Laporan Tugas Kecil 1 IF2211 Strategi Algoritma
Penyelesaian Permainan Kartu 24 dengan Algoritma *Brute Force*
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Oleh:
Puti Nabilla Aidira (13521088)

Sekolah Teknik Elektro dan Informatika
Institut Teknologi Bandung
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Daftar Isi

Cek List Poin

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	✓	

Deskripsi Algoritma

Algoritma yang digunakan untuk menemukan solusi-solusi pada persoalan kartu 24 adalah algoritma Brute Force yang dijabarkan dalam langkah-langkah berikut.

1. Nomor-nomor kartu disimpan dalam variabel bertipe float a, b, c, dan d.
2. Keempat variabel a, b, c, dan d dievaluasi dalam fungsi `GROUPING1`, `GROUPING2`, `GROUPING3`, `GROUPING4`, dan `GROUPING5`, yang mengevaluasi operasi dengan urutan prioritas (tanda kurung) berturut-turut: `(a_b)_(c_d)`, `((a_b)_c)_d`, `(a_(b_c))_d`, `a_((b_c)_d)`, dan `a_(b_(c_d))`.
3. Pada setiap fungsi `GROUPING` dilakukan iterasi pada setiap permutasi nilai-nilai a, b, c, d (24 permutasi) dengan fungsi `PERMUTE`. Implementasi fungsi `PERMUTE` adalah dengan menggunakan switch-case untuk setiap permutasi (case 0-23) . Pada setiap case, nilai-nilai a, b, c, d di-*assign* dengan permutasinya.
4. Di dalam setiap iterasi permutasi nilai-nilai a, b, c, d, dilakukan pula iterasi sebanyak 4^3 untuk mempermutasikan kombinasi operasi (terdapat 4 jenis operator: +, -, *, / dan 3 kali operasi).
5. Selanjutnya, pada setiap 24 * 4^3 iterasi, operasi antara a, b, c, dan, d dihitung menggunakan fungsi `OPERATE` sesuai operator serta uratan prioritasnya.
6. Hasil operasi dibandingkan dengan 24 menggunakan fungsi `is24`. Jika hasil operasi berada pada rentang 24 ± 0.000001, hasil operasi tersebut dianggap sama dengan 24 dan menjadi salah satu solusi.
7. Setiap solusi yang memenuhi disimpan dengan format string ke dalam unsorted_set.
8. Pada akhir algoritma, semua solusi yang mungkin tersimpan pada unsorted_set.

