LAPORAN TUGAS KECIL I
IF2211 STRATEGI ALGORITMA

Penyelesaian Permainan Kartu 24 dengan Algoritma Brute Force

Disusun oleh:

Afnan Edsa Ramadhan 13521011

Teknik Informatika

Sekolah Teknik Elektro dan Informatika

Institut Teknologi Bandung

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BAB I

ALGORITMA BRUTE FORCE

A. Algoritma Brute Force

Algoritma brute force merupakan sebuah algoritma yang menggunakan prinsip *straightforward* untuk menyelesaikan suatu permasalahan. Algoritma ini biasanya bergantung pada kekuatan komputasi yang tinggi untuk mendapatkan semua solusi yang tepat daripada menggunakan teknik yang canggih. Algoritma ini dapat menyelesaikan hampir semua permasalahan komputasi, namun algoritma ini memiliki kelemahan dalam hal kompleksitas waktu untuk kasus yang besar.

B. Penerapan Algoritma Brute Force pada Permainan 24

Untuk melakukan strategi brute force pada permainan 24 adalah dengan cara melakukan pengecekan pada setiap kombinasi yang bisa dioperasikan dari 4 buah kartu.

1. Dari 4 kartu yang dipilih terdapat 24 kemungkinan penempatan kartu secara berbeda.
2. Terdapat 4 operasi matematika (+,-,*,/) dan dari 4 operasi diambil 3 saja, sehingga terdapat 64 kombinasi operasi.
3. Terdapat 5 jenis operasi kurung yang berbeda yaitu :
    a. ((a op b) op c) op d
    b. (a op (b op c)) op d
    c. a op ((b op c) op d)
    d. a op (b op (c op d))
    e. (a op b) op (c op d)

    Dimana (a,b,c,d) adalah kartu dan (op) adalah operator matematika

Sehingga total operasi yang harus dicek agar memenuhi seluruh kombinasi angka, operator, dan kurung adalah $64 \times 24 \times 5 = 7.650$. Jadi setiap menjalankan program komputer akan melakukan pengecekan sebanyak 7.560 kali.

