Laporan Tugas Kecil 1
IF2211 Strategi Algoritma: Penyelesaian Permainan *Queens* Linkedin

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I. Algoritma *Brute Force*

Algoritma *Brute Force* adalah algoritma strategi solusi langsung yang menyelesaikan persoalan secara lempeng. Algoritma ini bersifat sederhana, langsung, dan jelas caranya atau langkah-langkahnya mudah dipahami secara intuitif. Algoritma ini didasarkan pada pernyataan di dalam persoalan dan definisi/konsep yang dilibatkan dalam persoalan tersebut. Algoritma ini sering ditemui pada beberapa kasus berikut, mencari elemen terbesar/terkecil pada senarai, pencarian beruntun, dan masih banyak lagi.

Algoritma *Brute Force* juga dapat diimplementasikan pada game *Queens* Linkedin. Game ini termasuk jenis *board game* yang memiliki peraturan, antara lain:

- *Board* berukuran *NxN* berbentuk persegi.
- Warna pada *board* berjumlah N dengan saling terkoneksi antar kotaknya.
- Pada setiap baris, kolom, dan warna hanya ada satu *queen.*
- Serta, *queen* tidak boleh bertetangga (kotak bersentuhan) dengan *queen* lain baik horizontal, vertikal maupun diagonal.

Langkah yang saya ambil dalam penyelesaian game ini dengan algoritma *Brute Force* murni tanpa backtracking. Hal ini mengakibatkan konsumsi waktu yang sangat lama untuk board berukuran besar.

Algoritma *Brute Force* pada *Queens*:

1. Kelompokkan titik-titik yang berkorespondensi pada setiap warnanya.
2. Ambil kemungkinan pertama yaitu titik paling awal setiap warna yang terdaftar dalam kelompok tersebut.
3. Validasikan titik-titik pada kelompok tersebut sesuai peraturan yang berlaku.
4. Jika ada yang belum memenuhi, ambil kemungkinan kedua yaitu titik kedua (*Increment*) warna terakhir yang terdaftar dalam kelompok tersebut.
5. Lakukan langkah 3-4, sampai warna terakhir sudah mencapai titik terakhir lakukan langkah 4 pada warna sebelum terakhir dan reset warna terakhir menjadi titik pertama.
6. Lakukan terus menerus langkah 3-4-5, sampai validasi pada langkah ke-3 berhasil. Maka itu adalah kombinasi titik-titik pada setiap warna yang merupakan solusi jawabannya.

Pseudocode algoritma *Brute Force* pada *Queens*:

```
function validate_points_pure(combinations)-> boolean
{Validasikan titik-titik setiap i pada senarai combinations
sesuai peraturan}
Kamus Lokal
i, j: integer
q1, q2: point
Algoritma
i traversal[0..length(combinations)]
   j traversal[i+1 .. length(combinations)]
      q1 <- combinations[i]
      q2 <- combinations[j]
      if (abs(q1[0]-q2[0]) == 1 && abs(q1[1] - q2[1] == 1))
then {Memastikan tidak ada yang bertetangga (bersentuhan kotak)
antar titik satu sama lain dalam peranai titik}
         -> False
-> True
```

```
function play_pure(board: dictionary, n: integer) -> tuple
{ Mencari solusi penempatan Queen menggunakan pendekatan Brute
Force berbasis kelompok warna }
Kamus Lokal
   color_groups: dictionary { key: warna, value: list of point
}
   colors: list of string
   color_cell_lists: list of list of point
   combinations: list of integer { indeks sel yang dipilih
untuk tiap warna }
   solutions: list of point
   i, j, cnt: integer
   found: boolean
Algoritma
   { Pre-processing: Kelompokkan sel berdasarkan warna }
   color_groups <- group board by color
   colors <- sort(keys(color_groups))
   if (length(colors) != n) then -> null

   color_cell_lists <- list of points per color
   combinations <- [0, 0, ..., 0] { inisialisasi n elemen
dengan nilai 0 }
   cnt <- 0
   found <- True

   while (found) do
      cnt <- cnt + 1
      { Ambil titik koordinat berdasarkan indeks kombinasi saat
ini }
      solutions <- [color_cell_lists[i][combinations[i]] for i
in 0..n-1]

      { Validasi Baris, Kolom, dan Tetangga }
      if (unique(rows in solutions) and unique(cols in
solutions)) then
         if validate_position_pure(solutions) then
            ->(solutions, cnt)

      { Proses Increment / Mencari Kombinasi Berikutnya }
      i <- n - 1
      while (i >= 0 and combinations[i] ==
length(color_cell_lists[i]) - 1) do
         i <- i - 1

      if (i < 0) then
         found <- False { Semua kemungkinan habis }
      else
         combinations[i] <- combinations[i] + 1
         J traversal [i+1..n]
            combinations[j] <- 0

   -> null
```