Source Code

Program ditulis dalam bahasa pemograman C++. Berikut dilampirkan *source code* program.

```
#include <iostream>
#include <unordered_set>
#include <fstream>

using namespace std;

unordered_set <string> setres;

float OPERATE(char op, float val1, float val2){
   switch(op){
       case '+': return val1 + val2;
       case '-': return val1 - val2;
       case '*': return val1 * val2;
       case '/': return val1 / val2;
       default: return -1;
   }
}

float INPUT_CONVERTER(string s){
   if (s == "A" || s == "1") return 1;
   else if (s == "2") return 2;
   else if (s == "3") return 3;
   else if (s == "4") return 4;
   else if (s == "5") return 5;
   else if (s == "6") return 6;
   else if (s == "7") return 7;
   else if (s == "8") return 8;
   else if (s == "9") return 9;
   else if (s == "10") return 10;
   else if (s == "J") return 11;
   else if (s == "Q") return 12;
   else if (s == "K") return 13;
   else return -1;
}
```

```
bool is24(float x){
   return (24 - x <= 0.000001 && 24 - x >= -0.000001);
}

void PERMUTE(int i, float* a, float* b, float* c, float* d, float w, float x, float
y, float z){
   switch(i){
       case 0: break;
       case 1: {
           *a = x;
           *b = w;
           *c = y;
           *d = z;
           break;
       }
       case 2: {
           *a = y;
           *b = w;
           *c = x;
           *d = z;
           break;
       }
       case 3: {
           *a = w;
           *b = y;
           *c = x;
           *d = z;
           break;
       }
       case 4: {
           *a = x;
           *b = y;
           *c = w;
           *d = z;
           break;
       }
       case 5: {
           *a = y;
           *b = x;
           *c = w;
```

```
            *d = z;
            break;
        }
        case 6: {
            *a = y;
            *b = x;
            *c = z;
            *d = w;
            break;
        }
        case 7: {
            *a = x;
            *b = y;
            *c = z;
            *d = w;
            break;
        }
        case 8: {
            *a = z;
            *b = y;
            *c = x;
            *d = w;
            break;
        }
        case 9: {
            *a = y;
            *b = z;
            *c = x;
            *d = w;
            break;
        }
        case 10: {
            *a = x;
            *b = z;
            *c = y;
            *d = w;
            break;
        }
        case 11: {
            *a = z;
            *b = x;
```

```
            *c = y;
            *d = w;
            break;
        }
        case 12: {
            *a = z;
            *b = w;
            *c = y;
            *d = x;
            break;
        }
        case 13: {
            *a = w;
            *b = z;
            *c = y;
            *d = x;
            break;
        }
        case 14: {
            *a = y;
            *b = z;
            *c = w;
            *d = x;
            break;
        }
        case 15: {
            *a = z;
            *b = y;
            *c = w;
            *d = x;
            break;
        }
        case 16: {
            *a = w;
            *b = y;
            *c = z;
            *d = x;
            break;
        }
        case 17:
        {
```

```
            *a = y;
            *b = w;
            *c = z;
            *d = x;
            break;
        }
        case 18:
        {
            *a = x;
            *b = w;
            *c = z;
            *d = y;
            break;
        }
        case 19:
        {
            *a = w;
            *b = x;
            *c = z;
            *d = y;
            break;
        }
        case 20:
        {
            *a = z;
            *b = x;
            *c = w;
            *d = y;
            break;
        }
        case 21:
        {
            *a = x;
            *b = z;
            *c = w;
            *d = y;
            break;
        }
        case 22:
        {
            *a = w;
```

```
            *b = z;
            *c = x;
            *d = y;
            break;
        }
        case 23:
        {
            *a = z;
            *b = w;
            *c = x;
            *d = y;
            break;
        }
    }
}

void GROUPING1(float a, float b, float c, float d, char ops[4]){
    // (a_b)_(c_d)
    float w = a, x = b, y = c, z = d, res, res1, res2;
    for(int i = 0; i < 24; i++){
        PERMUTE(i, &a, &b, &c, &d, w, x, y, z);
        for(int j = 0; j < 4; j++){
            for(int k = 0; k < 4; k++){
                for(int l = 0; l < 4; l++){
                    res1 = OPERATE(ops[j], a, b);
                    res2 = OPERATE(ops[k], c, d);
                    res = OPERATE(ops[l], res1, res2);
                    if(is24(res)){
                        setres.insert("(" + to_string((int)a) + ops[j] +
to_string((int)b) + ")" + ops[l] + "(" + to_string((int)c) + ops[k] +
to_string((int)d) + ")");
                    }
                }
            }
        }
    }
}

void GROUPING2(float a, float b, float c, float d, char ops[4]){
    // ((a_b)_c)_d
    float w = a, x = b, y = c, z = d, res, res1, res2;
```

```
   for(int i = 0; i < 24; i++){
       PERMUTE(i, &a, &b, &c, &d, w, x, y, z);
       for(int j = 0; j < 4; j++){
           for(int k = 0; k < 4; k++){
               for(int l = 0; l < 4; l++){
                   res1 = OPERATE(ops[j], a, b);
                   res2 = OPERATE(ops[k], res1, c);
                   res = OPERATE(ops[l], res2, d);
                   if(is24(res)){
                       setres.insert("((" + to_string((int)a) + ops[j] +
to_string((int)b) + ")" + ops[k] + to_string((int)c) + ")" + ops[l] +
to_string((int)d));
                   }
               }
           }
       }
   }
}

void GROUPING3(float a, float b, float c, float d, char ops[4]){
   // (a_(b_c))_d
   float w = a, x = b, y = c, z = d, res, res1, res2;
   for(int i = 0; i < 24; i++){
       PERMUTE(i, &a, &b, &c, &d, w, x, y, z);
       for(int j = 0; j < 4; j++){
           for(int k = 0; k < 4; k++){
               for(int l = 0; l < 4; l++){
                   res1 = OPERATE(ops[j], b, c);
                   res2 = OPERATE(ops[k], a, res1);
                   res = OPERATE(ops[l], res2, d);
                   if(is24(res)){
                       setres.insert("(" + to_string((int)a) + ops[k] + "(" +
to_string((int)b) + ops[j] + to_string((int)c) + "))" + ops[l] + to_string((int)d));
                   }
               }
           }
       }
   }
}

void GROUPING4(float a, float b, float c, float d, char ops[4]){
```

```
    // a_((b_c)_d)
    float w = a, x = b, y = c, z = d, res, res1, res2;
    for(int i = 0; i < 24; i++){
        PERMUTE(i, &a, &b, &c, &d, w, x, y, z);
        for(int j = 0; j < 4; j++){
            for(int k = 0; k < 4; k++){
                for(int l = 0; l < 4; l++){
                    res1 = OPERATE(ops[j], b, c);
                    res2 = OPERATE(ops[k], res1, d);
                    res = OPERATE(ops[l], a, res2);
                    if(is24(res)){
                        setres.insert(to_string((int)a) + ops[l] + "((" +
to_string((int)b) + ops[j] + to_string((int)c) + ")" + ops[k] + to_string((int)d) +
"))");
                    }
                }
            }
        }
    }
}

void GROUPING5(float a, float b, float c, float d, char ops[4]){
    // a_(b_(c_d))
    float w = a, x = b, y = c, z = d, res, res1, res2;
    for(int i = 0; i < 24; i++){
        PERMUTE(i, &a, &b, &c, &d, w, x, y, z);
        for(int j = 0; j < 4; j++){
            for(int k = 0; k < 4; k++){
                for(int l = 0; l < 4; l++){
                    res1 = OPERATE(ops[j], c, d);
                    res2 = OPERATE(ops[k], b, res1);
                    res = OPERATE(ops[l], a, res2);
                    if(is24(res)){
                        setres.insert(to_string((int)a) + ops[l] + "(" +
