TUGAS KECIL 1

IF2211 STRATEGI ALGORITMA

Penyelesaian Cyberpunk 2077 Breach Protocol Dengan Algoritma Brute Force

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PROGRAM STUDI TEKNIK INFORMATIKA

SEKOLAH TEKNIK ELEKTRO DAN INFORMATIKA

INSTITUT TEKNOLOGI BANDUNG

2023

Daftar Isi

BAB I
Algoritma Brute Force dalam Breach Protocol

Breach protocol merupakan minigame yang menjadi salah satu mekanik dalam permainan video Cyberpunk 2077. *Minigame* ini memiliki empat komponen utama, yaitu token, dua karakter alfanumerik, kemudian ada *code matrix*, rangkaian token berbentuk matrix yang akan dicocokkan dengan *sequence*, lalu ada *sequence*, rangkaian yang terdiri dari lebih dari satu token, dan *buffer* sebagai batas jumlah token yang dapat digunakan secara sekuensial.

Minigame ini memiliki aturan sebagai berikut :

1. Pencocokkan harus dimulai dari token yang ada pada baris pertama.
2. Token (jalur) yang digunakan harus bergantian dari vertikal dan horizontal dengan jalur pertama dari baris pertama bergerak secara vertikal.
3. Token yang digunakan tidak harus bersebelahan, token bisa digunakan selama tidak bertentangan dengan aturan no.2 dan berada pada baris atau kolom yang sama.
4. Token yang sudah diambil tidak bisa diambil lagi dalam satu kali pencocokan.
5. *Sequence* dicocokkan pada token yang telah digunakan pada *buffer*.
6. Satu *buffer* bisa digunakan oleh beberapa *sequence*.
7. Token yang digunakan tidak boleh melebihi ukuran *buffer*.
8. Setiap *sequence* memiliki bobot *reward* yang dapat bervariasi.

Gambar 1 Minigame Breach Protocol
(sumber : https://cyberpunk.fandom.com/wiki/Quickhacking?file=Breach_Protocol_Information_Screenshot_02.png)

Algoritma *brute force* merupakan algoritma yang cukup sederhana. Algoritma ini memerika satu per satu dari seluruh kemungkinan yang ada untuk mencari solusi yang optimal. Algoritma ini akan digunakan untuk menyelesaikan *Minigame Breach Protocol* tersebut. Langkah langkahnya adalah :

1. Periksa apakah *buffer* yang digunakan sudah penuh dengan token atau belum. Jika sudah maka tidak ada token yang dapat diambil lagi. Jika belum, dapat lanjut ke langkah selanjutnya.
2. Periksa seluruh token dan koordinat yang dapat digunakan dari posisi koordinat awal.
3. Jika ada token yang digunakan, cocokkan dengan *sequence* yang tersedia.
4. Jika terdapat *sequence* yang cocok, periksa apakah *reward* yang diberikan lebih besar dari *reward* awal (default *reward* = 0).
5. Ulangi langkah no.1 dengan posisi koordinat terakhir yang digunakan.

6. Jika sudah tidak ada koordinat dan token yang dapat digunakan dari koordinat terakhir, kembali ke koordinat sebelumnya (*backtrack)* dan lanjut ke koordinat dan token lain.
7. Algoritma berakhir saat semua kemungkinan sudah diperiksa.

BAB II
Source Program

Program ini ditulis dengan menggunakan bahasa pemrograman Python
Daftar Module/Library :

