

Tugas Kecil 1 - IF2211 Strategi dan Algoritma
Penyelesaian Cyberpunk 2077 Breach Protocol
dengan Algoritma Brute Force



Disusun oleh:
Muhammad Dava Fathurrahman (13522114)

SEKOLAH TEKNIK ELEKTRO DAN INFORMATIKA
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BAB 1

Algoritma Brute Force

1.1. Pendahuluan

Brute force adalah sebuah pendekatan yang lempang (straightforward) untuk memecahkan suatu masalah, biasanya didasarkan pada pernyataan masalah (problem statement) dan definisi konsep yang melibatkan. Algoritma Brute Force memecahkan suatu persoalan dengan metode pencarian solusi yang langsung dan dengan cara yang jelas. Algoritma ini secara eksplisit mencoba semua kemungkinan solusi.

Cyberpunk 2077 Breach Protocol adalah minigame meretas pada permainan video Cyberpunk 2077. Minigame ini merupakan simulasi peretasan jaringan local dari ICE (Intrusion Countermeasures Electronics) pada permainan Cyberpunk 2077. Komponen pada permainan ini terdiri atas

1. Token, dua karakter alfanumerik seperti E9, BD, dan 55.
2. Matriks, terdiri atas token-token yang akan dipilih untuk menyusun urutan kode.
3. Sekuens, sebuah rangkaian token (dua atau lebih) yang harus dicocokkan.
4. Buffer, jumlah maksimal token yang dapat disusun secara sekuensial.

Pemain akan mengikuti aturan yang meliputi gerakan vertikal dan horizontal secara bergantian, dimulai dengan memilih satu token di posisi teratas matriks kemudian mencocokkan sekuens pada token dalam buffer. Satu token dapat digunakan untuk beberapa sekuens dan setiap sekuens memiliki bobot hadiah yang bervariasi, dengan panjang minimal sekuens adalah dua token.

1.2. Deskripsi Langkah

Dengan pendekatan brute force dan fungsi rekursif, program akan membentuk sekuens hingga sepanjang ukuran buffer jika memungkinkan. Pada sumber program, algoritma brute force terdapat pada fungsi move(). Token pertama (langkah ke-1) dipilih dari baris-baris teratas matriks. Kemudian, sel yang telah dipilih akan mengunjungi salah satu sel token di bawah nya sehingga membentuk rangkaian token (sekuens). Langkah di atas diulangi dengan gerakan secara horizontal (jika langkah pada kode sumber adalah ganjil) atau vertikal (jika langkah pada kode

sumber adalah genap). Setiap rangkaian baru akan dilakukan pengecekan hadiah pada fungsi checkScore() berdasarkan bobot sekuens. Rekursif akan berhenti jika langkah telah sebanyak ukuran buffer atau seluruh token di sekitarnya telah dikunjungi. Penulis menandai token yang telah dikunjungi dengan membuat cermin matriks dan memberi sel matriks dengan nomor atau langkah kunjungan. Selain itu, penulis membatasi pembuatan sekuens secara acak dengan maksimum 10.000.000. Hal tersebut disebabkan pustaka Tkinter yang terganggu oleh senarai yang menampung begitu banyak produk katersian, serta kinerja yang mulai melambat.