BAB II

SOURCE CODE

```
int main(){
    float bil[4];
    vector<float> bilangan;
    list<string> hasil;
    vector<string> inputan;
    list<string> kartu =
{"a","A","2","3","4","5","6","7","8","9","10","j","J","q","Q","k","K"};
    string opp[64] = {"+++","++-","++*","++/","+-+","+--","+-*","+-
/","+*+","+*-","+**","+*/","+/+","+/-","+/*","+//","-++","-+-","-+*","-+/","--
+","---","--*","--/","-*+","-*-","-**","-*/","-/+","-/-","-/*","-
//","*++","*+-","*+*","*+/","*-+","*--","*-*","*-/","**+","**-
","***","**/","*/+","*/-","*/*","*//","/++","/+-","/+*","/+/","/-+","/--","/-
*","/-/","/*+","/*-","/**","/*/","//+","//-","//*","///"};

    splashScreen();
    cout << "\n---------------------------------------------"<< endl;


    bilangan = mintaInput(bil, kartu);
    inputan = floatToString(bilangan);
    for (int i=0; i<4; i++){
        bil[i] = bilangan[i];
    }

    cout << "---------------------------------------------"<< endl;
    for (int i=0; i<4; i++){
        cout << inputan[i] << " ";
    }
    cout << "\n---------------------------------------------\n"<< endl;


    time_t start, end;
    start = clock();
    hasil = solve24(hasil, opp, bil);
    end = clock();

    for (list<string>::iterator i=hasil.begin(); i!=hasil.end();i++){
        cout << *i << endl;
    }

    cout << "\n"<< hasil.size() << " solutions found!\n" << endl;
    cout << "Waktu eksekusi: " << (end-start)/(double)(CLOCKS_PER_SEC) << "
detik\n" << endl;
```

```
    cout << "-----------------------------------------"<< endl;


    tanyaSave(bil, hasil);

    cout << "-----------------------------------------"<< endl;
    cout << "Program selesai" << endl;

}
```

```
float calc(float left, float right, char op){
    float answer;
    if (op == '+'){
        answer = left + right;
    }
    if (op == '-'){
        answer = left - right;
    }
    if (op == '*'){
        answer = left * right;
    }
    if (op == '/'){
        if (right == 0){
            answer =  -99999999;
        }else{
            answer =  left / right;
        }
    }
    return answer;
}

list<string> solve24(list<string> hasil , string opp[], float bil[]){
    int count = 1;
    for(int i=0; i<4; i++){
        for(int j=0; j<4; j++){
            for(int k=0; k<4; k++){
                for(int l=0; l<4; l++){
                    for(int m=0; m<64; m++){
                        if (i!=j && i!=k && i!=l && j!=k && j!=l && k!=l){
                            float ans;

                            // // ((a+b)+c)+d
                            ans =
calc(calc(calc(bil[i],bil[j],opp[m][0]),bil[k],opp[m][1]),bil[l],opp[m][2]);
```

```
                            if(ans == 24){
                                string temp = "((" + to_string((int)bil[i]) +
(1,opp[m][0]) + to_string((int)bil[j]) + ")" + (1,opp[m][1]) +
to_string((int)bil[k]) + ")" + (1,opp[m][2]) + to_string((int)bil[l]) + "";
                                hasil.insert(hasil.end(),temp);
                                hasil.sort();
                                hasil.unique();
                                count++;
                            }

                            // //(a+(b+c))+d
                            ans =
calc(calc(bil[i],calc(bil[j],bil[k],opp[m][1]),opp[m][0]),bil[l],opp[m][2]);
                            if(ans == 24){
                                string temp = "(" + to_string((int)bil[i]) +
(1,opp[m][0]) + "(" + to_string((int)bil[j]) + (1,opp[m][1]) +
to_string((int)bil[k]) + "))" + (1,opp[m][2]) + to_string((int)bil[l]) + "";
                                count++;
                                hasil.insert(hasil.end(),temp);
                                hasil.sort();
                                hasil.unique();
                            }

                            // // a+((b+c)+d)
                            ans =
calc(bil[i],calc(calc(bil[j],bil[k],opp[m][1]),bil[l],opp[m][2]),opp[m][0]);
                            if(ans == 24){
                                string temp = to_string((int)bil[i]) +
(1,opp[m][0]) + "((" + to_string((int)bil[j]) + (1,opp[m][1]) +
to_string((int)bil[k]) + ')' + (1,opp[m][2]) + to_string((int)bil[l]) + ")";
                                count++;
                                hasil.insert(hasil.end(),temp);
                                hasil.sort();
                                hasil.unique();
                            }

                            // //a+(b+(c+d))
                            ans =
calc(bil[i],calc(bil[j],calc(bil[k],bil[l],opp[m][2]),opp[m][1]),opp[m][0]);
                            if(ans == 24){
                                string temp = to_string((int)bil[i]) +
(1,opp[m][0]) + "(" + to_string((int)bil[j]) + (1,opp[m][1]) + "(" +
to_string((int)bil[k]) + (1,opp[m][2]) + to_string((int)bil[l]) + "))";
                                count++;
                                hasil.insert(hasil.end(),temp);
                                hasil.sort();
                                hasil.unique();
                            }
```

```
                            // (a+b)+(c+d)
                            ans =
calc(calc(bil[i],bil[j],opp[m][0]),calc(bil[k],bil[l],opp[m][2]),opp[m][1]);
                            if(ans == 24){
                                string temp = "(" + to_string((int)bil[i]) +
(1,opp[m][0]) + to_string((int)bil[j])+ ")" + (1,opp[m][1]) + "(" +
to_string((int)bil[k]) + (1,opp[m][2]) + to_string((int)bil[l]) + ")";
                                count++;
                                hasil.insert(hasil.end(),temp);
                                hasil.sort();
                                hasil.unique();
                            }
                        }
                    }
                }
            }
        }
    }
    return hasil;
}
```

```
void saveFile(string filename,float bil[], list<string> hasil){

    // buat file
    ofstream File("..//test//" + filename + ".txt");
    // tulis input
    for (int i = 0; i < 4; i++){
        if(bil[i] == 1){
            File << "A ";
        }else if(bil[i] == 11){
            File << "J ";
        }else if(bil[i] == 12){
            File << "Q ";
        }else if(bil[i] == 13){
            File << "K ";
        }else{
            File << bil[i] << " ";
        }
    }
```

```
    File << endl;

    // tulis jumlah hasil
    int total = hasil.size();
    File << total << " Solution Found" << endl;

    // tulis hasil ke file
    for (list<string>::iterator i = hasil.begin();i != hasil.end();i++){
        File << *i << endl;
    }
    File.close();
}

void tanyaSave(float bil[], list<string> hasil){
    cout << "Apakah ingin menyimpan solusi?? (y/n)" << endl;
    char save;
    cin >> save;
    while(save != 'y' && save != 'Y' && save != 'n' && save != 'N'){
        cout << "Masukan tidak sesuai" << endl;
        cin >> save;
    }

    if(save == 'y' || save == 'Y'){
        string filename;
        cout << "Masukkan nama file: ";
        cin >> filename;
        saveFile(filename, bil, hasil);
    }

}


vector<float> mintaInput(float bil[], list<string> kartu){
    string input[4];
    cout << "Input sendiri?? (y/n)" << endl;
    char inputSendiri;
    cin >> inputSendiri;
    while(inputSendiri != 'y' && inputSendiri != 'Y' && inputSendiri != 'n' &&
inputSendiri != 'N'){
        cout << "Masukan tidak sesuai" << endl;
        cin >> inputSendiri;
    }

    if(inputSendiri == 'y' || inputSendiri == 'Y'){
        cout << "\nMasukkan 4 kartu: " << endl;

        for (int i=0; i<4; i++){
            // minta input sekalian validasi
            do{
```

```
                cin >> input[i];
                if(find(kartu.begin(), kartu.end(), input[i]) == kartu.end()){
                    cout << "Masukan tidak sesuai" << endl;
                }
            }while(find(kartu.begin(), kartu.end(), input[i]) == kartu.end());
        }
        for (int i=0; i<4; i++){
        // konversi string ke float
            if(input[i] == "a" || input[i] == "A"){
                bil[i] = 1;
            }else if(input[i] == "j" || input[i] == "J"){
                bil[i] = 11;
            }else if(input[i] == "q" || input[i] == "Q"){
                bil[i] = 12;
            }else if(input[i] == "k" || input[i] == "K"){
                bil[i] = 13;
            }else{
                bil[i] = stof(input[i]);
            }
        }
    }else{
        // generate random
        srand(time(0));
        for (int i=0; i<4; i++){
            bil[i] = 1 + (rand() % 13);
        }
    }
    vector<float> bill;

    for (int i=0; i<4; i++){
        bill.push_back(bil[i]);
    }

    return bill;
}

void splashScreen(){
    cout <<  " ___  _  _      _____           __  __ ______\n|__ \\| || |    /
____|   /\\   |  \\/  |  ____|\n   ) | || |_  | |  __   /  \\  | \\  / |
|__\n  / /|__   _| | | |_ | / /\\ \\ | |\\/| |  __|\n / /_   | |   | |__| |/
____ \\| |  | | |____\n|____|  |_|    \\_____/_/    \\_\\_|  |_|______|" <<
endl;
}

vector<string> floatToString(vector<float> bil){
    vector<string> bilangan;
    for (int i=0; i<4; i++){
        if(bil[i] == 1){
```

```
            bilangan.push_back("A");
        }else if(bil[i] == 11){
            bilangan.push_back("J");
        }else if(bil[i] == 12){
            bilangan.push_back("Q");
        }else if(bil[i] == 13){
            bilangan.push_back("K");
        }else{
            bilangan.push_back(to_string((int)bil[i]));
        }
    }
    return bilangan;
}
```