- Tkinter
- CustomTkinter
- OS
- sys
- Random
- datetime
- webbrowser

Source code :

```python
# Program Cyberpunk 2077 Breach Protocol Solver dengan Brute Force

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# Desc : Sebuah program untuk mencari solusi dari minigame meretas pada permainan video Cyberpunk 2077.
#        Minigame ini merupakan simulasi peretasan jaringan local dari ICE
#        (Intrusion Countermeasures Electronics) pada permainan Cyberpunk 2077.
#       *+GUI :D


# Import Library
import customtkinter
import tkinter
import os
import sys
import random
import webbrowser
from datetime import datetime

# OS Check
if os.name=="nt":
    try:
        exe_path = sys.argv[0]
        os.chdir(os.path.dirname(exe_path))
    except:
        pass
file_path = os.getcwd()

# Default Color Theme
customtkinter.set_appearance_mode("dark")
customtkinter.set_default_color_theme("dark-blue")

# Batasan Input Token
ALPHANUMERIC = {'a','b','c','d','e','f',
                'A','B','C','D','E','F',
                '0','1','2','3','4','5',
                '6','7','8','9','0'}

NUMBER = {'0','1','2','3','4','5','6','7','8','9','0'}
```
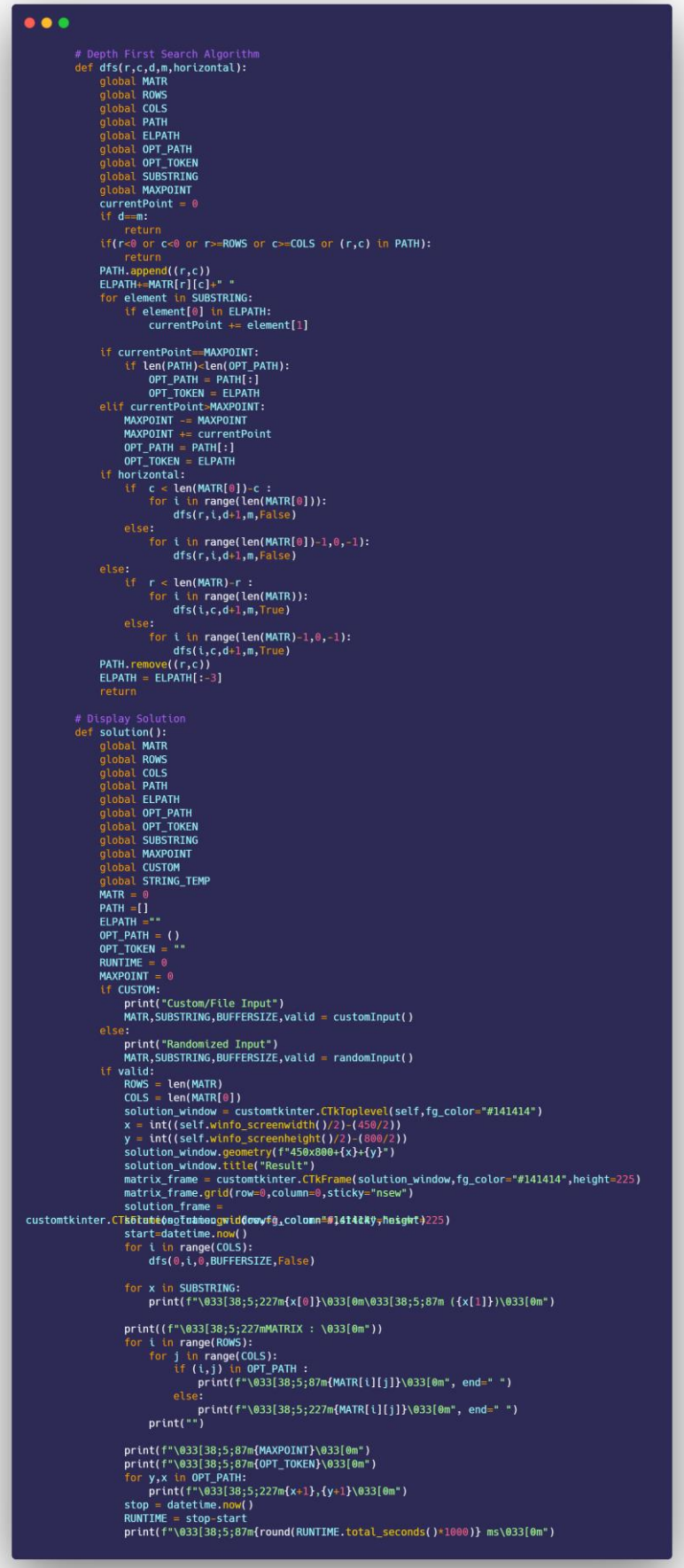

```python
# App
class App(customtkinter.CTk):

    def __init__(self):

        # Tab Random Input
        def randomizer():
            self.mainProgram = customtkinter.CTkFrame(self,fg_color="#141414",width=500,corner_radius=0)
            self.mainProgram.grid(row=0,column=1,sticky="nsew")
            global CUSTOM
            CUSTOM = False

            # Unique Token Count
            self.label_uniqueTokenNum = customtkinter.CTkLabel(
                self.mainProgram,
                text="Unique Token Count",
                font=("Terminal",20))
            self.label_uniqueTokenNum.grid(row=0,column=0,padx=(20,0),pady=(30,10),sticky="w")
            self.entry_uniqueTokenNum = customtkinter.CTkEntry(self.mainProgram, width=200,font=("Terminal",14))
            self.entry_uniqueTokenNum.grid(row=1,column=0,padx=(20,0),pady=(0,10),sticky="w")

            # Unique Token
            self.label_uniqueToken = customtkinter.CTkLabel(
                self.mainProgram,
                text="Unique Token",
                font=("Terminal",20))
            self.label_uniqueToken.grid(row=2,column=0,padx=(20,0),pady=(30,10),sticky="w")
            self.entry_uniqueToken = customtkinter.CTkEntry(self.mainProgram, width=200,font=("Terminal",14))
            self.entry_uniqueToken.grid(row=3,column=0,padx=(20,0),pady=(0,10),sticky="w")

            # Buffer Size
            self.label_bufferSize = customtkinter.CTkLabel(
                self.mainProgram,
                text="Buffer Size",
                font=("Terminal",20))
            self.label_bufferSize.grid(row=4,column=0,padx=(20,0),pady=(30,10),sticky="w")
            self.entry_bufferSize = customtkinter.CTkEntry(self.mainProgram, width=200,font=("Terminal",14))
            self.entry_bufferSize.grid(row=5,column=0,padx=(20,0),pady=(0,10),sticky="w")

            # Unique Sequence Count
            self.label_uniqueSequenceCount = customtkinter.CTkLabel(
                self.mainProgram,
                text="Unique Sequence Count",
                font=("Terminal",20))
            self.label_uniqueSequenceCount.grid(row=0,column=1,padx=(75,0),pady=(30,10),sticky="w")
            self.entry_uniqueSequenceCount = customtkinter.CTkEntry(self.mainProgram, width=200,font=("Terminal",14))
            self.entry_uniqueSequenceCount.grid(row=1,column=1,padx=(75,0),pady=(0,10),sticky="w")

            # Max Sequence Size
            self.label_maxSequenceSize = customtkinter.CTkLabel(
                self.mainProgram,
                text="Max Sequence Size",
                font=("Terminal",20))
            self.label_maxSequenceSize.grid(row=2,column=1,padx=(75,0),pady=(30,10),sticky="w")
            self.entry_maxSequenceSize = customtkinter.CTkEntry(self.mainProgram, width=200,font=("Terminal",14))
            self.entry_maxSequenceSize.grid(row=3,column=1,padx=(75,0),pady=(0,10),sticky="w")

            # Matrix Size
            self.label_codeMatrixSize = customtkinter.CTkLabel(
                self.mainProgram,
                text="Code Matrix Size",
                font=("Terminal",20))
            self.label_codeMatrixSize.grid(row=4,column=1,padx=(75,0),pady=(30,10),sticky="w")
            self.entry_codeMatrixSizeRow = customtkinter.CTkEntry(self.mainProgram, width=50,font=("Terminal",14))
            self.entry_codeMatrixSizeRow.grid(row=5,column=1,padx=(75,0),pady=(0,10),sticky="w")
            self.label_times = customtkinter.CTkLabel(
                self.mainProgram,
                text="X",
                font=("Terminal",20))
            self.label_times.grid(row=5,column=1,padx=(135,0),pady=(0,10),sticky="w")
            self.entry_codeMatrixSizeCol = customtkinter.CTkEntry(self.mainProgram, width=50,font=("Terminal",14))
            self.entry_codeMatrixSizeCol.grid(row=5,column=1,padx=(155,0),pady=(0,10),sticky="w")

            # Solve Button
            self.button_solve = customtkinter.CTkButton(self.mainProgram,text="Solve",font=