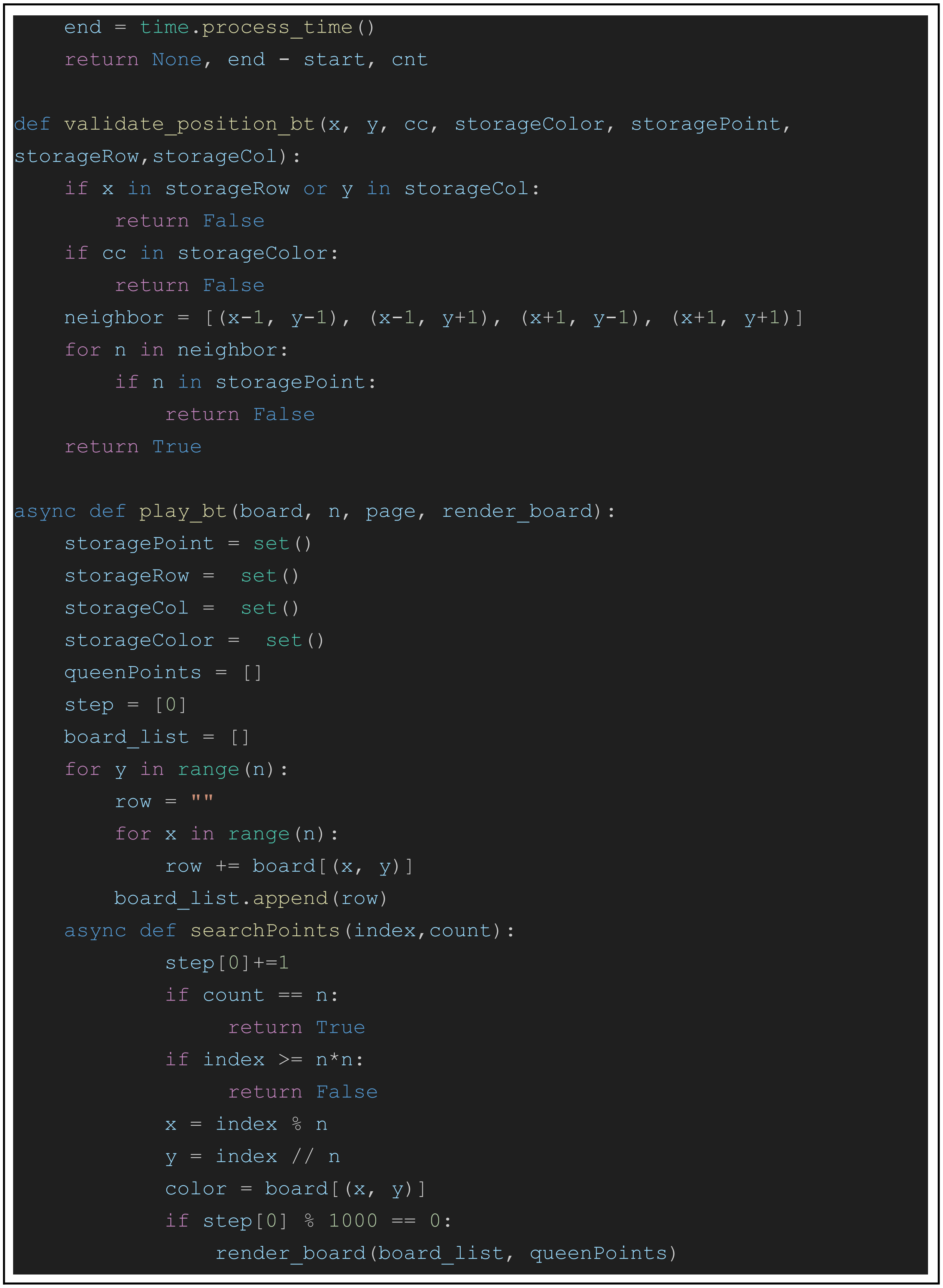
II. *Source* program dalam Python

Source program yang saya buat dalam bahasa Python dari opsi-opsi bahasa pemrograman lainnya. Model pengerjaan yang saya gunakan dengan struktur *model*, *view*, dan *control* (MVC). Setiap komponen model tersebut direpresentasikan pada file-file, yaitu *model* pada file `logic.py`, *view* dan *control* pada file `app.py`, serta fungsi pembantu pada file `utils.py`. Struktur folder yang saya gunakan sebagai berikut:

```
  Tucil1_13524075/
├── doc/           # Laporan Tugas Kecil
├── src/           # Source Code program
│   ├── app.py      # Main GUI Entry Point (Flet)
│   ├── logic.py    # Implementasi Algoritma
│   ├── utils.py    # Fungsi utilitas & validasi
│   ├── requirements.txt
├── test/          # File uji kasus (.txt)
└── README.md
```

Source program lengkap dari setiap file yang digunakan ada pada rincian berikut,
logic.py

```python
import time ,  asyncio

def validate_position_pure(combinations):
    for i in range(len(combinations)):
        for j in range(i + 1, len(combinations)):
            q1, q2 = combinations[i], combinations[j]
            if abs(q1[0] - q2[0]) == 1 and abs(q1[1] - q2[1]) == 1:
                return False
    return True

async def play_pure(board, n, page, render_board):
    start = time.process_time()
    cnt = 0

    board_list = []
    for y in range(n):
        row = ""
        for x in range(n):