to_string((int)b) + ops[k] + "(" + to_string((int)c) + ops[j] + to_string((int)d) +
"))");
                    }
                }
            }
        }
    }
```

```
}

void SPLASHSCREEN(){
   cout << "
_____         ___    " << "\n";
   cout << "
.-''-.           /    /     .'/   \\  " << "\n";
   cout << "    __  __   ___                  .           __.....__
.--.                          .' .-.  )          /    /      / /      \\ " << "\n";
   cout << "    |  |/  `.'   `.              .'|        .-''          '.
|__|                         / .'  / /          /    /       | |      | " << "\n";
   cout << "    |   .-.  .-.   '           .'  |       /      .-\'\'\"\'-.  `.
.--.     .|               (_/   / /          /    /        | |      | " << "\n";
   cout << "    |  |  |  |  |  |    __   <    |     /      /________\\   \\
|  |   .' |_                    / /          /    /  __     |/`.   .' " << "\n";
   cout << "    |  |  |  |  |  | .:--.'.  |   | ____|                  |          |
| .'     |                  / /          /    /  |  |    `.|   |  " << "\n";
   cout << "    |  |  |  |  |  |/ |   \\ | |   | \\ .\'\\    .-------------'
|  |'--.  .-'                . '          /    '   |  |     ||___|  " << "\n";
   cout << "    |  |  |  |  |  |`\" __ | | |   |/  .  \\     '-.____...---.
|  |   |  |                  / /    _.-')/    '----|  |---. |/___/  " << "\n";
   cout << "    |__|  |__|  |__| .'.''| | |    /\\  \\  `.              .'
|__|   |  |                .' '  _.'.-''/           |  |   | .'.--.  " << "\n";
   cout << "                      / /   | |_|   |  \\  \\   `''-..... -'
|  '.'            /  /.-'_.'    '----------|  |---'| |    | " << "\n";
   cout << "                      \\ \\._,\\ '/'    \\  \\  \\
|   /            /    _.'                  |  |    \\_\\    / " << "\n";
   cout <<"                      `--'  `\"\'------\'  \'---\'
`'-'            ( _.-'                    /____\\    `\'\'--\'  " << "\n\n";
   cout << "\'\'\'\'\'\'\'\'\n";
   cout << " The 24 card game is an arithmetic card game \n with the aim of finding
ways to operate 4 random card numbers \n so that the final result is 24.\n\n" ;
   cout << "\'\'\'\'\'\'\'\'\n\n";
}



int main(){
   float a, b, c, d;
   bool running = 1;
   char ops[4] = {'+', '-', '*', '/'};
   clock_t start, end;
```

```
   SPLASHSCREEN();
   while(running){
       int ressum = 0;
       int opt;
       cout << "Choose an option (1/2/3):\n";
       cout << "1. Generate random cards\n";
       cout << "2. Input my own cards\n";
       cout << "3. Exit\n";
       cin >> opt;
       switch(opt){
           case 1: {
               int ai, bi, ci, di;
               cout << "Generating random cards...\n";
               srand(time(0));
               ai = rand() % 13 + 1;
               bi = rand() % 13 + 1;
               ci = rand() % 13 + 1;
               di = rand() % 13 + 1;
               cout << "1: " << ai << "\n";
               cout << "2: " << bi << "\n";
               cout << "3: " << ci << "\n";
               cout << "4: " << di << "\n";
               a = (float) ai;
               b = (float) bi;
               c = (float) ci;
               d = (float) di;
               start = clock();
               GROUPING1(a, b, c, d, ops);
               GROUPING2(a, b, c, d, ops);
               GROUPING3(a, b, c, d, ops);
               GROUPING4(a, b, c, d, ops);
               GROUPING5(a, b, c, d, ops);
               end = clock();
               cout << "\n" << setres.size() << " solution(s) found\n";
               int i = 0;
               unordered_set<string> :: iterator itr;
               for (itr = setres.begin(); itr != setres.end(); itr++){
                   if(i % 4 == 0 || i % 4 == 1 || i % 4 == 2 || i == setres.size() -
1) cout << *itr << "  ";
                   else cout << *itr << "\n";
                   i++;
```