("Terminal",14),command=solution)
            self.button_solve.grid(row=6,column=0,sticky="sw",pady=(50,0),padx=(22.5,0))

        # Custom Value Tab / Import Txt Tab
        def customVal():
            global CUSTOM
            CUSTOM = True
            self.mainProgram = customtkinter.CTkFrame(self,fg_color="#141414",width=500,corner_radius=0)
            self.mainProgram.grid(row=0,column=1,sticky="nsew")

            # Enter Code Matrix
            self.label_codeMatrix = customtkinter.CTkLabel(
                self.mainProgram,
                text="Enter Code Matrix",
                font=("Terminal",20))
            self.label_codeMatrix.grid(row=0,column=0,padx=(20,0),pady=(30,10),sticky="w")
            self.entry_codeMatrix = customtkinter.CTkTextbox(self.mainProgram, width=200,font=("Terminal",14))
            self.entry_codeMatrix.grid(row=1,column=0,padx=(20,0),pady=(0,10),sticky="w")

            # Enter Sequence
            self.label_sequence = customtkinter.CTkLabel(
                self.mainProgram,
                text="Enter Sequences & Rewards",
                font=("Terminal",20))
            self.label_sequence.grid(row=0,column=1,padx=(40,0),pady=(30,10),sticky="w")
            self.entry_sequence = customtkinter.CTkTextbox(self.mainProgram, width=200,font=("Terminal",14))
            self.entry_sequence.grid(row=1,column=1,padx=(40,0),pady=(0,10),sticky="w")
```

```
            # Buffer Size
            self.label_bufferSize = customtkinter.CTkLabel(
                self.mainProgram,
                text="Buffer Size",
                font=("Terminal",20))
            self.label_bufferSize.grid(row=2,column=0,padx=(20,0),pady=(30,10),sticky="w")
            self.entry_bufferSize = customtkinter.CTkEntry(self.mainProgram, width=200,font=("Terminal",14))
            self.entry_bufferSize.grid(row=3,column=0,padx=(20,0),pady=(0,10),sticky="w")

            # Matrix Size
            self.label_codeMatrixSize = customtkinter.CTkLabel(
                self.mainProgram,
                text="Code Matrix Size",
                font=("Terminal",20))
            self.label_codeMatrixSize.grid(row=2,column=1,padx=(50,0),pady=(30,10),sticky="w")
            self.entry_codeMatrixSizeRow = customtkinter.CTkEntry(self.mainProgram, width=50,font=("Terminal",14))
            self.entry_codeMatrixSizeRow.grid(row=3,column=1,padx=(50,0),pady=(0,10),sticky="w")
            self.label_times = customtkinter.CTkLabel(
                self.mainProgram,
                text="X",
                font=("Terminal",20))
            self.label_times.grid(row=3,column=1,padx=(110,0),pady=(0,10),sticky="w")
            self.entry_codeMatrixSizeCol = customtkinter.CTkEntry(self.mainProgram, width=50,font=("Terminal",14))
            self.entry_codeMatrixSizeCol.grid(row=3,column=1,padx=(130,0),pady=(0,10),sticky="w")

            # Open Button
            self.button_openfile = customtkinter.CTkButton(self.mainProgram,text="Open txt file",font=
("Terminal",14),command=opentxtFiles)
            self.button_openfile.grid(row=4,column=0,sticky="sw",pady=(50,0),padx=(20,0))

            # Solve Button
            self.button_solve = customtkinter.CTkButton(self.mainProgram,text="Solve",font=
("Terminal",14),command=solution)
            self.button_solve.grid(row=4,column=1,sticky="sw",pady=(50,0),padx=(50,0))

        # Open Txt Prompt
        def opentxtFiles():
            self.filename = tkinter.filedialog.askopenfilename(initialdir=file_path,title="Select a *.txt
file",filetypes=[("Text Documents","*.txt")]))
            file = open(self.filename,"r")
            buffersize = int(file.readline())
            rowAndCol= file.readline().split(" ")
            matrixRow = int(rowAndCol[0])
            matrixCol = int(rowAndCol[1])

            matrixRow_var = tkinter.StringVar()
            matrixRow_var.set(matrixRow)

            matrixCol_var = tkinter.StringVar()
            matrixCol_var.set(matrixCol)

            buffer_size_var = tkinter.StringVar()
            buffer_size_var.set(buffersize)

            self.entry_bufferSize.configure(textvariable=buffer_size_var)
            self.entry_codeMatrixSizeCol.configure(textvariable=matrixCol_var)
            self.entry_codeMatrixSizeRow.configure(textvariable=matrixRow_var)

            matrix =""
            for i in range(matrixRow):
                matrix += file.readline()
            self.entry_codeMatrix.delete("1.0", tkinter.END)
            self.entry_codeMatrix.insert("1.0", matrix)

            sequence =""
            for sequences in file:
                sequence += sequences
            self.entry_sequence.delete("1.0", tkinter.END)
            self.entry_sequence.insert("1.0", sequence)
            file.close()

        # Input Validation
        def string_validation(alphabet,length,text,equalLength):
            words = text.split(" ")
            notEmpty = False
            if len(words)==1:
                return False
            for word in words:
                if word != '':
                    notEmpty = True
                if equalLength:
                    if len(word)!=length:
                        return False
                for letter in word:
                    if letter not in alphabet:
                        return False
            return notEmpty

        # Save to File Prompt
        def saveToFile():
            global STRING_TEMP
            try:
                save_path = tkinter.filedialog.asksaveasfilename(initialdir=file_path,title="Save
As",defaultextension=".txt",filetypes=[("Text Documents","*.txt")]))
                save_writer = open(save_path,"w")
                save_writer.write(STRING_TEMP)
                save_writer.close()
            except:
                print("exception")
                pass
```

```
        # Custom Input Getter
        def customInput():
            global ALPHANUMERIC
            valid = True
            try:
                bufferSize = int(self.entry_bufferSize.get())
                matrixRow = int(self.entry_codeMatrixSizeRow.get())
                matrixCol = int(self.entry_codeMatrixSizeCol.get())
                if matrixCol<2 or matrixRow<2:
                    valid = False
                matrix = [[""]*matrixCol]*matrixRow
                matrixTemp = str(self.entry_codeMatrix.get("0.0",customtkinter.END)).split("\n")
                while '' in matrixTemp:
                    matrixTemp.remove('')
                if matrixRow!=len(matrixTemp):
                    valid = False
                for i in range(matrixRow):
                    currInput = matrixTemp[i]
                    if len(currInput.split(" "))!=matrixCol or string_validation(ALPHANUMERIC,0,currInput,False)==False:
                        valid = False
                    else:
                        matrix[i] = currInput.split(" ")
                sequenceTemp = str(self.entry_sequence.get("0.0",customtkinter.END)).split("\n")
                numberOfSequence = int(sequenceTemp[0])
                sequence = [["", 0] for _ in range(numberOfSequence)]
                for i in range(1,numberOfSequence*2+1,2):
                    sequence[int((i-1)/2)][0] = sequenceTemp[i].upper()
                    if(string_validation(ALPHANUMERIC,0,sequenceTemp[i],False)==False):
                        valid = False
                for i in range(2,numberOfSequence*2+1,2):
                    sequence[int((i-1)/2)][1] = int(sequenceTemp[i])

                for i in range(len(matrix)):
                    for j in range(len(matrix[0])):
                        print(matrix[i][j],end=" ")
                    print("")
                print(sequence)
                print(bufferSize)
                print(valid)
                return matrix,sequence,bufferSize,valid
            except:
                return [],[],0,False

        # Random Input Generator
        def randomInput():
            global ALPHANUMERIC
            global NUMBER
            valid = True
            try:
                numberOfUniqueToken = int(self.entry_uniqueTokenNum.get())
                tokenString = str(self.entry_uniqueToken.get())
                if (not string_validation(ALPHANUMERIC,2,tokenString,True)) or (len(tokenString.split("
")!=numberOfUniqueToken):
                    print("wrong token")
                    valid = False
                    raise Exception
                matrixRow = int(self.entry_codeMatrixSizeRow.get())
                matrixCol = int(self.entry_codeMatrixSizeRow.get())
                if matrixRow<2 or matrixCol<2:
                    valid = False
                numberOfSequence = int(self.entry_uniqueSequenceCount.get())
                sequenceMaxSize = int(self.entry_maxSequenceSize.get())
                if sequenceMaxSize<2:
                    valid = False
                bufferSize = int(self.entry_bufferSize.get())
                if bufferSize<2:
                    valid = False
                tokenArray = tokenString.upper().split(" ")

                matrix = [[0] * matrixCol for i in range(matrixRow)]
                sequence = [["", 0] for _ in range(numberOfSequence)]

                for i in range(numberOfSequence):
                    randomnum = random.randint(2, sequenceMaxSize)
                    seq = ""
                    for j in range(randomnum):
                        seq += random.choice(tokenArray) + " "
                    sequence[i] = [seq.strip(), 0]
                    sequence[i][1] = random.randint(-100,100)
                    for k in sequence:
                        while sequence[i][0] in k[0] and i!=sequence.index(k):
                            sequence[i][0] = sequence[i][0][:3]
                            sequence[i][0] += random.choice(tokenArray)

                for i in range(matrixRow):
                    for j in range(matrixCol):
                        matrix[i][j] = tokenArray[random.randint(0,numberOfUniqueToken-1)]
            except:
                print("Other invalid input")
                valid = False
                return [],[],0,False

            return matrix,sequence,bufferSize,valid

        # My Youtube Channel (pls don't click :D)
        def yt_link():
            webbrowser.open_new("https://www.youtube.com/watch?v=W_czMS95ngY")
```