BAB 2

Kode Sumber

```
import tkinter as tk
from tkinter import ttk, filedialog, messagebox
from math import ceil
from random import randrange, randint
from itertools import product
import time

uniqToken = []; mtx_input = []; sequences = {}
best_binMtx = []; best_sequence = []; entries_token = {}
entries_mtx = {}

def clearWidget():
    global buffer_size, N_uniqToken, uniqToken, mtx_width, mtx_height,
    best_score, row_offset, num_rows
    mtx_width = 0; mtx_height = 0
    buffer_size = 0; N_uniqToken = 0
    uniqToken.clear(); mtx_input.clear(); sequences.clear()
    best_score = float('-inf')

    for entry in entries_mtx.values():
        entry.destroy()

    best_binMtx.clear(); best_sequence.clear(); entries_mtx.clear()
    row_offset = 3
    num_rows = 0
```

```
resultSeq.delete("1.0", tk.END);
resultPath.delete("1.0", tk.END)
resultSeq.grid_remove()
resultPath.grid_remove()
save_button.grid_remove()
```

```
def writeBinMtx(matrix, file, step=1):
    row = 0; col = 0
    while step <= len(best_sequence):
        if step % 2 == 0:
            for i in range(mtx_height):
                if matrix[i][col] == step:
                    row = i
                    file.write(f"{col+1}, {row+1}\n")
            else:
                for j in range(mtx_width):
                    if matrix[row][j] == step:
                        col = j
                        file.write(f"{col+1}, {row+1}\n")
        step += 1
```

```
def read_token():
    global N_uniqToken
    uniqToken.clear()

    N_uniqToken = int(box_NToken.get())
    width = 0 if box_NToken.get()==' ' else int(box_NToken.get()[:2])
    valid = True

    current_cell = 0
    for row in range(num_rows + 1):
        for col in range(3, min(10, width - current_cell) + 3):
            token = entries_token[(row, col)].get()
            if token not in uniqToken and token.isalnum() and len(token)==2:
                uniqToken.append(token)
            else:
                entries_token[((row, col))].delete(0, 'end')
                valid = False
        current_cell += 1
```

```

        if not valid:
            uniqToken.clear()

        return valid

def read_Matrix():
    global mtx_height, mtx_width, mtx_input
    mtx_input.clear()

    mtx_height = 0 if box_rows.get()==' ' else int(box_rows.get())
    mtx_width = 0 if box_cols.get()==' ' else int(box_cols.get())

    valid = True
    for i in range(mtx_height):
        row = []
        for j in range(mtx_width):
            try:
                value = entries_mtx[(i, j)].get()
                if value in uniqToken:
                    row.append(value)
            else:
                entries_mtx[(i, j)].delete(0 , 'end')
                valid = False
        except KeyError:
            messagebox.showinfo('Matrix Size', 'Matrix size not updated!')
            valid = False
        mtx_input.append(row)

    if not valid:
        mtx_input.clear()

    return valid

def updateBuffer(event):
    try:
        x = int(box_buffer.get())
        if x < 2:
            box_buffer.delete(0 , 'end')
    except:
        box_buffer.delete(0 , 'end')

```

```

def updateNSeq(event):
    try:
        x = int(box_NSeq.get())
        if x < 1:
            box_NSeq.delete(0 , 'end')
    except:
        box_NSeq.delete(0 , 'end')

def updateMaxSeq(event):
    try:
        x = int(box_MaxSeq.get())
        if x < 2:
            box_MaxSeq.delete(0 , 'end')
    except:
        box_MaxSeq.delete(0 , 'end')

def updateTokens(event):
    clearWidget()
    global row_offset, num_rows

    width = 0 if box_NToken.get()==' ' else int(box_NToken.get()[ :2])

    for entry in entries_token.values():
        entry.destroy()
    entries_token.clear()

    num_rows = ceil(width / 10)
    current_cell = 0

    for row in range(num_rows + 1):
        for col in range(3, min(10, width - current_cell) + 3):
            entry = tk.Entry(root, width=5, justify='center')
            entry.grid(row=row, column=col, sticky="nsew")
            entries_token[(row, col)] = entry
            current_cell += 1

    row_offset = num_rows + 1

    label_buffer.grid(row=row_offset, column=0)
    box_buffer.grid(row=row_offset, column=1)

```

```

label_rows.grid(row=row_offset+1, column=0)
box_rows.grid(row=row_offset+1, column=1)

label_cols.grid(row=row_offset+1, column=2)
box_cols.grid(row=row_offset+1, column=3)

label_NSeq.grid(row=row_offset+2, column=0)
box_NSeq.grid(row=row_offset+2, column=1)

label_MaxSeq.grid(row=row_offset+2, column=2)
box_MaxSeq.grid(row=row_offset+2, column=3)

browse_button.grid(row=row_offset+3, column=1)
generate_button.grid(row=row_offset+3, column=2)
updateMtxSize()

def updateMtxSize():
    global mtx_height, mtx_width
    if read_token():
        mtx_input.clear()
        sequences.clear()
        resultSeq.delete("1.0", tk.END)
        resultPath.delete("1.0", tk.END)

    mtx_height = 0 if box_rows.get()==' ' else int(box_rows.get())
    mtx_width = 0 if box_cols.get()==' ' else int(box_cols.get())

    for entry in entries_mtx.values():
        entry.destroy()
    entries_mtx.clear()

    for i in range(mtx_height):
        for j in range(mtx_width):
            entry = tk.Entry(root, width=5, justify='center')
            entry.grid(row=i + row_offset+4, column=j+3, sticky="nsew")
            entries_mtx[(i, j)] = entry

    if mtx_height != 0:
        resultSeq.grid(row=mtx_height+ row_offset+4, column=3,
columnspan=7)