            row += board[(x, y)]
        board_list.append(row)

    color_groups = {}
    for pos, color in board.items():
        if color not in color_groups:
            color_groups[color] = []
        color_groups[color].append(pos)

    colors = sorted(color_groups.keys())

    if len(colors) != n:
        end = time.process_time()
        return None, end - start

    color_cell_lists = [color_groups[c] for c in colors]
    group_sizes = [len(cells) for cells in color_cell_lists]


    combinations = [0 for _ in range(n)]

    found = True
    while found:
        cnt += 1

        solutions = [color_cell_lists[i][combinations[i]] for i in
range(n)]


        rows = [q[1] for q in solutions]
        if len(set(rows)) == n:
            cols = [q[0] for q in solutions]
            if len(set(cols)) == n:
                if validate_position_pure(solutions):
                    end = time.process_time()
                    render_board(board_list, solutions)
                    await asyncio.sleep(0)
                    return solutions, end - start, cnt

        if cnt % 1000 == 0:
            render_board(board_list, solutions)
            await asyncio.sleep(0)


        i = n - 1
        while i >= 0 and combinations[i] == group_sizes[i] - 1:
            i -= 1

        if i < 0:
            found = False
        else:
            combinations[i] += 1
            for j in range(i + 1, n):
                combinations[j] = 0
```

