LAPORAN TUGAS KECIL

IF2211 Strategi Algoritma

Kelas Mahasiswa (K-1)

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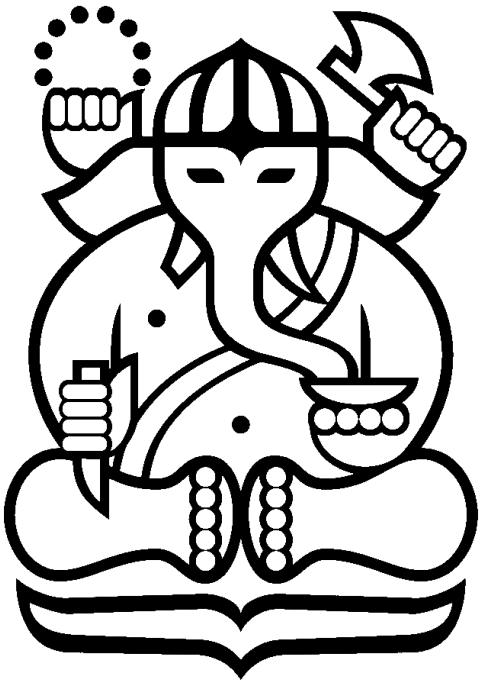

Penulis:

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Daftar Isi

Bab 1:

Penjelasan Algoritma Brute Force

Pada program ini, algoritma utama dijalankan dengan proses iterasi yang cukup banyak berulang. Proses iterasi dilakukan mulai pada elemen pemosisian angka dan operator yang digunakan.

1. Terdapat 24 kemungkinan urutan angka yang ada pada program ini:

n1, n2, n3, n4
n1, n2, n4, n3
n1, n3, n2, n4
n1, n3, n4, n2
n1, n4, n2, n3
n1, n4, n3, n2
n2, n1, n3, n4
n2, n1, n4, n3
n2, n3, n1, n4
n2, n3, n4, n1
n2, n4, n1, n3
n2, n4, n3, n1
n3, n1, n2, n4
n3, n1, n4, n2
n3, n2, n1, n4
n3, n2, n4, n1
n3, n4, n1, n2
n3, n4, n2, n1
n4, n1, n2, n3
n4, n1, n3, n2
n4, n2, n1, n3
n4, n2, n3, n1
n4, n3, n1, n2
n4, n3, n2, n1

2. Terdapat 64 kemungkinan operator yang digunakan pada program ini (menggunakan iterasi for)

3. Terdapat 5 kemungkinan pemosisian tanda kurung

((n op n) op n) op n
(n op n) op (n op n)
(n op (n op n)) op n
n op (n op (n op n))
n op ((n op n) op n)

Dengan ketiga kemungkinan tadi, maka terdapat 24*64*5 = 7680 buah operasi yang dapat dilakukan kepada 4 buah angka. Di antara 7680 ini, dicari operasi yang menghasilkan nilai 24 dan dimasukkan ke dalam suatu array yang akan menjadi solusi dari permainan.

Bab 2:

