**LAPORAN TUGAS KECIL 1**

**IF2211 STRATEGI ALGORITMA**

**PENYELESAIAN PERMAINAN KARTU 24 DENGAN**

***BRUTE FORCE ALGORITHM***

**Logo

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BAB I

DESKRIPSI MASALAH

Permainan kartu 24 adalah permainan kartu aritmatika dengan tujuan mencari cara untuk mengubah 4 buah angka random sehingga mendapatkan hasil akhir sejumlah 24. Permainan ini menarik cukup banyak peminat dikarenakan dapat meningkatkan kemampuan berhitung serta mengasah otak agar dapat berpikir dengan cepat dan akurat. Permainan Kartu 24 biasa dimainkan dengan menggunakan kartu remi. Kartu remi terdiri dari 52 kartu yang terbagi menjadi empat suit (sekop, hati, keriting, dan wajik) yang masing-masing terdiri dari 13 kartu (As, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, dan King). Yang perlu diperhatikan hanyalah nilai kartu yang didapat (As, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, dan King). As bernilai 1, Jack bernilai 11, Queen bernilai 12, King bernilai 13, sedangkan kartu bilangan memiliki nilai dari bilangan itu sendiri. Pada awal permainan moderator atau salah satu pemain mengambil 4 kartu dari dek yang sudah dikocok secara random. Permainan berakhir ketika pemain berhasil menemukan solusi untuk membuat kumpulan nilainya menjadi 24. Pengubahan nilai tersebut dapat dilakukan menggunakan operasi dasar matematika penjumlahan (+), pengurangan (-), perkalian (×), divisi (/) dan tanda kurung ( () ). Tiap kartu harus digunakan tepat sekali dan urutan penggunaannya bebas. (Source : <https://informatika.stei.itb.ac.id/~rinaldi.munir/Stmik/2015-2016/Makalah-2016/MakalahStima-2016-038.pdf>)

Pada laporan ini akan dibahas sebuah program yang menggunakan Algoritma *Brute Force* untuk menghasilkan solusi dari permainan kartu 24. Program akan ditulis dalam bahasa Java.