BAB III

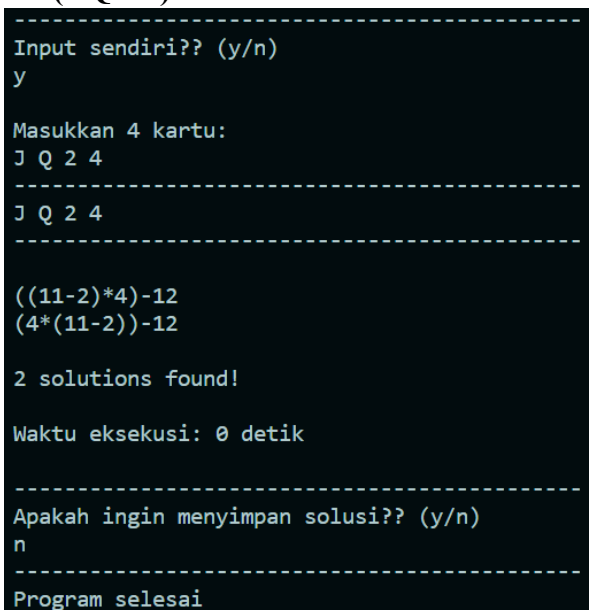
TEST CASE

A. Input User

1.1 (6 6 6 6)

```
 ___  _  _      _____          __  __ ______
|__ \| || |    / ____|   /\   |  \/  |  ____|
   ) | || |_  | |  __   /  \  | \  / | |__
  / /|__   _| | | |_ | / /\ \ | |\/| |  __|
 / /_   | |   | |__| |/ ____ \| |  | | |____
|____|  |_|    \_____/_/    \_\_|  |_|______|

-------------------------------------------
Input sendiri?? (y/n)
y

Masukkan 4 kartu:
6 6 6 6
-------------------------------------------
6 6 6 6
-------------------------------------------

((6*6)-6)-6
((6+6)+6)+6
(6*6)-(6+6)
(6+(6+6))+6
(6+6)+(6+6)
6+((6+6)+6)
6+(6+(6+6))

7 solutions found!

Waktu eksekusi: 0.002 detik

-------------------------------------------
Apakah ingin menyimpan solusi?? (y/n)
n
-------------------------------------------
Program selesai
```