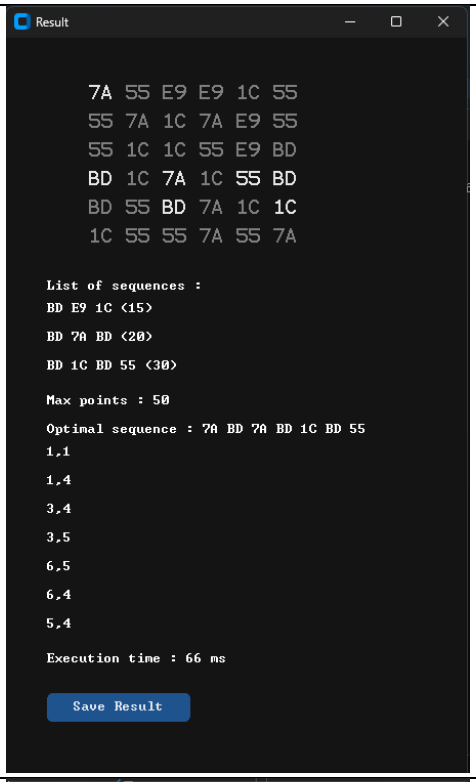
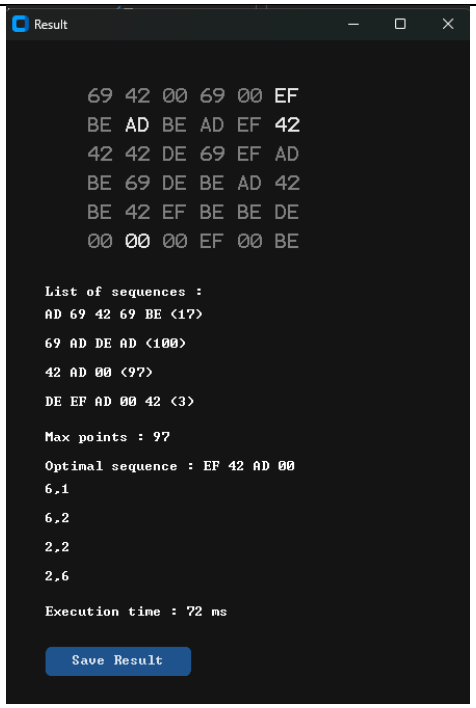


```
        # Depth First Search Algorithm
        def dfs(r,c,d,m,horizontal):
            global MATR
            global ROWS
            global COLS
            global PATH
            global ELPATH
            global OPT_PATH
            global OPT_TOKEN
            global SUBSTRING
            global MAXPOINT
            currentPoint = 0
            if d==m:
                return
            if(r<0 or c<0 or r>=ROWS or c>=COLS or (r,c) in PATH):
                return
            PATH.append((r,c))
            ELPATH+=MATR[r][c]+" "
            for element in SUBSTRING:
                if element[0] in ELPATH:
                    currentPoint += element[1]

            if currentPoint==MAXPOINT:
                if len(PATH)<len(OPT_PATH):
                    OPT_PATH = PATH[:]
                    OPT_TOKEN = ELPATH
            elif currentPoint>MAXPOINT:
                MAXPOINT -= MAXPOINT
                MAXPOINT += currentPoint
                OPT_PATH = PATH[:]
                OPT_TOKEN = ELPATH
            if horizontal:
                if  c < len(MATR[0])-c :
                    for i in range(len(MATR[0])):
                        dfs(r,i,d+1,m,False)
                else:
                    for i in range(len(MATR[0])-1,0,-1):
                        dfs(r,i,d+1,m,False)
            else:
                if  r < len(MATR)-r :
                    for i in range(len(MATR)):
                        dfs(i,c,d+1,m,True)
                else:
                    for i in range(len(MATR)-1,0,-1):
                        dfs(i,c,d+1,m,True)
            PATH.remove((r,c))
            ELPATH = ELPATH[:-3]
            return

        # Display Solution
        def solution():
            global MATR
            global ROWS
            global COLS
            global PATH
            global ELPATH
            global OPT_PATH
            global OPT_TOKEN
            global SUBSTRING
            global MAXPOINT
            global CUSTOM
            global STRING_TEMP
            MATR = 0
            PATH =[]
            ELPATH =""
            OPT_PATH = ()
            OPT_TOKEN = ""
            RUNTIME = 0
            MAXPOINT = 0
            if CUSTOM:
                print("Custom/File Input")
                MATR,SUBSTRING,BUFFERSIZE,valid = customInput()
            else:
                print("Randomized Input")
                MATR,SUBSTRING,BUFFERSIZE,valid = randomInput()
            if valid:
                ROWS = len(MATR)
                COLS = len(MATR[0])
                solution_window = customtkinter.CTkToplevel(self,fg_color="#141414")
                x = int((self.winfo_screenwidth()/2)-(450/2))
                y = int((self.winfo_screenheight()/2)-(800/2))
                solution_window.geometry(f"450x800+{x}+{y}")
                solution_window.title("Result")
                matrix_frame = customtkinter.CTkFrame(solution_window,fg_color="#141414",height=225)
                matrix_frame.grid(row=0,column=0,sticky="nsew")
                solution_frame =
customtkinter.CTkScrollableFrame(solution_window,fg_color="#141414",height=225)
                start=datetime.now()
                for i in range(COLS):
                    dfs(0,i,0,BUFFERSIZE,False)

                for x in SUBSTRING:
                    print(f"\033[38;5;227m{x[0]}\033[0m\033[38;5;87m ({x[1]})\033[0m")

                print((f"\033[38;5;227mMATRIX : \033[0m"))
                for i in range(ROWS):
                    for j in range(COLS):
                        if (i,j) in OPT_PATH :
                            print(f"\033[38;5;87m{MATR[i][j]}\033[0m", end=" ")
                        else:
                            print(f"\033[38;5;227m{MATR[i][j]}\033[0m", end=" ")
                    print("")

                print(f"\033[38;5;87m{MAXPOINT}\033[0m")
                print(f"\033[38;5;87m{OPT_TOKEN}\033[0m")
                for y,x in OPT_PATH:
                    print(f"\033[38;5;227m{x+1},{y+1}\033[0m")
                stop = datetime.now()
                RUNTIME = stop-start
                print(f"\033[38;5;87m{round(RUNTIME.total_seconds()*1000)} ms\033[0m")
```

```
                STRING_TEMP = ""
                STRING_TEMP += str(MAXPOINT)+"\n"
                STRING_TEMP += str(OPT_TOKEN)+"\n"
                for y,x in OPT_PATH:
                    STRING_TEMP += str(x+1)+","+str(y+1)+"\n"
                STRING_TEMP += "\n"+str(round(RUNTIME.total_seconds()*1000))+" ms"
                for i in range(ROWS):
                    for j in range(COLS):
                        if (i,j) in OPT_PATH:
                            color = "E6E6E6"
                        else:
                            color = "7F7F7F"
                        matrix_solution = customtkinter.CTkLabel(
                            matrix_frame,
                            text=MATR[i][j].upper()+" ",
                            text_color=f"#{color}",
                            font=("Terminal",16))
                        if j==0:
                            right = 80
                        else:
                            right = 0
                        if i==0:
                            top = 40
                        else:
                            top = 0
                        matrix_solution.grid(row=i, column=j,padx=(right,0),pady=(top,0),sticky="nsew")

                sequence_title = customtkinter.CTkLabel(
                            solution_frame,
                            text="List of sequences : ",
                            text_color=f"#FFFFFF",
                            font=("Terminal",12),
                    )
                sequence_title.grid(row=0, column=0,padx=(40,0),pady=(20,0),sticky="w")
                for i in range(len(SUBSTRING)):
                    sequence_list = customtkinter.CTkLabel(
                            solution_frame,
                            text=SUBSTRING[i][0]+" "+"("+str(SUBSTRING[i][1])+")\n",
                            text_color=f"#FFFFFF",
                            font=("Terminal",12),
                    )
                    if i==0:
                        sequence_list.grid(row=i+1, column=0,padx=(40,0),pady=(0,0),sticky="w")
                    else:
                        sequence_list.grid(row=i+1, column=0,padx=(40,0),pady=(0,0),sticky="w")
                opt_path_label = customtkinter.CTkLabel(
                        solution_frame,
                        text="Optimal sequence : "+str(OPT_TOKEN),
                        text_color=f"#FFFFFF",
                        font=("Terminal",12))
                opt_path_label.grid(row=len(SUBSTRING)+2, column=0,padx=(40,0),pady=(0,0),sticky="w")
                point_label = customtkinter.CTkLabel(
                            solution_frame,
                            text="Max points : "+str(MAXPOINT),
                            text_color=f"#FFFFFF",
                            font=("Terminal",12))
                point_label.grid(row=len(SUBSTRING)+1, column=0,padx=(40,0),pady=(0,0),sticky="w")
                for i in range(len(OPT_PATH)):
                    coord = customtkinter.CTkLabel(
                            solution_frame,
                            text=str(OPT_PATH[i][1]+1)+","+str(OPT_PATH[i][0]+1)+"\n",
                            text_color=f"#FFFFFF",
                            font=("Terminal",12))
                    coord.grid(row=len(SUBSTRING)+3+i, column=0,padx=(40,0),pady=(0,0),sticky="w")
                runtime_label = customtkinter.CTkLabel(
                    solution_frame,
                    text="Execution time : "+str(round(RUNTIME.total_seconds()*1000))+" ms",
                    text_color=f"#FFFFFF",
                    font=("Terminal",12))
                runtime_label.grid(row=len(SUBSTRING)+len(OPT_PATH)+4, column=0,padx=(40,0),pady=(0,0),sticky="w")

                save_button = customtkinter.CTkButton(solution_frame,text="Save Result",font=
("Terminal",14),command=saveToFile)
                save_button.grid(row=len(SUBSTRING)+len(OPT_PATH)+5, column=0,padx=(40,0),pady=(20,0),sticky="w")
                solution_window.attributes("-topmost",True)
                solution_window.grab_set()
                solution_window.mainloop()


            else:
                invalid_window = customtkinter.CTkToplevel(self)
                invalid_window.title("")
                x = int((self.winfo_screenwidth()/2)-(250/2))
                y = int((self.winfo_screenheight()/2)-(100/2))
                invalid_window.geometry(f"250x100+{x}+{y}")
                invalid_window.maxsize(250,100)
                invalid_window.minsize(250,100)
                invalid_window.attributes("-topmost",True)
                invalid_window_label = customtkinter.CTkLabel(invalid_window,text="Input Invalid!",pady=50,font=
("Terminal",20))
                invalid_window_label.pack()
                invalid_window.grab_set()
                invalid_window.mainloop()
            try:
                self.grab_release()
            except:
                pass
```