Source Program

Berikut adalah source code yang ditulis dengan bahasa pemrograman C++

```
#include <chrono>
#include <iostream>
#include <algorithm>
#include <vector>
#include <fstream>
#include <cstdlib>
#include <string>
#include <random>

using namespace std;


vector<string> removeduplicate(vector<string> str, int n)
{
   int idx=0;
   for (int i=0;i<n;i++)
   {
        int j;
        for(j=0;j<i;j++)
        {
            if(str[i]==str[j])
            {
               break;
            }
        }
        if(j==i)
        {
            str[idx++]=str[i];
        }
   }
   return str;
}

double kabataku(int ops, double n1, double n2){
```

```
    if(ops == 0){
        return n1*n2;
    }
    else if(ops == 1){
        return n1/n2;
    }
    else if(ops == 2){
        return n1+n2;
    }
    else if(ops == 3){
        return n1-n2;
    }
    else{
        return 9999.0;
    }
}

char ops(int oper){
    if(oper == 0){
        return '*';
    }
    else if(oper == 1){
        return '/';
    }
    else if(oper == 2){
        return '+';
    }
    else if(oper == 3){
        return '-';
    }
}

string ubahInt(double i){
    if(i == 1.0){
        return "1";
    }
    else if(i == 2.0){
        return "2";
    }
    else if(i == 3.0){
```

```
        return "3";
    }
    else if(i == 4.0){
        return "4";
    }
    else if(i == 5.0){
        return "5";
    }
    else if(i == 6.0){
        return "6";
    }
    else if(i == 7.0){
        return "7";
    }
    else if(i == 8.0){
        return "8";
    }
    else if(i == 9.0){
        return "9";
    }
    else if(i == 10.0){
        return "10";
    }
    else if(i == 11.0){
        return "11";
    }
    else if(i == 12.0){
        return "12";
    }
    else if(i == 13.0){
        return "13";
    }
}


double evalKartu(string card){
    if(card=="A"){
        return 1.0;
    }
    else if(card=="2"){
```

```
        return 2.0;
    }
    else if(card=="3"){
        return 3.0;
    }
    else if(card=="4"){
        return 4.0;
    }
    else if(card=="5"){
        return 5.0;
    }
    else if(card=="6"){
        return 6.0;
    }
    else if(card=="7"){
        return 7.0;
    }
    else if(card=="8"){
        return 8.0;
    }
    else if(card=="9"){
        return 9.0;
    }
    else if(card=="10"){
        return 10.0;
    }
    else if(card=="J"){
        return 11.0;
    }
    else if(card=="K"){
        return 13.0;
    }
    else if(card=="Q"){
        return 12.0;
    }
    else{
        return 9999.0;
    }
}
```

```
int randint(int Min, int Max) {
    return (rand() % (Max + 1 - Min)) + Min;
}

int main(){
    string x1,x2,x3,x4;
    double n1,n2,n3,n4;
    int cho;
    cout << "Selamat datang pada solver permainan 24." << endl;
    cout << "Apakah anda ingin memasukkan kartu sendiri? \n(1/Ya,
2/Masukkan kartu secara random)" << endl;
    do{
        cin >> cho;
        if(cho != 1 && cho != 2){
            cout << "Mohon masukkan input yang sesuai." << endl;
        }
    }while(cho != 1 && cho != 2);

    if(cho == 1){
        do{
            printf("Masukkan 4 buah kartu yang ingin digunakan\n");
            cin >> x1;
            n1 = evalKartu(x1);
            cin >> x2;
            n2 = evalKartu(x2);
            cin >> x3;
            n3 = evalKartu(x3);
            cin >> x4;
            n4 = evalKartu(x4);
            if(n1 == 9999 || n2 == 9999 || n3 == 9999 || n4 == 9999){
                printf("Terdapat kesalahan input pada kartu yang
dimasukkan.\n");
            }
            printf("Kartu anda adalah: \n");
            printf("%f %f %f %f\n",n1,n2,n3,n4);
        }while(n1 == 9999 || n2 == 9999 || n3 == 9999 || n4 == 9999);
    }
    else if(cho == 2){
        n1 = randint(1,13);
        n2 = randint(1,13);
```

```
        n3 = randint(1,13);
        n4 = randint(1,13);
        printf("Kartu anda adalah: \n");
        printf("%f %f %f %f\n",n1,n2,n3,n4);
    }

    string sol = "";
    vector<string> sols;
    int counter = 0;
    auto init = chrono::steady_clock::now();
    for(int i=0;i<4;i++){
        for(int j=0;j<4;j++){
            for(int k=0;k<4;k++){
                // i/j/k merupakan ops
                // 1
                if(kabataku(k,kabataku(j,kabataku(i,n1,n2),n3),n4) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n1) + ops(i) + ubahInt(n2) + ")"
+ ops(j) + ubahInt(n3) + ")" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n1,n2),kabataku(j,n3,n4)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n1) + ops(i) + ubahInt(n2) + ")" +
ops(k) + "(" + ubahInt(n3) + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n1,kabataku(i,n2,n3))) ==
24.0){
                    sol = "(" + ubahInt(n1) + ops(j) + "(" + ubahInt(n2) +
ops(i) + ubahInt(n3) + "))" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n2,kabataku(i,n3,n4))) ==
24.0){
```

```
                    sol = ubahInt(n1) + ops(k) + "(" + ubahInt(n2) +
ops(j) + "(" + ubahInt(n3) + ops(i) + ubahInt(n4) + "))";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n4,kabataku(i,n2,n3))) ==
24.0){
                    sol = ubahInt(n1) + ops(k) + "((" + ubahInt(n2) +
ops(i) + ubahInt(n3) + ")" + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
---------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n1,n2),n4),n3) ==
24.0){
                    sol = "((" + ubahInt(n1) + ops(i) + ubahInt(n2) + ")"
+ ops(j) + ubahInt(n4) + ")" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n1,n2),kabataku(j,n4,n3)) ==
24.0){
                    sol = "(" + ubahInt(n1) + ops(i) + ubahInt(n2) + ")" +
ops(k) + "(" + ubahInt(n4) + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n1,kabataku(i,n2,n4))) ==
24.0){
                    sol = "(" + ubahInt(n1) + ops(j) + "(" + ubahInt(n2) +
ops(i) + ubahInt(n4) + "))" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n2,kabataku(i,n4,n3))) ==
24.0){
                    sol = ubahInt(n1) + ops(k) + "(" + ubahInt(n2) +
ops(j) + "(" + ubahInt(n4) + ops(i) + ubahInt(n3) + "))";
```

```
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n3,kabataku(i,n2,n4))) ==
24.0){
                    sol = ubahInt(n1) + ops(k) + "((" + ubahInt(n2) +
ops(i) + ubahInt(n4) + ")" + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n1,n3),n2),n4) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n1) + ops(i) + ubahInt(n3) + ")"