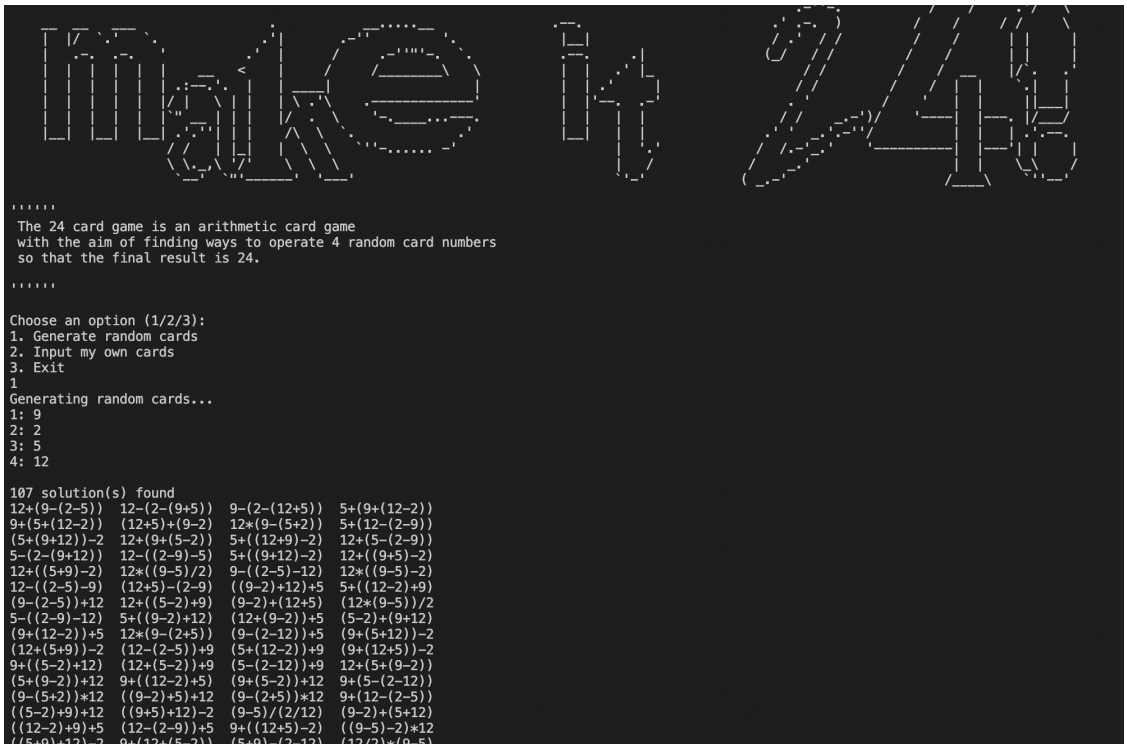
```
                }
                cout << "\n\n";
                double time_taken = double (end - start) / double(CLOCKS_PER_SEC);
                cout << "Time taken to search the solution is : " << fixed <<
time_taken << setprecision(5) << " sec\n\n";
                cout << "*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o\n\n";
                bool invalid = 1;
                invalid = 1;
                while(invalid){
                    cout << "Do you want to save the solution(s) (y/n)?  ";
                    char saveopt;
                    cin >> saveopt;
                    if(saveopt == 'y'){
                        invalid = 0;
                        cout << "Filename (without extension): ";
                        string filename;
                        cin >> filename;
                        ofstream File("../test/" + filename + ".txt");
                        unordered_set<string> :: iterator itr;
                        for (itr = setres.begin(); itr != setres.end(); itr++){
                            if(i % 4 == 0 || i % 4 == 1 || i % 4 == 2 || i ==
setres.size() - 1) File << *itr << "  ";
                            else File << *itr << "\n";
                            i++;
                        }
                        cout << "\'../test/" << filename << ".txt\' successfully
saved!\n\n";
                        cout << "*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o\n\n";
                    }
                    else if (saveopt == 'n') invalid = 0;
                    else cout << "Invalid input!\n";
                }
                break;
            }
            case 2: {
                string ai, bi, ci, di;
                bool invalid = 1;
                while(invalid){
                    cout << "Write your 4 cards!\n";
                    cout << "Write in the form of: A/1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
J, Q, K\n";
```

```
                    cout << "1: ";
                    cin >> ai;
                    cout << "2: ";
                    cin >> bi;
                    cout << "3: ";
                    cin >> ci;
                    cout << "4: ";
                    cin >> di;
                    a = INPUT_CONVERTER(ai);
                    b = INPUT_CONVERTER(bi);
                    c = INPUT_CONVERTER(ci);
                    d = INPUT_CONVERTER(di);
                    if(a == -1 || b == -1 || c == -1 || d == -1){
                        cout << "Invalid input!\n";
                        invalid = 1;
                    }
                    else invalid = 0;
                }
                start = clock();
                GROUPING1(a, b, c, d, ops);
                GROUPING2(a, b, c, d, ops);
                GROUPING3(a, b, c, d, ops);
                GROUPING4(a, b, c, d, ops);
                GROUPING5(a, b, c, d, ops);
                end = clock();
                cout << "\n" << setres.size() << " solution(s) found\n";
                int i = 0;
                unordered_set<string> :: iterator itr;
                for (itr = setres.begin(); itr != setres.end(); itr++){
                    if(i % 4 == 0 || i % 4 == 1 || i % 4 == 2 || i == setres.size() -
1) cout << *itr << "  ";
                    else cout << *itr << "\n";
                    i++;
                }
                cout << "\n\n";
                double time_taken = double (end - start) / double(CLOCKS_PER_SEC);
                cout << "Time taken to search the solution is : " << fixed <<
time_taken << setprecision(5) << " sec\n\n";
                cout << "*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o\n\n";
                invalid = 1;
                while(invalid){
```

```
                    cout << "Do you want to save the solution(s) (y/n)?  ";
                    char saveopt;
                    cin >> saveopt;
                    if(saveopt == 'y'){
                        invalid = 0;
                        cout << "Filename (without extension): ";
                        string filename;
                        cin >> filename;
                        ofstream File("../test/" + filename + ".txt");
                        unordered_set<string> :: iterator itr;
                        for (itr = setres.begin(); itr != setres.end(); itr++){
                            if(i % 4 == 0 || i % 4 == 1 || i % 4 == 2 || i ==
setres.size() - 1) File << *itr << "  ";
                            else File << *itr << "\n";
                            i++;
                        }
                        cout << "\'../test/" << filename << ".txt\' successfully
saved!\n\n";
                        cout << "*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o\n\n";
                    }
                    else if (saveopt == 'n') invalid = 0;
                    else cout << "Invalid input!\n";
                }
                break;
            }
            case 3: {
                cout << "exiting program...";
                running = 0;
                break;
            }
            default:{
                cout << "Invalid input!\n";
                break;
            }
        }
    }
    return 0;
}
```