BAB II

ALGORITMA BRUTE FORCE DAN ALUR PROGRAM

Lorem

BAB III

KODE PROGRAM DALAM BAHASA JAVA

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| File : **main.java** |
| import java.util.\*;  import java.security.SecureRandom;  import java.io.\*;  import datatype.\*;  public class main extends shortcut {  *// global variables*      public static Scanner scan = new Scanner(System.in);      public static long startTime = 0;      public static long endTime = 0;      public static void main(String[] *args*) {  *// splash screen*          println("\nWelcome to 24 Games Solver");          println("==========================");          println();    *// menu options*          println("Options: ");          println("[0] Exit");          println("[1] Input Cards from Console");          println("[2] Auto Generate cards");          println();          int option;          do { *// input validation*              print("Enter option [0-2]: ");              option = scan.nextInt();              scan.nextLine();          } while (option < 0 || option > 2);          println();          switch(option){              case 1:                  userInput();                  break;              case 2:                  autoInput();                  break;              default:                  println("See ya! Thank you mate!");                  System.exit(0);                  break;          }          println("\nExecution time : " + (endTime-startTime) + " miliseconds");      }      public static void userInput(){          println("User Input");          println("==========");          println();          String[] inputs;          String input;          boolean reinput;          do{ *// inputs validation*              reinput = false;  *// user input*              print("Input : ");              input = scan.nextLine();    *// trim and split the input*              inputs = Arrays.copyOfRange(input.trim().split("[ ]+"), 0, 4);    *// validation of each input*              int i = 0;              while (!reinput && i < inputs.length){                  int ascii = (int)(inputs[i].toLowerCase().charAt(0));                  if (inputs[i].length() > 1){                      reinput = (inputs[i] != "10");                  } else if ((ascii == 97) || (ascii == 106) || (ascii == 107) || (ascii == 113) || (ascii >= 50 && ascii <= 57)) {                      reinput = false;                  } else {                      reinput = true;                  }                  i++;              }          } while (reinput);          parseInput(inputs);      }      public static void autoInput(){          println("Auto Generate Cards");          println("===================");          println();          String[] inputs = new String[4];          String[] cards = {"A", "2", "3", "4", "5", "6", "7", "8", "9", "10", "J", "Q", "K"};    *// randomizer*          SecureRandom rand = new SecureRandom();          print("Your cards are : ");  *// random 4 cards*          for (int i = 0; i < 4; i++){              inputs[i] = cards[rand.nextInt(13)];              print(inputs[i] + ' ');          }          println();          parseInput(inputs);      }      public static void parseInput(String[] *inputs*){          int[] numbers = new int[4];  *// create dictionary*          Hashtable<String, Integer> dict = new Hashtable<String, Integer>();          dict.put("A", 1);          dict.put("a", 1);          dict.put("2", 2);          dict.put("3", 3);          dict.put("4", 4);          dict.put("5", 5);          dict.put("6", 6);          dict.put("7", 7);          dict.put("8", 8);          dict.put("9", 9);          dict.put("10", 10);          dict.put("J", 11);          dict.put("j", 11);          dict.put("Q", 12);          dict.put("q", 12);          dict.put("K", 13);          dict.put("k", 13);  *// parse*          for (int i = 0; i < *inputs*.length; i++){              numbers[i] = dict.get(*inputs*[i]);          }  *// start timer*          startTime = System.currentTimeMillis();  *// call for solution*          solution.solution(numbers);      }      public static void output(Set<StrDoub> *solutions*){  *// end timer*          endTime = System.currentTimeMillis();          println("\nOutput options : ");          println("[1] Console");          println("[2] Text File");          println();          int option;          do { *// input validation*              print("Enter option [1-2]: ");              option = scan.nextInt();              scan.nextLine();          } while (option < 1 || option > 2);          switch(option){              case 1:                  outputConsole(*solutions*);                  break;              case 2:                  try {                      outputFile(*solutions*);                  } catch (IOException *ex*) {                      println("Failed to create file. Please try again...");                      output(*solutions*);                  }                  break;          }      }      public static void outputConsole(Set<StrDoub> *solutions*){          println((*solutions*.size() == 0) ? "There is no solution" : ("There are " + *solutions*.size() + " solutions\n"));          int i = 1;  *// print all results*          for (StrDoub solution : *solutions*){              print(i + ". ");              println(solution.expr);              i++;          }      }      public static void outputFile(Set<StrDoub> *solutions*) throws IOException{  *// user input filename*          print("Output file name [\_\_\_.txt] : ");          String filename = scan.nextLine();  *// initialize buffer*          String output = "";  *// header*          output += (*solutions*.size() == 0) ? "There is no solution" : ("There are " + *solutions*.size() + " solutions\n");  *// write contents*          int i = 1;          for (StrDoub solution : *solutions*){              output += (i + ". " + solution.expr +'\n');              i++;          }  *// write to file*          FileWriter writer = new FileWriter("../test/" + filename);          writer.write(output);          writer.close();  *// success message*          print("Successfully added "+ filename +" to test folder.");      }  }  class shortcut {        public static void print(char *item*){          System.out.print(*item*);      }      public static void print(int *item*){          System.out.print(*item*);      }        public static void print(String *item*){          System.out.print(*item*);      }      public static void println(){          System.out.println();      }      public static void println(char *item*){          System.out.println(*item*);      }      public static void println(int *item*){          System.out.println(*item*);      }      public static void println(String *item*){          System.out.println(*item*);      }      public static void printArr(int[] *arr*){          Arrays.stream(*arr*).forEach(System.out::print);          println();      }  } |