+ ops(j) + ubahInt(n2) + ")" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n1,n3),kabataku(j,n2,n4)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n1) + ops(i) + ubahInt(n3) + ")" +
ops(k) + "(" + ubahInt(n2) + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n1,kabataku(i,n3,n2))) ==
24.0){
                    sol = "(" + ubahInt(n1) + ops(j) + "(" + ubahInt(n3) +
ops(i) + ubahInt(n2) + "))" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n3,kabataku(i,n2,n4))) ==
24.0){
                    sol = ubahInt(n1) + ops(k) + "(" + ubahInt(n3) +
ops(j) + "(" + ubahInt(n2) + ops(i) + ubahInt(n4) + "))";
```

```
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n4,kabataku(i,n3,n2))) ==
24.0){
                    sol = ubahInt(n1) + ops(k) + "((" + ubahInt(n3) +
ops(i) + ubahInt(n2) + ")" + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n1,n3),n4),n2) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n1) + ops(i) + ubahInt(n3) + ")"
+ ops(j) + ubahInt(n4) + ")" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n1,n3),kabataku(j,n4,n2)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n1) + ops(i) + ubahInt(n3) + ")" +
ops(k) + "(" + ubahInt(n4) + ops(j) + ubahInt(n2) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n1,kabataku(i,n3,n4))) ==
24.0){
                    sol = "(" + ubahInt(n1) + ops(j) + "(" + ubahInt(n3) +
ops(i) + ubahInt(n4) + "))" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n3,kabataku(i,n4,n2))) ==
24.0){
                    sol = ubahInt(n1) + ops(k) + "(" + ubahInt(n3) +
ops(j) + "(" + ubahInt(n4) + ops(i) + ubahInt(n2) + "))";
```

```
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n2,kabataku(i,n3,n4))) ==
24.0){
                    sol = ubahInt(n1) + ops(k) + "((" + ubahInt(n3) +
ops(i) + ubahInt(n4) + ")" + ops(j) + ubahInt(n2) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
---------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n1,n4),n2),n3) ==
24.0){
                    sol = "((" + ubahInt(n1) + ops(i) + ubahInt(n4) + ")"
+ ops(j) + ubahInt(n2) + ")" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n1,n4),kabataku(j,n2,n3)) ==
24.0){
                    sol = "(" + ubahInt(n1) + ops(i) + ubahInt(n4) + ")" +
ops(k) + "(" + ubahInt(n2) + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n1,kabataku(i,n4,n2))) ==
24.0){
                    sol = "(" + ubahInt(n1) + ops(j) + "(" + ubahInt(n4) +
ops(i) + ubahInt(n2) + "))" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n4,kabataku(i,n2,n3))) ==
24.0){
                    sol = ubahInt(n1) + ops(k) + "(" + ubahInt(n4) +
ops(j) + "(" + ubahInt(n2) + ops(i) + ubahInt(n3) + "))";
                    counter++;
                    sols.push_back(sol);
```

```
                }
                if(kabataku(k,n1,kabataku(j,n3,kabataku(i,n4,n2))) ==
24.0){
                    sol = ubahInt(n1) + ops(k) + "((" + ubahInt(n4) +
ops(i) + ubahInt(n2) + ")" + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n1,n4),n3),n2) ==
24.0){
                    sol = "((" + ubahInt(n1) + ops(i) + ubahInt(n4) + ")"
+ ops(j) + ubahInt(n3) + ")" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n1,n4),kabataku(j,n3,n2)) ==
24.0){
                    sol = "(" + ubahInt(n1) + ops(i) + ubahInt(n4) + ")" +
ops(k) + "(" + ubahInt(n3) + ops(j) + ubahInt(n2) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n1,kabataku(i,n4,n3))) ==
24.0){
                    sol = "(" + ubahInt(n1) + ops(j) + "(" + ubahInt(n4) +
ops(i) + ubahInt(n3) + "))" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n4,kabataku(i,n3,n2))) ==
24.0){
                    sol = ubahInt(n1) + ops(k) + "(" + ubahInt(n4) +
ops(j) + "(" + ubahInt(n3) + ops(i) + ubahInt(n2) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n1,kabataku(j,n2,kabataku(i,n4,n3))) ==
24.0){
                    sol = ubahInt(n1) + ops(k) + "((" + ubahInt(n4) +
ops(i) + ubahInt(n3) + ")" + ops(j) + ubahInt(n2) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                //
--------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n2,n1),n3),n4) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n2) + ops(i) + ubahInt(n1) + ")"
+ ops(j) + ubahInt(n3) + ")" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n2,n1),kabataku(j,n3,n4)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n2) + ops(i) + ubahInt(n1) + ")" +
ops(k) + "(" + ubahInt(n3) + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n2,kabataku(i,n1,n3))) ==
24.0){
                    sol = "(" + ubahInt(n2) + ops(j) + "(" + ubahInt(n1) +
ops(i) + ubahInt(n3) + "))" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n1,kabataku(i,n3,n4))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "(" + ubahInt(n1) +
ops(j) + "(" + ubahInt(n3) + ops(i) + ubahInt(n4) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n2,kabataku(j,n4,kabataku(i,n1,n3))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "((" + ubahInt(n1) +
ops(i) + ubahInt(n3) + ")" + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
--------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n2,n1),n4),n3) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n2) + ops(i) + ubahInt(n1) + ")"
+ ops(j) + ubahInt(n4) + ")" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n2,n1),kabataku(j,n4,n3)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n2) + ops(i) + ubahInt(n1) + ")" +
ops(k) + "(" + ubahInt(n4) + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n2,kabataku(i,n1,n4))) ==
24.0){
                    sol = "(" + ubahInt(n2) + ops(j) + "(" + ubahInt(n1) +
ops(i) + ubahInt(n4) + "))" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n1,kabataku(i,n4,n3))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "(" + ubahInt(n1) +
ops(j) + "(" + ubahInt(n4) + ops(i) + ubahInt(n3) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n2,kabataku(j,n3,kabataku(i,n1,n4))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "((" + ubahInt(n1) +
ops(i) + ubahInt(n4) + ")" + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
--------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n2,n3),n1),n4) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n2) + ops(i) + ubahInt(n3) + ")"