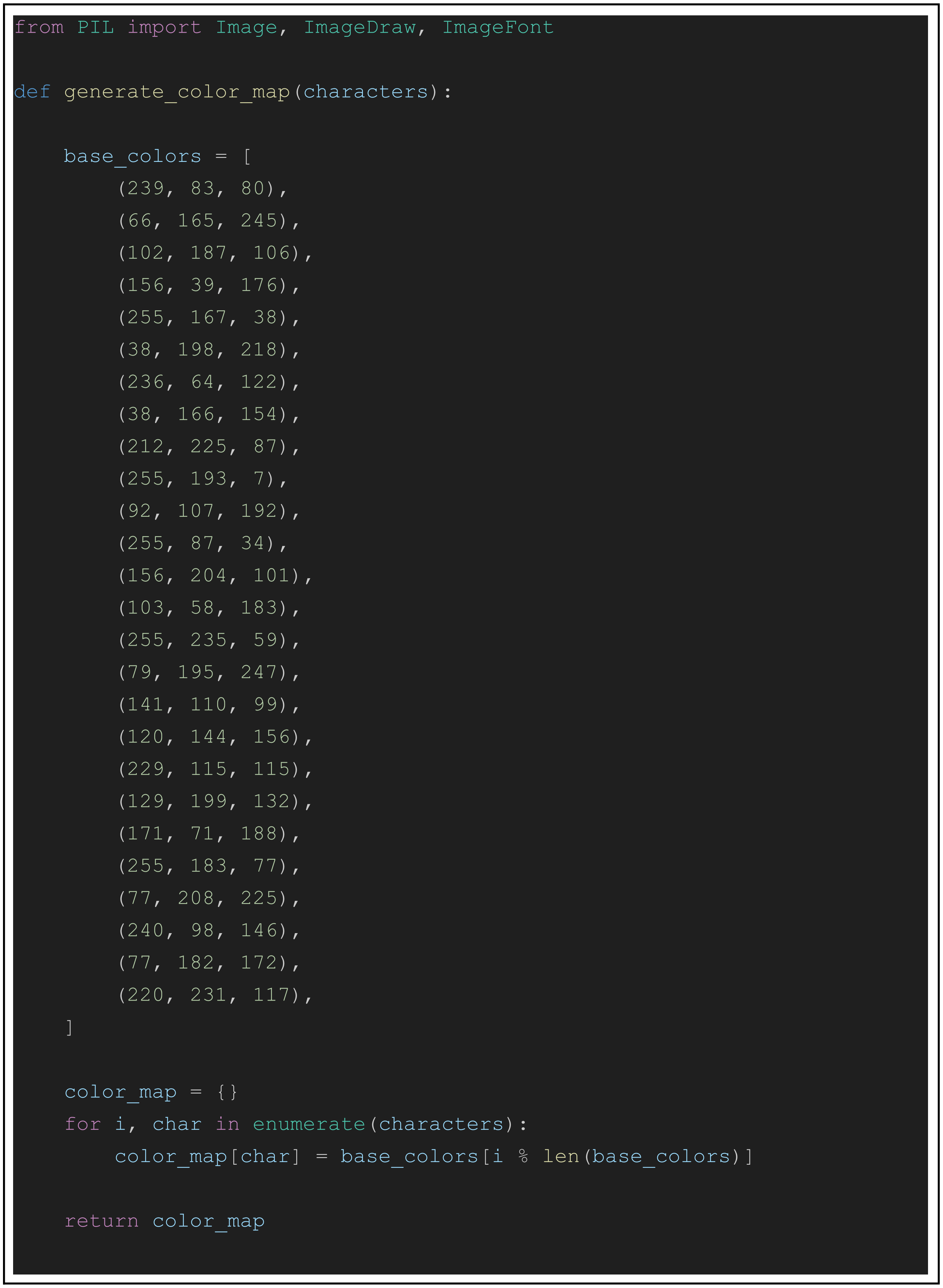

```
    end = time.process_time()
    return None, end - start, cnt

def validate_position_bt(x, y, cc, storageColor, storagePoint,
storageRow,storageCol):
    if x in storageRow or y in storageCol:
        return False
    if cc in storageColor:
        return False
    neighbor = [(x-1, y-1), (x-1, y+1), (x+1, y-1), (x+1, y+1)]
    for n in neighbor:
        if n in storagePoint:
            return False
    return True

async def play_bt(board, n, page, render_board):
    storagePoint = set()
    storageRow =  set()
    storageCol =  set()
    storageColor =  set()
    queenPoints = []
    step = [0]
    board_list = []
    for y in range(n):
        row = ""
        for x in range(n):
            row += board[(x, y)]
        board_list.append(row)
    async def searchPoints(index,count):
            step[0]+=1
            if count == n:
                 return True
            if index >= n*n:
                 return False
            x = index % n
            y = index // n
            color = board[(x, y)]
            if step[0] % 1000 == 0:
                render_board(board_list, queenPoints)
                await asyncio.sleep(0)
            if validate_position_bt(x, y, color, storageColor,
storagePoint, storageRow, storageCol):
                storagePoint.add((x, y))
                storageRow.add(x)
                storageCol.add(y)
                storageColor.add(color)
                queenPoints.append((x, y))

                if await searchPoints(index + 1, count + 1):
                    return True

                storagePoint.remove((x, y))
                storageRow.remove(x)
                storageCol.remove(y)
                storageColor.remove(color)
                queenPoints.pop()


            if await searchPoints(index + 1, count):
                return True

            return False

    start = time.process_time()
    if(await searchPoints(0,0)):
         end = time.process_time()
         return queenPoints, end-start, step[0]
    else:
        end = time.process_time()
        return None, end-start, step[0]
```