```



```

        save_button.grid(row=row_offset+3, column=13)
        resultPath.grid(row=row_offset+4, column=13, rowspan=10)

    return True
else:
    mtx_input.clear()

    for entry in entries_mtx.values():
        entry.destroy()
    resultSeq.grid_remove()

    entries_mtx.clear()

    return False

def insertMtx():
    mtx_input.clear()
    valid = True

    for i in range(mtx_height):
        row = []
        for j in range(mtx_width):
            try:
                value = uniqToken[randint(0, N_uniqToken-1)]
                entries_mtx[(i, j)].insert(0, value)
                row.append(value)
            except KeyError:
                messagebox.showerror('Invalid Matrix Size', 'Invalid Matrix
Size')

                valid = False
        mtx_input.append(row)

    if not valid:
        mtx_input.clear()

    return valid

def generateProduct(L, r):
    est_len = sum(len(L) ** x for x in range(2, r + 1))

```

```

prod = []
if est_len <= 10000000:
    for r in range(2, r+1):
        prod.extend(product(L, repeat=r))

return prod

def genSequences():
    sequences.clear()

    N_seq = int(box_NSeq.get())
    max_seq = int(box_MaxSeq.get())

    while True:
        tokenProduct = generateProduct(uniqToken, max_seq)

        if N_seq <= len(tokenProduct):
            for _ in range(N_seq):
                idx = randint(0, len(tokenProduct)-1)
                val = str(list(tokenProduct[idx]))

                sequences[val] = randrange(-200, 200, 10)
                resultSeq.insert(tk.END, ' '.join(eval(val)) + ' : ' +
str(sequences[val]) + '\n')
                tokenProduct.pop(idx)
            break
        else:
            messagebox.showinfo('Sequence Failed!', f'Cannot create {N_seq}
sequences')
            break

def checkScore(temp_seq, binMtx):
    global best_score, best_binMtx, best_sequence
    score = 0; flag_occur = False

    for key, value in sequences.items():
        key = eval(key)
        occur = len([key for idx in range(len(temp_seq)) if temp_seq[idx : idx
+ len(key)] == key])

```

```

        if occur:
            flag_occur = True
            score += occur * value

if flag_occur and score > 0:
    if score > best_score:
        best_score = score
        best_sequence = [_ for _ in temp_seq]
        best_binMtx = [row[:] for row in binMtx]
    elif score == best_score:
        if len(temp_seq) < len(best_sequence):
            best_score = score
            best_sequence = [_ for _ in temp_seq]
            best_binMtx = [row[:] for row in binMtx]

def move(step=1, row=0, col=0, temp_seq=[], binMtx=None):
    if step == (buffer_size+1):
        return

    # ganjil horizontal
    if step % 2 != 0:
        for i in range(col, mtx_width):
            if binMtx[row][i] == 0:
                temp_seq.append(mtx_input[row][i])
                binMtx[row][i] = step

                checkScore(temp_seq, binMtx)

                move(step + 1, row, i, temp_seq, binMtx)

                temp_seq.pop()
                binMtx[row][i] = 0

    for i in range(col-1, -1, -1):
        if binMtx[row][i] == 0:
            temp_seq.append(mtx_input[row][i])
            binMtx[row][i] = step

            checkScore(temp_seq, binMtx)