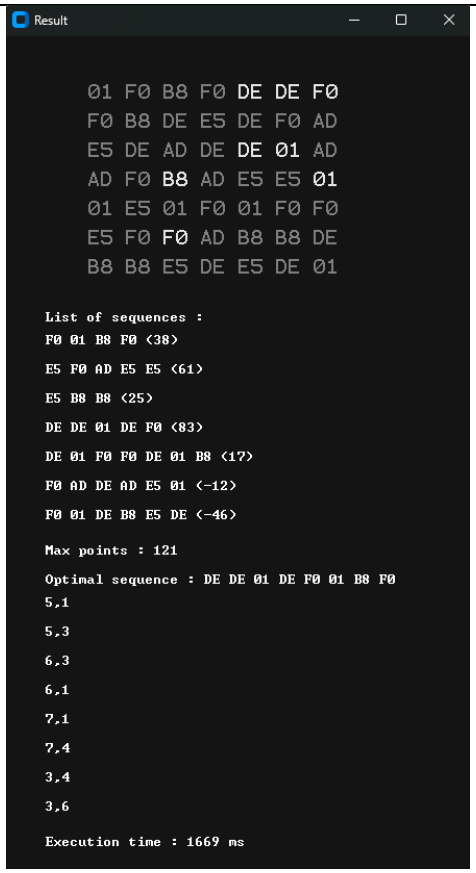
```
        # About Me Pop-up Window
        def about_me():
            about_me_window = customtkinter.CTkToplevel(self)
            about_me_window.title("About Me")
            x = int((self.winfo_screenwidth()/2)-(500/2))
            y = int((self.winfo_screenheight()/2)-(125/2))
            about_me_window.geometry(f"500x125+{x}+{y}")
            me_label = customtkinter.CTkLabel(
                about_me_window,
                text="Created by M. Hanief Fatkhan Nashrullah || 13522100\n GitHub : hannoobz",
                font=("Terminal",12))
            me_label.pack(pady=(20,0))
            yt_channel = customtkinter.CTkButton(
                about_me_window,
                text="My Youtube channel",
                font=("Terminal",12),
                command= yt_link
            )
            yt_channel.pack(pady=(10,0))

            about_me_window.maxsize(500,125)
            about_me_window.minsize(500,125)
            about_me_window.grab_set()
            about_me_window.mainloop()


        super().__init__()

        # App WxH
        appWidth = 800
        appHeight = 600
        screenWidth = self.winfo_screenwidth()
        screenHeight = self.winfo_screenheight()
        x = int((screenWidth/2)-(appWidth/2))
        y = int((screenHeight/2)-(appHeight/2))
        self.title('Brute Force Breach Protocol Solver')
        self.geometry(f'{appWidth}x{appHeight}+{x}+{y}')
        self.minsize(appWidth,appHeight)
        self.maxsize(appWidth,appHeight)

        # Frame
        self.modeOption = customtkinter.CTkFrame(self,fg_color="black",width=300,corner_radius=0)
        self.modeOption.grid(row=0,column=0,sticky="nsew")

        self.mainProgram = customtkinter.CTkFrame(self,fg_color="#141414",width=500,corner_radius=0)
        self.mainProgram.grid(row=0,column=1,sticky="nsew")

        # Set the weight of the columns and rows
        self.columnconfigure(0,weight=5)
        self.columnconfigure(1,weight=50)
        self.rowconfigure(0,weight=1)

        # Mode option
        self.button_randomizedValue = customtkinter.CTkButton(self.modeOption,text="Randomized",font=
("Terminal",14),command=randomizer)
        self.button_randomizedValue.pack(pady=20)

        self.button_customValue = customtkinter.CTkButton(self.modeOption,text="Custom Value",font=
("Terminal",14),command=customVal)
        self.button_customValue.pack()

        self.button_aboutMe = customtkinter.CTkButton(self.modeOption,text="About",font=
("Terminal",14),command=about_me)
        self.button_aboutMe.pack(side="bottom", pady=(0,40))

app = App()
app.mainloop()
```