+ ops(j) + ubahInt(n1) + ")" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n2,n3),kabataku(j,n1,n4)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n2) + ops(i) + ubahInt(n3) + ")" +
ops(k) + "(" + ubahInt(n1) + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n2,kabataku(i,n3,n1))) ==
24.0){
                    sol = "(" + ubahInt(n2) + ops(j) + "(" + ubahInt(n3) +
ops(i) + ubahInt(n1) + "))" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n3,kabataku(i,n1,n4))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "(" + ubahInt(n3) +
ops(j) + "(" + ubahInt(n1) + ops(i) + ubahInt(n4) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n2,kabataku(j,n4,kabataku(i,n3,n1))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "((" + ubahInt(n3) +
ops(i) + ubahInt(n1) + ")" + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
--------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n2,n3),n4),n1) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n2) + ops(i) + ubahInt(n3) + ")"
+ ops(j) + ubahInt(n4) + ")" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n2,n3),kabataku(j,n4,n1)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n2) + ops(i) + ubahInt(n3) + ")" +
ops(k) + "(" + ubahInt(n4) + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n2,kabataku(i,n3,n4))) ==
24.0){
                    sol = "(" + ubahInt(n2) + ops(j) + "(" + ubahInt(n3) +
ops(i) + ubahInt(n4) + "))" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n3,kabataku(i,n4,n1))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "(" + ubahInt(n3) +
ops(j) + "(" + ubahInt(n4) + ops(i) + ubahInt(n1) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n2,kabataku(j,n1,kabataku(i,n3,n4))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "((" + ubahInt(n3) +
ops(i) + ubahInt(n4) + ")" + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
--------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n2,n4),n1),n3) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n2) + ops(i) + ubahInt(n4) + ")"
+ ops(j) + ubahInt(n1) + ")" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n2,n4),kabataku(j,n1,n3)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n2) + ops(i) + ubahInt(n4) + ")" +
ops(k) + "(" + ubahInt(n1) + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n2,kabataku(i,n4,n1))) ==
24.0){
                    sol = "(" + ubahInt(n2) + ops(j) + "(" + ubahInt(n4) +
ops(i) + ubahInt(n1) + "))" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n4,kabataku(i,n1,n3))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "(" + ubahInt(n4) +
ops(j) + "(" + ubahInt(n1) + ops(i) + ubahInt(n3) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n2,kabataku(j,n3,kabataku(i,n4,n1))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "((" + ubahInt(n4) +
ops(i) + ubahInt(n1) + ")" + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
---------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n2,n4),n3),n1) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n2) + ops(i) + ubahInt(n4) + ")"
+ ops(j) + ubahInt(n3) + ")" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n2,n4),kabataku(j,n3,n1)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n2) + ops(i) + ubahInt(n4) + ")" +
ops(k) + "(" + ubahInt(n3) + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n2,kabataku(i,n4,n3))) ==
24.0){
                    sol = "(" + ubahInt(n2) + ops(j) + "(" + ubahInt(n4) +
ops(i) + ubahInt(n3) + "))" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n4,kabataku(i,n3,n1))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "(" + ubahInt(n4) +
ops(j) + "(" + ubahInt(n3) + ops(i) + ubahInt(n1) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n2,kabataku(j,n1,kabataku(i,n4,n3))) ==
24.0){
                    sol = ubahInt(n2) + ops(k) + "((" + ubahInt(n4) +
ops(i) + ubahInt(n3) + ")" + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
--------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n3,n1),n2),n4) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n3) + ops(i) + ubahInt(n1) + ")"
+ ops(j) + ubahInt(n2) + ")" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n3,n1),kabataku(j,n2,n4)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n3) + ops(i) + ubahInt(n1) + ")" +
ops(k) + "(" + ubahInt(n2) + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n3,kabataku(i,n1,n2))) ==
24.0){
                    sol = "(" + ubahInt(n3) + ops(j) + "(" + ubahInt(n1) +
ops(i) + ubahInt(n2) + "))" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n1,kabataku(i,n2,n4))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "(" + ubahInt(n1) +
ops(j) + "(" + ubahInt(n2) + ops(i) + ubahInt(n4) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n3,kabataku(j,n4,kabataku(i,n1,n2))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "((" + ubahInt(n1) +
ops(i) + ubahInt(n2) + ")" + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
--------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n3,n1),n4),n2) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n3) + ops(i) + ubahInt(n1) + ")"
+ ops(j) + ubahInt(n4) + ")" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n3,n1),kabataku(j,n4,n2)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n3) + ops(i) + ubahInt(n1) + ")" +
ops(k) + "(" + ubahInt(n4) + ops(j) + ubahInt(n2) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n3,kabataku(i,n1,n4))) ==
24.0){
                    sol = "(" + ubahInt(n3) + ops(j) + "(" + ubahInt(n1) +
ops(i) + ubahInt(n4) + "))" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n1,kabataku(i,n4,n2))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "(" + ubahInt(n1) +
ops(j) + "(" + ubahInt(n4) + ops(i) + ubahInt(n2) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n3,kabataku(j,n2,kabataku(i,n1,n4))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "((" + ubahInt(n1) +
ops(i) + ubahInt(n4) + ")" + ops(j) + ubahInt(n2) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
--------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n3,n2),n1),n4) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n3) + ops(i) + ubahInt(n2) + ")"
+ ops(j) + ubahInt(n1) + ")" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n3,n2),kabataku(j,n1,n4)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n3) + ops(i) + ubahInt(n2) + ")" +