utils.py

```
def is_connected(board):
    n = len(board)
    colors = set(char for row in board for char in row)

    for color in colors:
        start_node = None
        color_cells_count = 0
        for r in range(n):
            for c in range(n):
                if board[r][c] == color:
                    color_cells_count += 1
                    if not start_node:
                        start_node = (r, c)

        queue = [start_node]
        seen_in_bfs = {start_node}
        while queue:
            curr_r, curr_c = queue.pop(0)
            for dr, dc in [(0,1), (0,-1), (1,0), (-1,0)]:
                nr, nc = curr_r + dr, curr_c + dc
                if 0 <= nr < n and 0 <= nc < n and \
                   board[nr][nc] == color and (nr, nc) not in
seen_in_bfs:
                    seen_in_bfs.add((nr, nc))
                    queue.append((nr, nc))

        if len(seen_in_bfs) != color_cells_count:
            return False, f"Warna {color} terpecah/tidak menyatu!"

    return True, "Semua wilayah terkoneksi dengan baik."

def validate_board(board):
    n = len(board)
    for row in board:
        if len(row) != n:
            return False, "Papan tidak persegi!"

    warna = set(char for row in board for char in row)
    if len(warna) != n:
        return False,f"Jumlah warna ({len(warna)}) tidak sama dengan
ukuran papan {n}!"
```

```
    valid, pesan = is_connected(board)
    if (not valid):
        return valid, pesan
    return True, 'Papan Valid!'

def file_to_board(path):
    try:
        with open (path) as f:
            return [line.strip() for line in f.readlines() if
line.strip()]
    except:
          print("Gagal membaca file :(")

def convert_dict(board, n):
    points = [(x, y) for x in range(n) for y in range(n) ]
    boardDict = {}
    for x in range(n*n):
        x_coor, y_coor = points[x]
        color = board[y_coor][x_coor]
        boardDict[(x_coor, y_coor)] = color
    return boardDict

def interface(board,solution, n, f):
    for  y in range(n):
        for x in range(n):
            if (x, y) in solution:
                print('#', end='', file=f)
            else:
                print(f'{board[(x,y)]}', end='', file=f)
        print(file=f)
    print(file=f)
```