Hasil Pengujian

1. Pengujian pada opsi *random genarate*



```
''''''
 The 24 card game is an arithmetic card game
 with the aim of finding ways to operate 4 random card numbers
 so that the final result is 24.
''''''

Choose an option (1/2/3):
1. Generate random cards
2. Input my own cards
3. Exit
1
Generating random cards...
1: 9
2: 2
3: 5
4: 12

107 solution(s) found
12+(9-(2-5))  12-(2-(9+5))  9-(2-(12+5))  5+(9+(12-2))
9+(5+(12-2))  (12+5)+(9-2)  12*(9-(5+2))  5+(12-(2-9))
(5+(9+12))-2  12+(9+(5-2))  5+((12+9)-2)  12+(5-(2-9))
5-(2-(9+12))  12-((2-9)-5)  5+((9+12)-2)  12+((9+5)-2)
12+((5+9)-2)  12*((9-5)/2)  9-((2-5)-12)  12*((9-5)-2)
12-((2-5)-9)  (12+5)-(2-9)  ((9-2)+12)+5  5+((12-2)+9)
(9-(2-5))+12  12+((5-2)+9)  (9-2)+(12+5)  (12*(9-5))/2
5-((2-9)-12)  5+((9-2)+12)  (12+(9-2))+5  (5-2)+(9+12)
(9+(12-2))+5  12*(9-(2+5))  (9-(2-12))+5  (9+(5+12))-2
(12+(5+9))-2  (12-(2-5))+9  (5+(12-2))+9  (9+(12+5))-2
9+((5-2)+12)  (12+(5-2))+9  (5-(2-12))+9  12+(5+(9-2))
(5+(9-2))+12  9+((12-2)+5)  (9+(5-2))+12  9+(5-(2-12))
(9-(5+2))*12  ((9-2)+5)+12  (9-(2+5))*12  9+(12-(2-5))
((5-2)+9)+12  ((9+5)+12)-2  (9-5)/(2/12)  (9-2)+(5+12)
((12-2)+9)+5  (12-(2-9))+5  9+((12+5)-2)  ((9-5)-2)*12
```

```
9-(2-(5+12))  9+((5+12)-2)  (9+12)-(2-5)  (12+(9+5))-2
(9+5)-(2-12)  (5+9)+(12-2)  (12+9)+(5-2)  5-((2-12)-9)
(12-2)+(9+5)  9-((2-12)-5)  (9+5)+(12-2)  ((12-2)+5)+9
(12+9)-(2-5)  12/(5-(9/2))  12-(2-(5+9))  12/(2/(9-5))
5+(9-(2-12))  (9-5)*(12/2)  12*((9-2)-5)  ((5+12)+9)-2
((9+5)-2)+12  ((12+5)+9)-2  5-(2-(12+9))  (12-2)+(5+9)
((9+12)-2)+5  (5+12)-(2-9)  ((9-2)-5)*12  ((9-5)*12)/2
(5-2)+(12+9)  ((12+9)-2)+5  (5+12)+(9-2)  (5+(12+9))-2
(5-(2-9))+12  (9+12)+(5-2)  ((5+12)-2)+9

Time taken to search the solution is : 0.000427 sec

*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0

Do you want to save the solution(s) (y/n)?  y
Filename (without extension): test1
'../test/test1.txt' successfully saved!

*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0
```