ops(k) + "(" + ubahInt(n1) + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n3,kabataku(i,n2,n1))) ==
24.0){
                    sol = "(" + ubahInt(n3) + ops(j) + "(" + ubahInt(n2) +
ops(i) + ubahInt(n1) + "))" + ops(k) + ubahInt(n4);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n2,kabataku(i,n1,n4))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "(" + ubahInt(n2) +
ops(j) + "(" + ubahInt(n1) + ops(i) + ubahInt(n4) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n3,kabataku(j,n4,kabataku(i,n2,n1))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "((" + ubahInt(n2) +
ops(i) + ubahInt(n1) + ")" + ops(j) + ubahInt(n4) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
--------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n3,n2),n4),n1) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n3) + ops(i) + ubahInt(n2) + ")"
+ ops(j) + ubahInt(n4) + ")" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n3,n2),kabataku(j,n4,n1)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n3) + ops(i) + ubahInt(n2) + ")" +
ops(k) + "(" + ubahInt(n4) + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n3,kabataku(i,n2,n4))) ==
24.0){
                    sol = "(" + ubahInt(n3) + ops(j) + "(" + ubahInt(n2) +
ops(i) + ubahInt(n4) + "))" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n2,kabataku(i,n4,n1))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "(" + ubahInt(n2) +
ops(j) + "(" + ubahInt(n4) + ops(i) + ubahInt(n1) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n3,kabataku(j,n1,kabataku(i,n2,n4))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "((" + ubahInt(n2) +
ops(i) + ubahInt(n4) + ")" + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
--------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n3,n4),n1),n2) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n3) + ops(i) + ubahInt(n4) + ")"
+ ops(j) + ubahInt(n1) + ")" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n3,n4),kabataku(j,n1,n2)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n3) + ops(i) + ubahInt(n4) + ")" +
ops(k) + "(" + ubahInt(n1) + ops(j) + ubahInt(n2) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n3,kabataku(i,n4,n1))) ==
24.0){
                    sol = "(" + ubahInt(n3) + ops(j) + "(" + ubahInt(n4) +
ops(i) + ubahInt(n1) + "))" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n4,kabataku(i,n1,n2))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "(" + ubahInt(n4) +
ops(j) + "(" + ubahInt(n1) + ops(i) + ubahInt(n2) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n3,kabataku(j,n2,kabataku(i,n4,n1))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "((" + ubahInt(n4) +
ops(i) + ubahInt(n1) + ")" + ops(j) + ubahInt(n2) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
---------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n3,n4),n2),n1) ==
24.0){
                // ((n1 i n2) j n3) k n4
                    sol = "((" + ubahInt(n3) + ops(i) + ubahInt(n4) + ")"
+ ops(j) + ubahInt(n2) + ")" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n3,n4),kabataku(j,n2,n1)) ==
24.0){
                // (n1 i n2) k (n3 j n4)
                    sol = "(" + ubahInt(n3) + ops(i) + ubahInt(n4) + ")" +
ops(k) + "(" + ubahInt(n2) + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n3,kabataku(i,n4,n2))) ==
24.0){
                    sol = "(" + ubahInt(n3) + ops(j) + "(" + ubahInt(n4) +
ops(i) + ubahInt(n2) + "))" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n4,kabataku(i,n2,n1))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "(" + ubahInt(n4) +
ops(j) + "(" + ubahInt(n2) + ops(i) + ubahInt(n1) + "))";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                if(kabataku(k,n3,kabataku(j,n1,kabataku(i,n4,n2))) ==
24.0){
                    sol = ubahInt(n3) + ops(k) + "((" + ubahInt(n4) +
ops(i) + ubahInt(n2) + ")" + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
---------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n4,n1),n2),n3) ==
24.0){
                    sol = "((" + ubahInt(n4) + ops(i) + ubahInt(n1) + ")"
+ ops(j) + ubahInt(n2) + ")" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n4,n1),kabataku(j,n2,n3)) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(i) + ubahInt(n1) + ")" +
ops(k) + "(" + ubahInt(n2) + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n4,kabataku(i,n1,n2))) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(j) + "(" + ubahInt(n1) +
ops(i) + ubahInt(n2) + "))" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n1,kabataku(i,n2,n3))) ==
24.0){
                    sol = ubahInt(n4) + ops(k) + "(" + ubahInt(n1) +
ops(j) + "(" + ubahInt(n2) + ops(i) + ubahInt(n3) + "))";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n3,kabataku(i,n1,n2))) ==
24.0){
```

```
                    sol = ubahInt(n4) + ops(k) + "((" + ubahInt(n1) +
ops(i) + ubahInt(n2) + ")" + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
---------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n4,n1),n3),n2) ==
24.0){
                    sol = "((" + ubahInt(n4) + ops(i) + ubahInt(n1) + ")"
+ ops(j) + ubahInt(n3) + ")" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n4,n1),kabataku(j,n3,n2)) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(i) + ubahInt(n1) + ")" +
ops(k) + "(" + ubahInt(n3) + ops(j) + ubahInt(n2) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n4,kabataku(i,n1,n3))) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(j) + "(" + ubahInt(n1) +
ops(i) + ubahInt(n3) + "))" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n1,kabataku(i,n3,n2))) ==
24.0){
                    sol = ubahInt(n4) + ops(k) + "(" + ubahInt(n1) +
ops(j) + "(" + ubahInt(n3) + ops(i) + ubahInt(n2) + "))";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n2,kabataku(i,n1,n3))) ==
24.0){
                    sol = ubahInt(n4) + ops(k) + "((" + ubahInt(n1) +
ops(i) + ubahInt(n3) + ")" + ops(j) + ubahInt(n2) + ")";
```

```
                    counter++;
                    sols.push_back(sol);
                }

                //
----------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n4,n2),n1),n3) ==
24.0){
                    sol = "((" + ubahInt(n4) + ops(i) + ubahInt(n2) + ")"