image_process.py



```python
from PIL import Image, ImageDraw, ImageFont

def generate_color_map(characters):

    base_colors = [
        (239, 83, 80),
        (66, 165, 245),
        (102, 187, 106),
        (156, 39, 176),
        (255, 167, 38),
        (38, 198, 218),
        (236, 64, 122),
        (38, 166, 154),
        (212, 225, 87),
        (255, 193, 7),
        (92, 107, 192),
        (255, 87, 34),
        (156, 204, 101),
        (103, 58, 183),
        (255, 235, 59),
        (79, 195, 247),
        (141, 110, 99),
        (120, 144, 156),
        (229, 115, 115),
        (129, 199, 132),
        (171, 71, 188),
        (255, 183, 77),
        (77, 208, 225),
        (240, 98, 146),
        (77, 182, 172),
        (220, 231, 117),
    ]

    color_map = {}
    for i, char in enumerate(characters):
        color_map[char] = base_colors[i % len(base_colors)]

    return color_map
```

```python
def board_to_image(board_data, solution=None,
output_path="solution.png", cell_size=80, color_map=None):

    n = len(board_data)
    img_size = n * cell_size

    img = Image.new('RGB', (img_size, img_size), 'white')
    draw = ImageDraw.Draw(img)

    if color_map is None:
        unique_chars = sorted(set(''.join(board_data)))
        color_map = generate_color_map(unique_chars)

    try:
        font =
ImageFont.truetype("/usr/share/fonts/truetype/dejavu/DejaVuSans-Bold.ttf
", cell_size // 2)
        label_font =
ImageFont.truetype("/usr/share/fonts/truetype/dejavu/DejaVuSans.ttf",
cell_size // 4)
    except:
        try:
            font = ImageFont.truetype("arial.ttf", cell_size // 2)
            label_font = ImageFont.truetype("arial.ttf", cell_size // 4)
        except:
            font = ImageFont.load_default()
            label_font = ImageFont.load_default()

    for y in range(n):
        for x in range(n):
            char = board_data[y][x]
            color = color_map.get(char, (200, 200, 200))

            x1 = x * cell_size
            y1 = y * cell_size
            x2 = x1 + cell_size
            y2 = y1 + cell_size
            draw.rectangle([x1, y1, x2, y2], fill=color,
outline='black', width=2)

            draw.text((x1 + 5, y1 + 5), char, fill='white',
font=label_font)

            if solution and (x, y) in solution:
                text = "Q"

                bbox = draw.textbbox((0, 0), text, font=font)
                text_width = bbox[2] - bbox[0]
                text_height = bbox[3] - bbox[1]

                text_x = x1 + (cell_size - text_width) // 2
                text_y = y1 + (cell_size - text_height) // 2

                draw.text((text_x, text_y), text, fill='white',
font=font)

    img.save(output_path)
    print(f"Image saved: {output_path}")
    return output_path
```