BAB III: Pengujian dan Hasil Pengujian

<table>
<tr><td colspan="2">Input File</td></tr>
<tr><td>Input</td><td>Output</td></tr>
<tr><td>tc1.txt
7
6 6
7A 55 E9 E9 1C 55
55 7A 1C 7A E9 55
55 1C 1C 55 E9 BD
BD 1C 7A 1C 55 BD
BD 55 BD 7A 1C 1C
1C 55 55 7A 55 7A
3
BD E9 1C
15
BD 7A BD
20
BD 1C BD 55
30</td><td> 
</td></tr>
<tr><td>tc2.txt
7
6 6
69 42 00 69 00 EF
BE AD BE AD EF 42
42 42 DE 69 EF AD
BE 69 DE BE AD 42
BE 42 EF BE BE DE
00 00 00 EF 00 BE
4
AD 69 42 69 BE
17
69 AD DE AD
100
42 AD 00
97
DE EF AD 00 42
3</td><td> 
</td></tr>
</table>

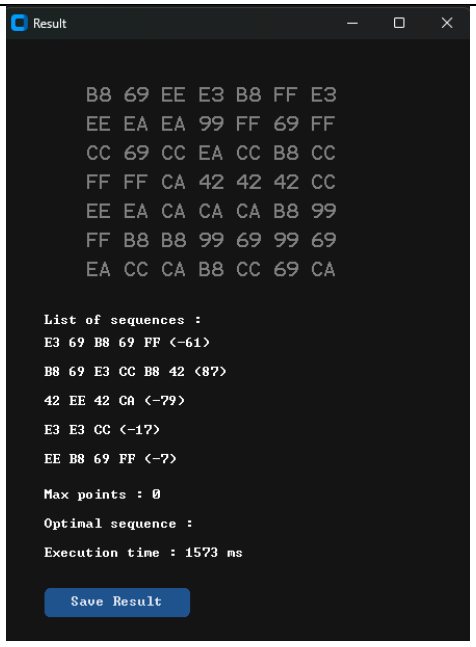
tc3.txt

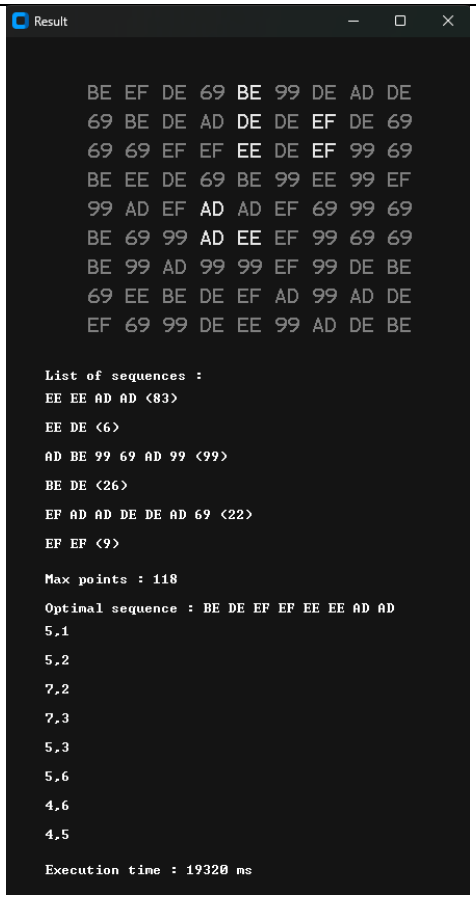
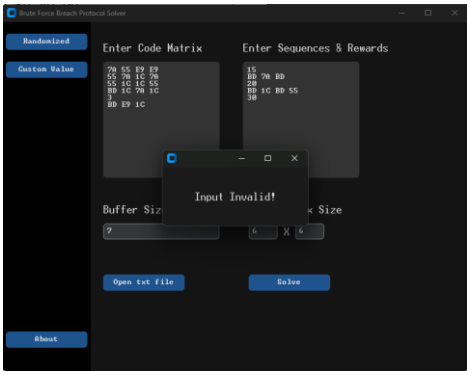
```
8
7 7
01 F0 B8 F0 DE DE F0
F0 B8 DE E5 DE F0 AD
E5 DE AD DE DE 01 AD
AD F0 B8 AD E5 E5 01
01 E5 01 F0 01 F0 F0
E5 F0 F0 AD B8 B8 DE
B8 B8 E5 DE E5 DE 01
7
F0 01 B8 F0
38
E5 F0 AD E5 E5
61
E5 B8 B8
25
DE DE 01 DE F0
83
DE 01 F0 F0 DE 01 B8
17
F0 AD DE AD E5 01
-12
F0 01 DE B8 E5 DE
-46
```