+ ops(j) + ubahInt(n1) + ")" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n4,n2),kabataku(j,n1,n3)) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(i) + ubahInt(n2) + ")" +
ops(k) + "(" + ubahInt(n1) + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n3,kabataku(j,n4,kabataku(i,n2,n1))) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(j) + "(" + ubahInt(n2) +
ops(i) + ubahInt(n1) + "))" + ops(k) + ubahInt(n3);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n2,kabataku(i,n1,n3))) ==
24.0){
                    sol = ubahInt(n4) + ops(k) + "(" + ubahInt(n2) +
ops(j) + "(" + ubahInt(n1) + ops(i) + ubahInt(n3) + "))";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n3,kabataku(i,n2,n1))) ==
24.0){
                    sol = ubahInt(n4) + ops(k) + "((" + ubahInt(n2) +
ops(i) + ubahInt(n1) + ")" + ops(j) + ubahInt(n3) + ")";
                    counter++;
                    sols.push_back(sol);
```

```
                }

                //
-------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n4,n2),n3),n1) ==
24.0){
                    sol = "((" + ubahInt(n4) + ops(i) + ubahInt(n2) + ")"
+ ops(j) + ubahInt(n3) + ")" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n4,n2),kabataku(j,n3,n1)) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(i) + ubahInt(n2) + ")" +
ops(k) + "(" + ubahInt(n3) + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n4,kabataku(i,n2,n3))) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(j) + "(" + ubahInt(n2) +
ops(i) + ubahInt(n3) + "))" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n2,kabataku(i,n3,n1))) ==
24.0){
                    sol = ubahInt(n4) + ops(k) + "(" + ubahInt(n2) +
ops(j) + "(" + ubahInt(n3) + ops(i) + ubahInt(n1) + "))";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n1,kabataku(i,n2,n3))) ==
24.0){
                    sol = ubahInt(n4) + ops(k) + "((" + ubahInt(n2) +
ops(i) + ubahInt(n3) + ")" + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }
```

```
                //
--------------------------------------------------------------------------
                if(kabataku(k,kabataku(j,kabataku(i,n4,n3),n1),n2) ==
24.0){
                    sol = "((" + ubahInt(n4) + ops(i) + ubahInt(n3) + ")"
+ ops(j) + ubahInt(n1) + ")" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n4,n3),kabataku(j,n1,n2)) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(i) + ubahInt(n3) + ")" +
ops(k) + "(" + ubahInt(n1) + ops(j) + ubahInt(n2) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n2,kabataku(j,n4,kabataku(i,n3,n1))) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(j) + "(" + ubahInt(n3) +
ops(i) + ubahInt(n1) + "))" + ops(k) + ubahInt(n2);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n3,kabataku(i,n1,n2))) ==
24.0){
                    sol = ubahInt(n4) + ops(k) + "(" + ubahInt(n3) +
ops(j) + "(" + ubahInt(n1) + ops(i) + ubahInt(n2) + "))";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n2,kabataku(i,n3,n1))) ==
24.0){
                    sol = ubahInt(n4) + ops(k) + "((" + ubahInt(n3) +
ops(i) + ubahInt(n1) + ")" + ops(j) + ubahInt(n2) + ")";
                    counter++;
                    sols.push_back(sol);
                }

                //
--------------------------------------------------------------------------
```

```
                if(kabataku(k,kabataku(j,kabataku(i,n4,n3),n2),n1) ==
24.0){
                    sol = "((" + ubahInt(n4) + ops(i) + ubahInt(n3) + ")"
+ ops(j) + ubahInt(n2) + ")" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,kabataku(i,n4,n3),kabataku(j,n2,n1)) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(i) + ubahInt(n3) + ")" +
ops(k) + "(" + ubahInt(n2) + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n1,kabataku(j,n4,kabataku(i,n3,n2))) ==
24.0){
                    sol = "(" + ubahInt(n4) + ops(j) + "(" + ubahInt(n3) +
ops(i) + ubahInt(n2) + "))" + ops(k) + ubahInt(n1);
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n3,kabataku(i,n2,n1))) ==
24.0){
                    sol = ubahInt(n4) + ops(k) + "(" + ubahInt(n3) +
ops(j) + "(" + ubahInt(n2) + ops(i) + ubahInt(n1) + "))";
                    counter++;
                    sols.push_back(sol);
                }
                if(kabataku(k,n4,kabataku(j,n1,kabataku(i,n3,n2))) ==
24.0){
                    sol = ubahInt(n4) + ops(k) + "((" + ubahInt(n3) +
ops(i) + ubahInt(n2) + ")" + ops(j) + ubahInt(n1) + ")";
                    counter++;
                    sols.push_back(sol);
                }

            }
        }
    }
    auto end = chrono::steady_clock::now();
```

```
    double waktu = chrono::duration_cast<chrono::microseconds>(end -
init).count() * 0.001;

    if(counter != 0){
        cout << counter << " solusi ditemukan." << endl;
        /*auto it = std::unique(sols.begin(), sols.end());
        sols.erase(it, sols.end());
        std::sort(sols.begin(), sols.end());
        it = std::unique(sols.begin(), sols.end()); */

        vector<string> nsols = removeduplicate(sols, sols.size());
        for(int ok=0;ok<counter;ok++){
            cout << nsols[ok] << endl;
        }
    }
    else{
        cout << "Tidak ada solusi yang ditemukan." << endl;
    }
    cout << "Program berhasil dijalankan dengan waktu " << waktu << " ms."
<< endl;

    cout << "Ingin menyimpan jawaban dalam bentuk file? (1 (Ya), 0
(Tidak))" << endl;
    int pil;
    do{
        cin >> pil;
        if(pil != 1 && pil != 0){
            cout << "Mohon masukkan input yang sesuai." << endl;
        }
    }while(pil != 1 && pil != 0);

    if(pil == 1){
        ofstream ansFile;
        string file = "../test/answer.txt";
        ansFile.open(file.c_str());
        ansFile << "Untuk kartu " + x1 + ", " + x2 + ", " + x3 + " dan " +
x4 + ","<< endl;
        if(counter != 0){
            ansFile << "Terdapat " << counter  << " solusi ditemukan." <<
endl;
```

```
            vector<string> nsols = removeduplicate(sols, sols.size());
            for(int ok=0;ok<counter;ok++){
                ansFile << nsols[ok] << endl;
            }
        }
        else{
            ansFile << "Tidak ada solusi yang ditemukan.";
        }
    }
    else{
        cout << "Terima kasih telah menggunakan solver ini." << endl;
    }

    return 0;


}
```