```

```

        move(step + 1, row, i, temp_seq, binMtx)

        temp_seq.pop()
        binMtx[row][i] = 0

# genap vertikal
else:
    for i in range(row, mtx_height):
        if binMtx[i][col] == 0:
            temp_seq.append(mtx_input[i][col])
            binMtx[i][col] = step

            checkScore(temp_seq, binMtx)

            move(step + 1, i, col, temp_seq, binMtx)

            temp_seq.pop()
            binMtx[i][col] = 0

    for i in range(row-1, -1, -1):
        if binMtx[i][col] == 0:
            temp_seq.append(mtx_input[i][col])
            binMtx[i][col] = step

            checkScore(temp_seq, binMtx)

            move(step + 1, i, col, temp_seq, binMtx)

            temp_seq.pop()
            binMtx[i][col] = 0

def startSolver():
    global end_time
    end_time = 0
    binMtx = [[0 for _ in range(mtx_width)] for __ in range(mtx_height)]

    start_time = time.time()
    move(binMtx=binMtx)

    if best_score == float('-inf'):
        resultPath.insert(tk.END, '0\n')

```

```

else:
    resultPath.insert(tk.END, str(best_score) + '\n')
    resultPath.insert(tk.END, ' '.join(best_sequence) + '\n')

    step=1; row = 0 ; col = 0
    while step <= len(best_sequence):
        # vertikal
        if step % 2 == 0:
            for i in range(mtx_height):
                if best_binMtx[i][col] == step:
                    row = i
                    resultPath.insert(tk.END, str(col+1) + ', ' +
str(row+1) + '\n')
            # horizontal
        else:
            for j in range(mtx_width):
                if best_binMtx[row][j] == step:
                    col = j
                    resultPath.insert(tk.END, str(col+1) + ', ' +
str(row+1) + '\n')
            step += 1

    resultPath.insert(tk.END, '\n')
    end_time = int(round((time.time() - start_time) * 1000))
    resultPath.insert(tk.END, str(end_time) + ' ms\n')

def random_input():
    global buffer_size, best_score
    if updateMtxSize():
        genSequences()
        if len(sequences) > 0:
            insertMtx()

    resultSeq.grid(row=mtx_height+ row_offset+4, column=3,
columnspan=7)

    best_score = float('-inf')
    best_binMtx.clear()
    best_sequence.clear()

```

```

        if read_token():
            if read_Matrix():
                buffer_size = int(box_buffer.get())
                startSolver()

def file_input():
    clearWidget()

    box_NToken.delete(0, 'end')
    for entry in entries_token.values():
        entry.destroy()
    entries_token.clear()
    box_buffer.delete(0, 'end')
    box_cols.set('')
    box_rows.set('')
    box_NSeq.delete(0, 'end')
    box_MaxSeq.delete(0, 'end')

    global buffer_size, mtx_width, mtx_height, mtx_input, sequences

    finput_path = filedialog.askopenfilename(title='Open a file',
filetypes=(("Text Files", "*.txt"),))

    with open(finput_path, 'r') as finput:
        buffer_size = int(finput.readline())
        mtx_width, mtx_height = map(int, finput.readline().split())

        if mtx_height > 0 and mtx_width > 0:
            try:
                for _ in range(mtx_height):
                    row = finput.readline().split()
                    temp = []
                    for j in range(mtx_width):
                        token = row[j]
                        if token.isalnum() and len(token)==2:
                            temp.append(row[j])
                        else:
                            messagebox.showerror('Invalid token', 'Invalid
token')

                    root.destroy()
                    mtx_input.append(temp)

```

```

except:
    messagebox.showerror('Invalid Matrix', 'Invalid Matrix')
    root.destroy()

try:
    N_seq = int(fininput.readline())

    for _ in range(N_seq):
        key = fininput.readline().split()
        for token in key:
            if not (token.isalnum() and len(token)==2):
                messagebox.showerror('Invalid sequences', 'Invalid
sequences')

                root.destroy()

        val = int(fininput.readline())
        sequences[str(key)] = val
except:
    messagebox.showerror('Invalid sequences', 'Invalid sequences')
    root.destroy()

save_button.grid(row=row_offset+3, column=4)
resultPath.grid(row=row_offset+4, column=4, rowspan=10)
startSolver()

def saveFile():
    file_path = filedialog.asksaveasfilename(defaultextension=".txt",
filetypes=[("Text files", "*.txt"),])
    if file_path:
        try:
            with open(file_path, 'w') as file:
                if best_score == float('-inf'):
                    file.write('0\n')
                    file.write('\n' + str(end_time) + ' ms\n')
                else:
                    file.write(str(best_score) + '\n')
                    file.write(str(' '.join(best_sequence)) + '\n')
                    writeBinMtx(best_binMtx, file)
                    file.write('\n' + str(end_time) + ' ms\n')
            messagebox.showinfo("Success", "File saved successfully.")
        except Exception as e:

```

```

        messagebox.showerror("Error", f"An error occurred: {str(e)}")

root = tk.Tk()
root.title("Cyberpunk 2077 Breach Protocol | SOLVER")

curr_mtx_width = tk.StringVar()
curr_mtx_height = tk.StringVar()

# Label and entry widgets for number of rows
label_NToken = tk.Label(root, text="Number of token:")
label_NToken.grid(row=0, column=0)
box_NToken = tk.Entry(root, width=3)
box_NToken.grid(row=0, column=1)

box_NToken.bind('<KeyRelease>', updateTokens)

# Label and entry widgets for number of rows
label_buffer = tk.Label(root, text="Buffer Size:")
label_buffer.grid(row=2, column=0)
box_buffer = tk.Entry(root, width=3)
box_buffer.grid(row=2, column=1)

box_buffer.bind('<KeyRelease>', updateBuffer)

# Label and entry widgets for number of rows
label_rows = tk.Label(root, text="Matrix Height:")
label_rows.grid(row=3, column=0)

box_rows = ttk.Combobox(root, width=2, textvariable=curr_mtx_height)
box_rows.grid(row=3, column=1)
box_rows['values'] = [_ for _ in range(2, 11)]
box_rows['state'] = 'readonly'

# Label and entry widgets for number of columns
label_cols = tk.Label(root, text="Matrix Width:")
label_cols.grid(row=3, column=2)

box_cols = ttk.Combobox(root, width=2, textvariable=curr_mtx_width)
box_cols.grid(row=3, column=3)
box_cols['values'] = [_ for _ in range(2, 11)]

```



```
box_cols['state'] = 'readonly'

# Label and entry widgets for Sequences
label_NSeq = tk.Label(root, text="Number of sequence:")
label_NSeq.grid(row=4, column=0)
box_NSeq = tk.Entry(root, width=3)
box_NSeq.grid(row=4, column=1)

# Label and entry widgets for Length Sequences
label_MaxSeq = tk.Label(root, text="Max size:")
label_MaxSeq.grid(row=4, column=2)

box_MaxSeq = tk.Entry(root, width=3)
box_MaxSeq.grid(row=4, column=3)

browse_button = tk.Button(root, text="browse file...", command=file_input)
browse_button.grid(row=5, column=1)

generate_button = tk.Button(root, text="generate", command=random_input)
generate_button.grid(row=5, column=2)

resultSeq = tk.Text(root, height = 10, width = 40)
resultPath = tk.Text(root, height = 25, width = 40)
save_button = tk.Button(root, text='Save Output', command=saveFile)

root.mainloop()
```

BAB 3

Testing

3.1. Masukan Manual dan Acak

Cyberpunk 2077 Breach Protocol | SOLVER

Number of token:

1a	2A	A2	BC	33
----	----	----	----	----

Buffer Size:

Matrix Height: Matrix Width:

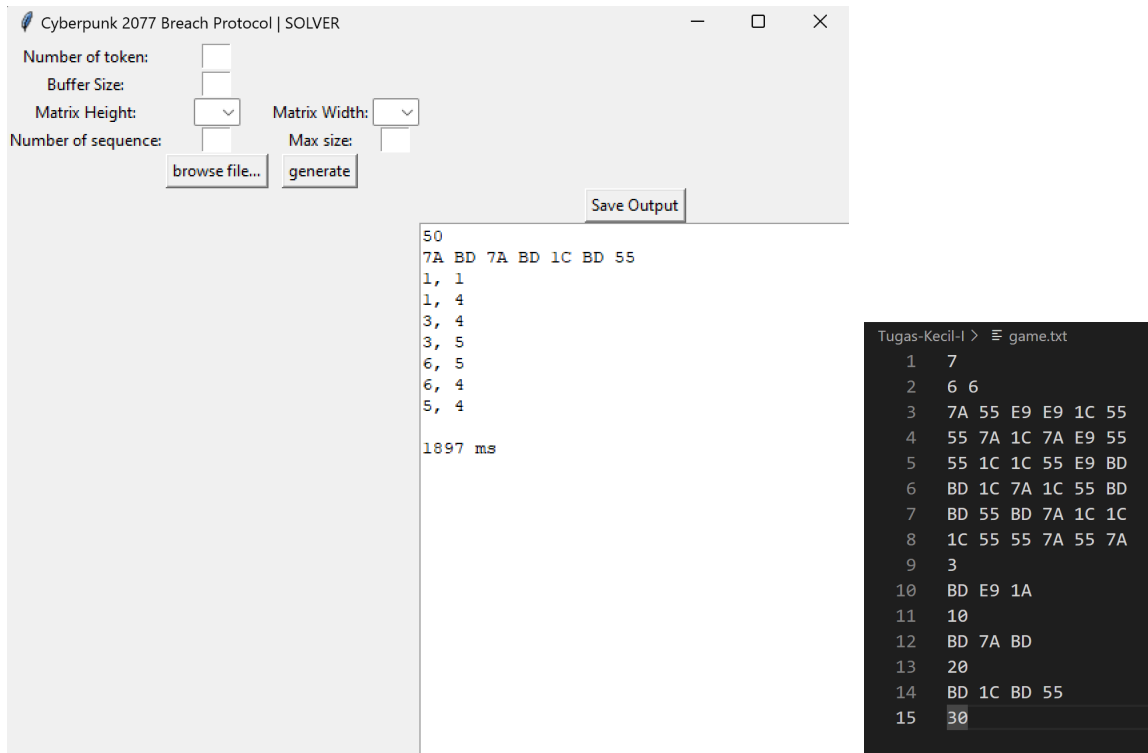
Number of sequence: Max size:

A2	33	1a	BC
A2	2A	BC	2A
33	2A	BC	A2
BC	BC	A2	1a

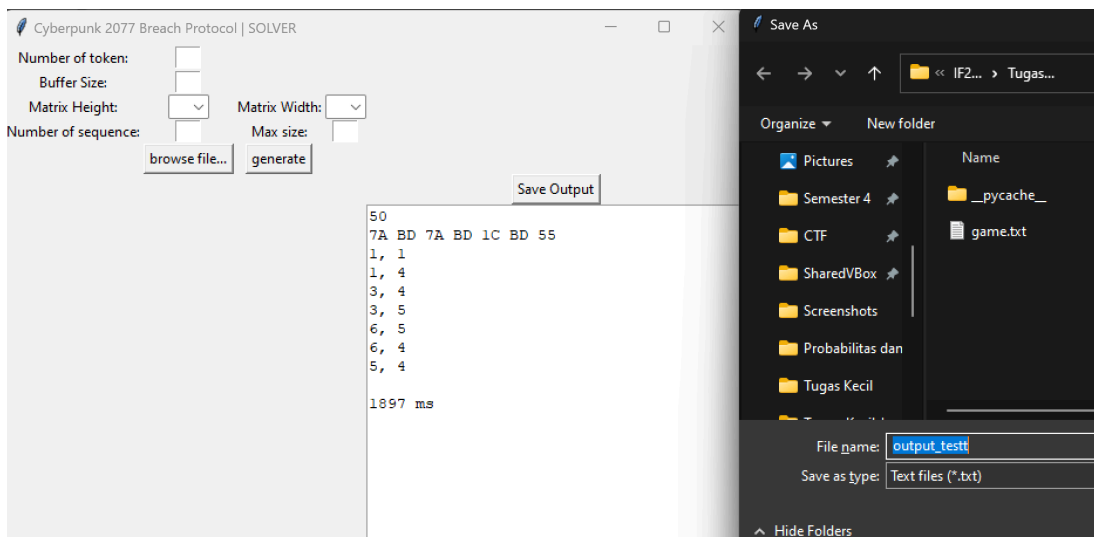
```
130
33 2A BC BC A2 A2 1a
2, 1
2, 3
3, 3
3, 2
1, 2
1, 1
3, 1
105 ms

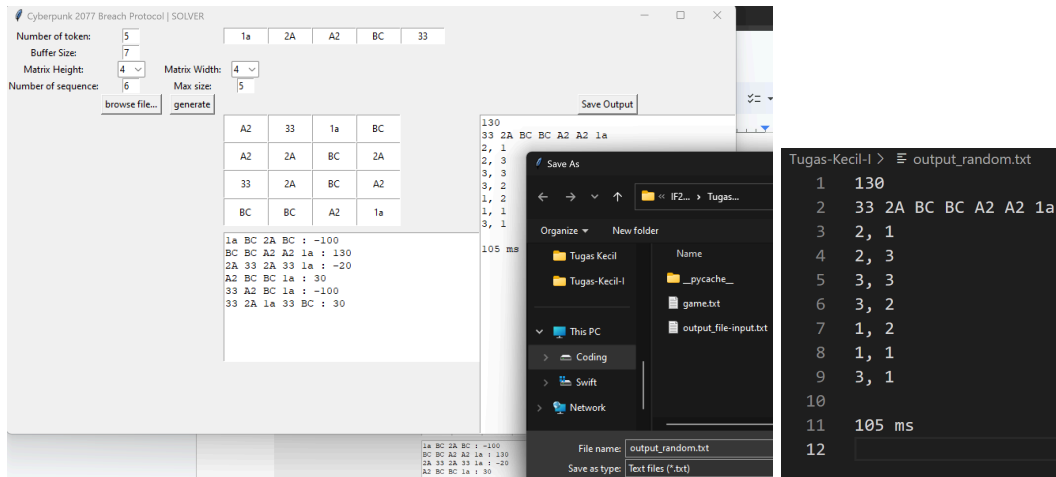
1a BC 2A BC : -100
BC BC A2 A2 1a : 130
2A 33 2A 33 1a : -20
A2 BC BC 1a : 30
33 A2 BC 1a : -100
33 2A 1a 33 BC : 30
```