2. Pengujian pada opsi *random genarate*

```
Choose an option (1/2/3):
1. Generate random cards
2. Input my own cards
3. Exit
1
Generating random cards...
1: 11
2: 8
3: 9
4: 8

14 solution(s) found
8-(8*(9-11))  9*(8/(11-8))  (8*(11-9))+8  8/((11-8)/9)
8+((11-9)*8)  8+(8*(11-9))  8-((9-11)*8)  (9/(11-8))*8
8*(9/(11-8))  ((11-9)*8)+8  (8/(11-8))*9  (9*8)/(11-8)
9/((11-8)/8)  (8*9)/(11-8)

Time taken to search the solution is : 0.000557 sec

*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o

Do you want to save the solution(s) (y/n)?  y
Filename (without extension): test2
'../test/test2.txt' successfully saved!

*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o
```

3. Pengujian pada opsi *random genarate*

```
Choose an option (1/2/3):
1. Generate random cards
2. Input my own cards
3. Exit
1
Generating random cards...
1: 6
2: 5
3: 9
4: 2

16 solution(s) found
9+(6/(2/5))  9+(5/(2/6))  9+(6*(5/2))  (5/(2/6))+9
((5*6)/2)+9  (6*(5/2))+9  9+((6/2)*5)  9+((5/2)*6)
9+((5*6)/2)  (5*(6/2))+9  ((6/2)*5)+9  9+(5*(6/2))
((6*5)/2)+9  9+((6*5)/2)  ((5/2)*6)+9  (6/(2/5))+9

Time taken to search the solution is : 0.000694 sec

*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o*o

Do you want to save the solution(s) (y/n)?  y
Filename (without extension): test3
'../test/test3.txt' successfully saved!
```