Bab 3:

Contoh Input dan Output

1.

```
Selamat datang pada solver permainan 24.
Apakah anda ingin memasukkan kartu sendiri?
(1/Ya, 2/Masukkan kartu secara random)
1
Masukkan 4 buah kartu yang ingin digunakan
A J K Q
Kartu anda adalah:
1.000000 11.000000 13.000000 12.000000
31 solusi ditemukan.
(1*12)*(13-11)
((13*1)-11)*12
(13-(1*11))*12
(13-(11*1))*12
12*((1*11)-13)
(12*1)*(13-11)
12*((11*1)-13)
12*(13-(1*11))
12*(13-(11*1))
((13/1)-11)*12
(13-(11/1))*12
(12/1)*(13-11)
12*((11/1)-13)
12*(13-(11/1))
(1*(13-11))*12
1*((13-11)*12)
1*(12*(13-11))
((13-11)*1)*12
(13-11)*(1*12)
((13-11)*12)*1
```

```
12*(1*(13-11))
(12*(13-11))*1
12*((13-11)*1)
((13-11)*12)/1
((13-11)/1)*12
(13-11)*(12/1)
(1/(13-11))/12
12/(1/(13-11))
12/((13-11)/1)
Program berhasil dijalankan dengan waktu 0.992 ms.
Ingin menyimpan jawaban dalam bentuk file? (1 (Ya), 0 (Tidak))
0
Jawaban tidak disimpan dalam bentuk file.
Terima kasih telah menggunakan solver ini.
```