3.2. Masukan File

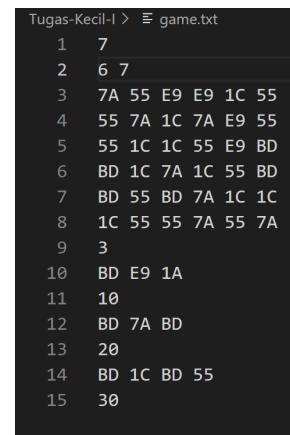
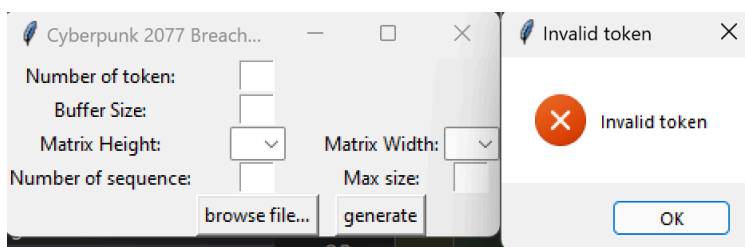


3.3. Simpan File

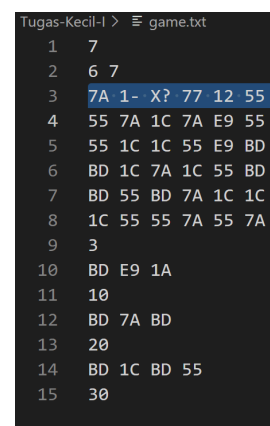
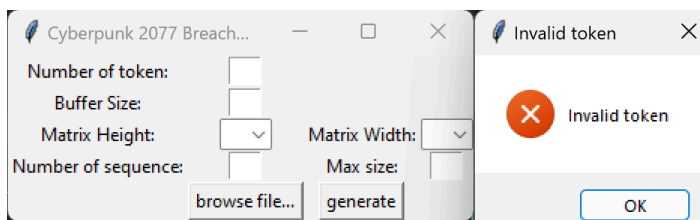




3.4. Ukuran Matriks Tidak Sesuai



3.5. Token Tidak Alfanumerik



LAMPIRAN

Link repository: <https://github.com/mdavaf17>

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	✓	