4. Pengujian pada opsi *user input*

```
Choose an option (1/2/3):
1. Generate random cards
2. Input my own cards
3. Exit
2
Write your 4 cards!
Write in the form of: A/1, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K
1: 1
2: 2
3: 3
4: 4

242 solution(s) found
4*(1*(2*3))  2*(4/(1/3))  4*(2*(1*3))  4*(2+(1+3))
3/(1/(4*2))  3*(1*(4*2))  4*(3*(1*2))  1*(3*(4*2))
4*(3+(1+2))  3*(4*(1*2))  1*(4*(3*2))  4/(1/(3*2))
4*(1*(3*2))  1*(4*(2*3))  4*(1+(3+2))  4*(2*(3/1))
4*(2+(3+1))  2*(4*(3/1))  2*(4*(3*1))  3*(4*(2/1))
3*(4*(2*1))  4*(3*(2/1))  4*(3*(2*1))  4*(3+(2+1))
2*(3*(4/1))  3*(2*(4/1))  3*(2*(1*4))  2*(3/(1/4))
2*(4*(1*3))  3*(2/(1/4))  1*(3*(2*4))  3/(1/(2*4))
3*(1*(2*4))  2/(1/(3*4))  4*((1*2)*3)  1*((4*2)*3)
4*((2*1)*3)  4*((2+1)+3)  (1*(2*4))*3  1*((2*4)*3)
((4*3)*2)/1  2*((1*4)*3)  4*((3*1)*2)  4*((3+1)+2)
4/((1/3)/2)  4*((1*3)*2)  4*((2*3)*1)  2*(1*(4*3))
4*((2+3)+1)  (4*2)*(3/1)  (2*(3*1))*4  2*((4*3)/1)
1*(2*(4*3))  3*((4*2)/1)  1*((4*3)*2)  4*((3*2)/1)
((3*4)*2)/1  ((3/1)*4)*2  4*((3*2)*1)  2*((3*4)/1)
((2*3)*4)/1  ((2*4)*3)*1  2*((3*4)*1)  (1*(3*4))*2
3*((2*4)*1)  1*(2*(3*4))  3*((2/1)*4)  2*((3*1)*4)
(4+2)*(1+3)  2*((3/1)*4)  3/((1/2)/4)  ((2/1)*4)*3
3*((1*2)*4)  ((3+2)+1)*4  2/((1/3)/4)  2*((1*3)*4)
(4*(1*2))*3  2*((4*1)*3)  3*(2*(4*1))  (1*(4*2))*3
(3*(2/1))*4  (4*(2/1))*3  (4/(1/2))*3  (2*(4/1))*3
(4*(2*1))*3  3*((1*4)*2)  3*((4*1)*2)  (2*(1*4))*3
4*((2*3)/1)  3/((1/4)/2)  (3*(4/1))*2  3*((2*1)*4)
```

5. Pengujian pada opsi *user input*

```
Choose an option (1/2/3):
1. Generate random cards
2. Input my own cards
3. Exit
2
Write your 4 cards!
Write in the form of: A/1, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K
1: A
2: 1
3: 1
4: 1

0 solution(s) found


Time taken to search the solution is : 0.00053 sec

*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0

Do you want to save the solution(s) (y/n)?  y
Filename (without extension): test5
'../test/test5.txt' successfully saved!

*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0
```

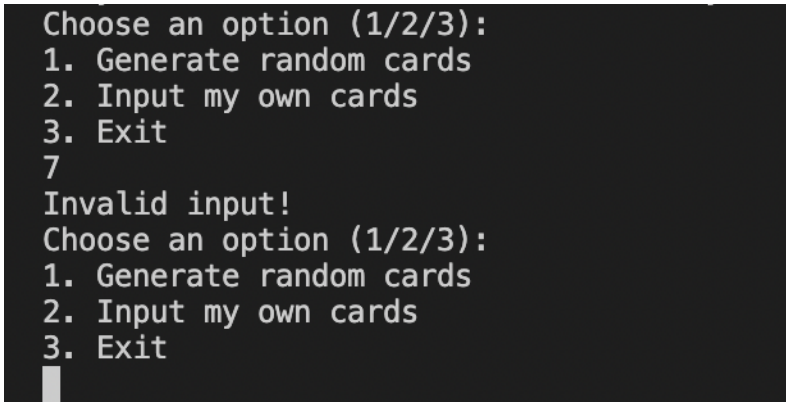
6. Pengujian pada input jenis kartu invalid

```
Choose an option (1/2/3):
1. Generate random cards
2. Input my own cards
3. Exit
2
Write your 4 cards!
Write in the form of: A/1, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K
1: 1
2: 3
3: 5
4: 456
Invalid input!
Write your 4 cards!
Write in the form of: A/1, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K
1:
```

7. Pengujian pada input opsi invalid

```
*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0*0

Do you want to save the solution(s) (y/n)?  k
Invalid input!
Do you want to save the solution(s) (y/n)?
```


Choose an option (1/2/3):
1. Generate random cards
2. Input my own cards
3. Exit
7
Invalid input!
Choose an option (1/2/3):
1. Generate random cards
2. Input my own cards
3. Exit

Link to Repository

https://github.com/Putinabillaa/Tucil1_13521088