLI (bagian 2)

```
BB CC CC CC AA CC BB CC
1


BB BB BB AA CC BB BB BB
51


Highest score : 278
Buffer :
CC AA CC BB AA AA BB
Path :
3 1
3 4
5 4
5 7
3 7
3 5
7 5
Time elapsed : 3589 ms

Do you wish to save the output? (Y/N)
Y
Input file name:
Jawaban6
File has been saved : Jawaban6.txt
```

Gambar 3.10 Output dari input CLI (bagian 3)
Output disimpan pada Jawaban6.txt

BAB 5
PENUTUP

5.1 Kesimpulan

Melalui tugas besar ini, saya menjadi belajar banyak hal terkait library dan bahasa pemrograman Java. Algoritma *brute force* dapat menyelesaikan hampir segala macam persoalan algoritma, namun tidak efisien dan memakan banyak memori.

5.2 Link Repository

Link repository untuk tugas kecil 1 mata kuliah IF2211 Strategi Algoritma adalah sebagai berikut

Link : AlthariqFairuz/Tucil_13522027 (github.com)

5.3 Tabel Checkpoint Program

Poin	Ya	Tidak
1. Program berhasil dikompilasi tanpa kesalahan	✓	
2. Program berhasil dijalankan	✓	
3. Program dapat membacamasukan berkas .txt	✓	
4. Program dapat menghasilkan masukan secara acak	✓	
5. Solusi yang diberikan program optimal	✓	
6. Program dapat menyimpan solusi dalam berkas .txt	✓	
7. Program memiliki GUI		✓

DAFTAR REFERENSI

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Algoritma-Brute-Force-(2022)-Bag1.pdf (itb.ac.id)