2.

```
Selamat datang pada solver permainan 24.
Apakah anda ingin memasukkan kartu sendiri?
(1/Ya, 2/Masukkan kartu secara random)
2
Kartu anda adalah:
3.000000 8.000000 4.000000 7.000000
7 solusi ditemukan.
8+(4*(7-3))
8+((7-3)*4)
(4*(7-3))+8
((7-3)*4)+8
8-((3-7)*4)
8-(4*(3-7))
(4*(3-7))-8
Program berhasil dijalankan dengan waktu 0 ms.
Ingin menyimpan jawaban dalam bentuk file? (1 (Ya), 0 (Tidak))
1
File telah berhasil tersimpan pada test/answer.txt
Terima kasih telah menggunakan solver ini.
```

3.

```
Selamat datang pada solver permainan 24.
Apakah anda ingin memasukkan kartu sendiri?
(1/Ya, 2/Masukkan kartu secara random)
1
Masukkan 4 buah kartu yang ingin digunakan
5 7 8 9
Kartu anda adalah:
5.000000 7.000000 8.000000 9.000000
24 solusi ditemukan.
(5*8)-(7+9)
(5*8)-(9+7)
(8*5)-(7+9)
(8*5)-(9+7)
((5*8)-7)-9
((5*8)-9)-7
((8*5)-7)-9
((8*5)-9)-7
((5+7)-9)*8
((7+5)-9)*8
(5+(7-9))*8
((5-9)+7)*8
(7+(5-9))*8
((7-9)+5)*8
8*(5+(7-9))
8*((5-9)+7)
8*(7+(5-9))
8*((7-9)+5)
(5-(9-7))*8
(7-(9-5))*8
8*(5-(9-7))
8*(7-(9-5))
8*((9-5)-7)
8*((9-7)-5)
Program berhasil dijalankan dengan waktu 0 ms.
Ingin menyimpan jawaban dalam bentuk file? (1 (Ya), 0 (Tidak))
0
Jawaban tidak disimpan dalam bentuk file.
Terima kasih telah menggunakan solver ini.
```

4.

```
Selamat datang pada solver permainan 24.
Apakah anda ingin memasukkan kartu sendiri?
(1/Ya, 2/Masukkan kartu secara random)
1
Masukkan 4 buah kartu yang ingin digunakan
8 6 9 5
Kartu anda adalah:
8.000000 6.000000 9.000000 5.000000
22 solusi ditemukan.
((6+9)*8)/5
((9+6)*8)/5
((6+9)/5)*8
((9+6)/5)*8
(6+9)/(5/8)
(9+6)/(5/8)
((8+5)-9)*6
((5+8)-9)*6
((8-9)+5)*6
(8+(5-9))*6
6*((8-9)+5)
6*(8+(5-9))
6*(5+(8-9))
6*((5-9)+8)
(5+(8-9))*6
((5-9)+8)*6
(8-(9-5))*6
6*(8-(9-5))
6*((9-8)-5)
6*((9-5)-8)
6*(5-(9-8))
(5-(9-8))*6
Program berhasil dijalankan dengan waktu 0 ms.
Ingin menyimpan jawaban dalam bentuk file? (1 (Ya), 0 (Tidak))
1
File telah berhasil tersimpan pada test/answer.txt
Terima kasih telah menggunakan solver ini.
```

5.

```
Selamat datang pada solver permainan 24.
Apakah anda ingin memasukkan kartu sendiri?
(1/Ya, 2/Masukkan kartu secara random)
1
Masukkan 4 buah kartu yang ingin digunakan
8 6 4 5
Kartu anda adalah:
8.000000 6.000000 4.000000 5.000000
16 solusi ditemukan.
((4+5)-6)*8
((5+4)-6)*8
8*((4-6)+5)
8*(4+(5-6))
8*((5-6)+4)
8*(5+(4-6))
((4-6)+5)*8
(4+(5-6))*8
((5-6)+4)*8
(5+(4-6))*8
8*((6-4)-5)
8*((6-5)-4)
8*(4-(6-5))
8*(5-(6-4))
(4-(6-5))*8
(5-(6-4))*8
Program berhasil dijalankan dengan waktu 0 ms.
Ingin menyimpan jawaban dalam bentuk file? (1 (Ya), 0 (Tidak))
0
Jawaban tidak disimpan dalam bentuk file.
Terima kasih telah menggunakan solver ini.
```

6.

```
Selamat datang pada solver permainan 24.
Apakah anda ingin memasukkan kartu sendiri?
(1/Ya, 2/Masukkan kartu secara random)
1
Masukkan 4 buah kartu yang ingin digunakan
K 4 5 6
Kartu anda adalah:
13.000000 4.000000 5.000000 6.000000
8 solusi ditemukan.
(13-(4+5))*6
(13-(5+4))*6
6*(13-(4+5))
6*(13-(5+4))
6*((4+5)-13)
6*((5+4)-13)
((13-4)-5)*6
((13-5)-4)*6
Program berhasil dijalankan dengan waktu 0 ms.
Ingin menyimpan jawaban dalam bentuk file? (1 (Ya), 0 (Tidak))
0
Jawaban tidak disimpan dalam bentuk file.
Terima kasih telah menggunakan solver ini.
```

Lampiran

Link repository github: https://github.com/shidqizh/Tucil1_13521097

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