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| File : **solution.java** |
| import java.util.Arrays;  import java.util.HashSet;  import java.util.Set;  import java.util.stream.Collectors;  import datatype.\*;  public class solution extends shortcut {  *// global variable*      public static int indexPermute = 0;      public static int[][] permutations = new int[24][];        public static void solution(int[] *nums*) {  *// initialize set for solutions*          Set<StrDoub> solutions = new HashSet<>();  *// nums permutation*          permute(*nums*, 0);  *// loop through all possible combination*          for (int i = 0; i < permutations.length; i++){              Double[] numTemp = new Double[4];              int[] toProcess = permutations[i];  *// cast type to double*              for (int j=0; j < toProcess.length; j++){                  double temp = toProcess[j];                  numTemp[j] = temp;              }  *// solve*              Set<StrDoub> ans = rec(numTemp);  *// append to solutions set*              solutions.addAll(ans);          }  *// filter solutions to only if result equal to 24*          Set<StrDoub> filteredSet = solutions.stream()                  .filter(*x* -> *x*.res == 24)                  .collect(Collectors.toSet());  *// call for output processing*          main.output(filteredSet);      }  *// permute through numbers*      public static void permute(int[] *arr*, int *index*) {          if (*index* == *arr*.length) {  *// initialize temp array*              int[] tempArr = new int[*arr*.length];  *// copy to temp array*              System.arraycopy(*arr*, 0, tempArr, 0, *arr*.length);  *// assign array to permutations global variable*              permutations[indexPermute] = tempArr;  *// increment the index*              indexPermute++;          } else {              for (int i = *index*; i < *arr*.length; i++) {                  swap(*arr*, *index*, i);                  permute(*arr*, *index* + 1);                  swap(*arr*, *index*, i);              }          }      }  *// swap items in array*      public static void swap(int[] *arr*, int *i*, int *j*) {          int temp = *arr*[*i*];  *arr*[*i*] = *arr*[*j*];  *arr*[*j*] = temp;      }      public static StrDoub operate(char *operator*, StrDoub *a*, StrDoub *b*, Boolean *bracket*){  *// variable declaration*          StrDoub result = new StrDoub(null, 0.0);  *// assign expr*          result.expr = (*bracket* ? '(' : "") + *a*.expr + *operator* + *b*.expr + (*bracket* ? ')' : "");  *// assign res*          switch(*operator*){              case '-':                  result.res = *a*.res-*b*.res;                  break;              case '\*':                  result.res = *a*.res\**b*.res;                  break;              case '/':                  result.res = *a*.res/*b*.res;                  break;              case '+':                  result.res = *a*.res+*b*.res;                  break;          }          return result;        }      public static Set<StrDoub> rec(Double[] *arr*){  *// initialize variables*          Double[] head;          Double[] tail;    *// initialize results set*          Set<StrDoub> results = new HashSet<>();  *// initialize operators*          char[] operators = {'+', '-', '\*', '/'};          if (*arr*.length > 1){              for (int i = 1; i < *arr*.length; i++){  *// split array*                  head = Arrays.copyOfRange(*arr*, 0, i);                  tail = Arrays.copyOfRange(*arr*, i, *arr*.length);  *// recursion*                  Set<StrDoub> headRes = rec(head);                  Set<StrDoub> tailRes = rec(tail);  *// loop through operators, headRes, and tailRes*                  for(char operator : operators){                      for (StrDoub x : headRes){                          for (StrDoub y : tailRes){                              if (operator != '/' || (operator == '/' && y.res != 0)){                                  StrDoub ans = operate(operator, x, y, *arr*.length != 4);                                  results.add(ans);                              }                          }                      }                  }              }          }          else { *// if arr.length == 0*              StrDoub res = new StrDoub(Integer.toString(*arr*[0].intValue()), *arr*[0]);              results.add(res);          }          return results;      }  } |

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| File : **StrDoub.java** |
| package datatype;  public class StrDoub {      public String expr;      public Double res;      public StrDoub (String *expr*, Double *res*){          this.expr = *expr*;          this.res = *res*;      }  } |

BAB IV

INPUT/OUTPUT PROGRAM

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| **Kondisi 1** | |
| Input from console  Output from console |  |
| **Kondisi 2** | |
| Input Random  Output from console |  |

BAB V

TABEL PENILAIAN

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| --- | --- | --- |
| Poin | Ya | Tidak |
| 1. Program berhasil dikompilasi tanpa kesalahan | ✅ |  |
| 2. Program berhasil running | ✅ |  |
| 3. Program dapat membaca input / generate sendiri dan memberikan luaran | ✅ |  |
| 4. Solusi yang diberikan program memenuhi (berhasil mencapai 24) | ✅ |  |
| 5. Program dapat menyimpan solusi dalam file teks | ✅ |  |

BAB IV

REPOSITORY GITHUB

<https://github.com/JeffreyChow19/Tucil1_13521046.git>