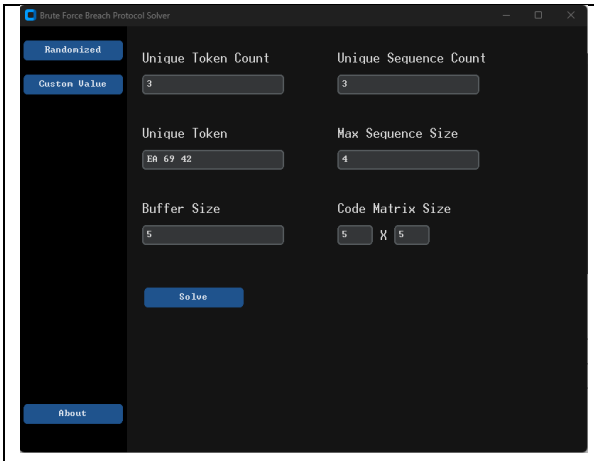


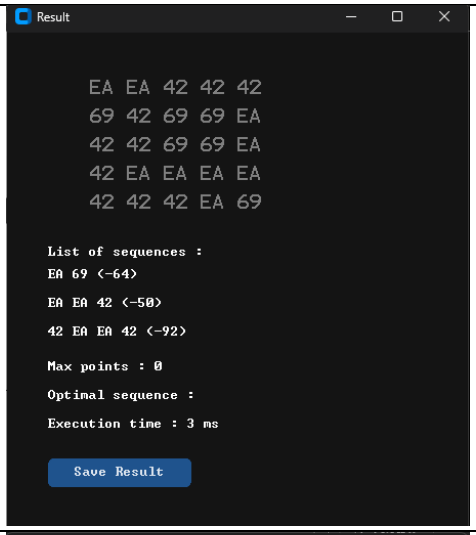
tc4.txt

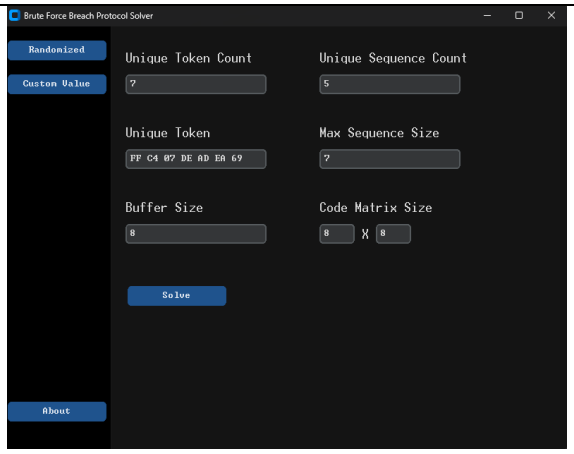
```
8
7 7
B8 69 EE E3 B8 FF E3
EE EA EA 99 FF 69 FF
CC 69 CC EA CC B8 CC
FF FF CA 42 42 42 CC
EE EA CA CA CA B8 99
FF B8 B8 99 69 99 69
EA CC CA B8 CC 69 CA
5
E3 69 B8 69 FF
-61
B8 69 E3 CC B8 42
87
42 EE 42 CA
-79
E3 E3 CC
-17
EE B8 69 FF
-7
```

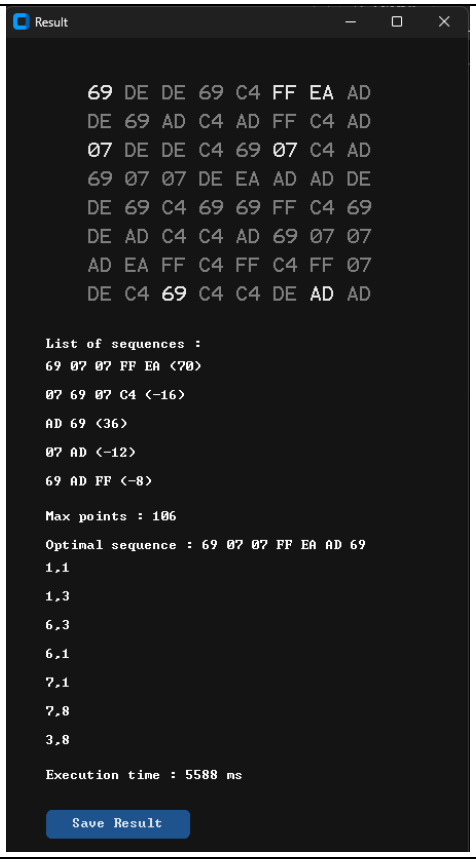


tc5.txt 8 9 9 BE EF DE 69 BE 99 DE AD DE 69 BE DE AD DE DE EF DE 69 69 69 EF EF EE DE EF 99 69 BE EE DE 69 BE 99 EE 99 EF 99 AD EF AD AD EF 69 99 69 BE 69 99 AD EE EF 99 69 69 BE 99 AD 99 99 EF 99 DE BE 69 EE BE DE EF AD 99 AD DE EF 69 99 DE EE 99 AD DE BE 6 EE EE AD AD 83 EE DE 6 AD BE 99 69 AD 99 99 BE DE 26 EF AD AD DE DE AD 69 22 EF EF 9	
invalidmatrixtc.txt 7 6 6 7A 55 E9 E9 55 7A 1C 7A 55 1C 1C 55 BD 1C 7A 1C 3 BD E9 1C 15 BD 7A BD 20 BD 1C BD 55 30	
Randomized Input	
Input	Output


Brute Force Breach Protocol Solver
Randomized
Custom Value
About
Unique Token Count
3
Unique Sequence Count
3
Unique Token
EA 69 42
Max Sequence Size
4
Buffer Size
5
Code Matrix Size
5
X
5
Solve


Result
EA EA 42 42 42
69 42 69 69 EA
42 42 69 69 EA
42 EA EA EA EA
42 42 42 EA 69
List of sequences :
EA 69 (-64)
EA EA 42 (-50)
42 EA EA 42 (-92)
Max points : 0
Optimal sequence :
Execution time : 3 ms
Save Result


Brute Force Breach Protocol Solver
Randomized
Custom Value
About
Unique Token Count
7
Unique Sequence Count
5
Unique Token
FF C4 07 DE AD EA 69
Max Sequence Size
7
Buffer Size
8
Code Matrix Size
8
X
8
Solve


Result
69 DE DE 69 C4 FF EA AD
DE 69 AD C4 AD FF C4 AD
07 DE DE C4 69 07 C4 AD
69 07 07 DE EA AD AD DE
DE 69 C4 69 69 FF C4 69
DE AD C4 C4 AD 69 07 07
AD EA FF C4 FF C4 FF 07
DE C4 69 C4 C4 DE AD AD
List of sequences :
69 07 07 FF EA (70)
07 69 07 C4 (-16)
AD 69 (36)
07 AD (-12)
69 AD FF (-8)
Max points : 106
Optimal sequence : 69 07 07 FF EA AD 69
1,1
1,3
6,3
6,1
7,1
7,8
3,8
Execution time : 5588 ms
Save Result

Lampiran

1. *Checklist*

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

2. Pranala *repository*
   https://github.com/hannoobz/Tucil1_13522100