1.2 (J Q 2 4)



```
-------------------------------------------
Input sendiri?? (y/n)
y

Masukkan 4 kartu:
J Q 2 4
-------------------------------------------
J Q 2 4
-------------------------------------------

((11-2)*4)-12
(4*(11-2))-12

2 solutions found!

Waktu eksekusi: 0 detik

-------------------------------------------
Apakah ingin menyimpan solusi?? (y/n)
n
-------------------------------------------
Program selesai
```

1.3 (A J Q K)

```
-------------------------------------------
Input sendiri?? (y/n)
y

Masukkan 4 kartu:
A Q K J
-------------------------------------------
A Q K J
-------------------------------------------

((1*13)-11)*12
((13*1)-11)*12
((13-11)*1)*12
((13-11)*12)*1
((13-11)*12)/1
((13-11)/1)*12
((13/1)-11)*12
(1*(13-11))*12
(1*12)*(13-11)
(12*(13-11))*1
(12*(13-11))/1
(12*1)*(13-11)
(12/1)*(13-11)
(13-(1*11))*12
(13-(11*1))*12
(13-(11/1))*12
(13-11)*(1*12)
(13-11)*(12*1)
(13-11)*(12/1)
(13-11)/(1/12)
1*((13-11)*12)
1*(12*(13-11))
12*((1*13)-11)
12*((13*1)-11)
12*((13-11)*1)
12*((13-11)/1)
12*((13/1)-11)
12*(1*(13-11))
12*(13-(1*11))
```

```
1*((13-11)*12)
1*(12*(13-11))
12*((1*13)-11)
12*((13*1)-11)
12*((13-11)*1)
12*((13-11)/1)
12*((13/1)-11)
12*(1*(13-11))
12*(13-(1*11))
12*(13-(11*1))
12*(13-(11/1))
12/(1/(13-11))

32 solutions found!

Waktu eksekusi: 0.001 detik

-------------------------------------------
Apakah ingin menyimpan solusi?? (y/n)
n
-------------------------------------------
Program selesai
```

B. Input Random

2.1 (9 K 3 Q)

```
--------------------------------------------
Input sendiri?? (y/n)
n
--------------------------------------------
9 K 3 Q
--------------------------------------------

((12+9)-13)*3
((12-13)+9)*3
((13-9)*3)+12
((9+12)-13)*3
((9-13)+12)*3
(12+(9-13))*3
(12-(13-9))*3
(3*(13-9))+12
(9+(12-13))*3
(9-(13-12))*3
12+((13-9)*3)
12+(3*(13-9))
12-((9-13)*3)
12-(3*(9-13))
3*((12+9)-13)
3*((12-13)+9)
3*((9+12)-13)
3*((9-13)+12)
3*(12+(9-13))
3*(12-(13-9))
3*(9+(12-13))
3*(9-(13-12))

22 solutions found!

Waktu eksekusi: 0.001 detik

--------------------------------------------
Apakah ingin menyimpan solusi?? (y/n)
n
--------------------------------------------
Program selesai
```

2.2 (7 8 9 5)

```
--------------------------------------------
Input sendiri?? (y/n)
n
--------------------------------------------
7 10 9 5
--------------------------------------------

((10-7)*5)+9
(5*(10-7))+9
9+((10-7)*5)
9+(5*(10-7))
9-((7-10)*5)
9-(5*(7-10))

6 solutions found!

Waktu eksekusi: 0.001 detik

--------------------------------------------
Apakah ingin menyimpan solusi?? (y/n)
n
--------------------------------------------
Program selesai
```

2.3 (K J 8 6)

```
-------------------------------------------
Input sendiri?? (y/n)
n
-------------------------------------------
K J 8 6
-------------------------------------------

((6*8)-11)-13
((6*8)-13)-11
((8*6)-11)-13
((8*6)-13)-11
(6*8)-(11+13)
(6*8)-(13+11)
(6*8)/(13-11)
(6/(13-11))*8
(8*6)-(11+13)
(8*6)-(13+11)
(8*6)/(13-11)
(8/(13-11))*6
6*(8/(13-11))
6/((13-11)/8)
8*(6/(13-11))
8/((13-11)/6)

16 solutions found!

Waktu eksekusi: 0.001 detik

-------------------------------------------
Apakah ingin menyimpan solusi?? (y/n)
n
-------------------------------------------
Program selesai
```

Lampiran

A. Link GitHub

https://github.com/afnanramadhan/Tucil1_13521011

B. Check List

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	✓	