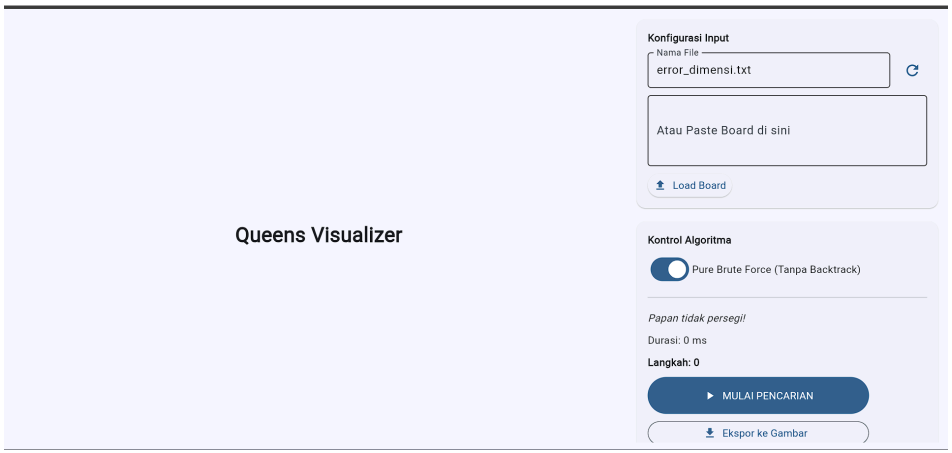
app.py

```
import flet as ft
import logic, utils, image_process


async def main(page: ft.Page):
    page.title = "Queens Game by Brute Force Algorithm"
    page.theme_mode = ft.ThemeMode.LIGHT
    page.scroll = ft.ScrollMode.ADAPTIVE
    page.window_width = 1000
    page.window_height = 800

    state = {
        "board": None,
        "n": 0,
        "boardDict": {},
        "is_running": False,
        "solution": None
    }

    status_text = ft.Text("Pilih file atau masukkan teks board...",
italic=True)
    step_counter = ft.Text("Langkah: 0", weight="bold")
    duration_text = ft.Text("Durasi: 0 ms")

    file_name_input = ft.TextField(label="Nama File", hint_text="Contoh:
board.txt", expand=True)
    manual_input = ft.TextField(label="Atau Paste Board di sini",
multiline=True, min_lines=3)

    pure_bt_switch = ft.Switch(label="Pure Brute Force (Tanpa
Backtrack)", value=True)

    grid_display = ft.Container(
        content=ft.Column(),
        alignment=ft.alignment.Alignment(0, 0),
        padding=20
    )

    def render_board(board_data, solution=None):
        n = len(board_data)
        state["n"] = n
        state["boardDict"] = utils.convert_dict(board_data, n)

        color_map = {
            'A': ft.Colors.RED_400,
            'B': ft.Colors.BLUE_400,
            'C': ft.Colors.GREEN_400,
            'D': ft.Colors.PURPLE_400,
            'E': ft.Colors.ORANGE_400,
            'F': ft.Colors.CYAN_400,
            'G': ft.Colors.PINK_400,
            'H': ft.Colors.TEAL_400,
            'I': ft.Colors.LIME_400,
            'J': ft.Colors.AMBER_400,
            'K': ft.Colors.INDIGO_400,
            'L': ft.Colors.DEEP_ORANGE_400,
            'M': ft.Colors.LIGHT_GREEN_400,
            'N': ft.Colors.DEEP_PURPLE_400,
            'O': ft.Colors.YELLOW_400,
            'P': ft.Colors.LIGHT_BLUE_400,
            'Q': ft.Colors.BROWN_400,
            'R': ft.Colors.BLUE_GREY_400,
            'S': ft.Colors.RED_300,
            'T': ft.Colors.GREEN_300,
            'U': ft.Colors.PURPLE_300,
            'V': ft.Colors.ORANGE_300,
            'W': ft.Colors.CYAN_300,
            'X': ft.Colors.PINK_300,
            'Y': ft.Colors.TEAL_300,
            'Z': ft.Colors.LIME_300
        }

        rows = []
        state["grid_cells"] = []

        for y in range(n):
            row_controls = []
            for x in range(n):
                char = board_data[y][x]
                is_queen = solution and (x, y) in solution

                cell = ft.Container(
                    content=ft.Text("Q" if is_queen else "", size=20,
weight="bold", color="white"),
                    bgcolor=color_map[char],
                    width=45, height=45,
                    alignment=ft.alignment.Alignment(0, 0),
                    border=ft.border.all(1, "black12"),
                    border_radius=4
                )
                row_controls.append(cell)
            rows.append(ft.Row(controls=row_controls, spacing=5,
alignment=ft.MainAxisAlignment.CENTER))

        grid_display.content = ft.Column(controls=rows, spacing=5,
horizontal_alignment=ft.CrossAxisAlignment.CENTER)
        page.update()

    def load_board(e):
        try:
            if file_name_input.value:
                board = utils.file_to_board(file_name_input.value)
            else:
                board = [line.strip() for line in
manual_input.value.split("\n") if line.strip()]

            valid, msg = utils.validate_board(board)
            status_text.value = msg
            if valid:
                state["board"] = board
                render_board(board)
            page.update()
        except Exception as ex:
            status_text.value = f"Error: {str(ex)}"
            page.update()

    async def start_game(e):
        if not state["board"]:
            status_text.value = "Load board dulu!"
            page.update()
            return

        state["is_running"] = True
        status_text.value = "Sedang mencari solusi..."
        page.update()

        if pure_bt_switch.value:
            answer, duration, step = await
logic.play_pure(state["boardDict"], state["n"], page, render_board)
        else:
            answer, duration, step = await
logic.play_bt(state["boardDict"], state["n"], page, render_board)

        if answer is None:
            status_text.value = "Tidak ada jawabannya, berikan board
lain ya :)"
            state["solution"] = None
        else:
            status_text.value = "Solusi Ditemukan!"
            state["solution"] = answer
            render_board(state["board"], answer)

        duration_text.value = f"Permainan berlangsung selama {duration *
1000:.2f} ms"
        step_counter.value = f"Permainan berlangsung dengan banyaknya
konfigurasi: {step}"
        state["is_running"] = False
        page.update()

    def export_to_txt(e):
        if not state['board']:
            status_text.value="Tidak ada board untuk diekspor!"
            page.update()
            return
        try:
            solution = state.get('solution')
            board = state.get('board')
            n = state.get('n')

            import datetime
            timestamp =
datetime.datetime.now().strftime("%Y%m%d_%H%M%S")
            output_path = f"queens_solution_{timestamp}.txt"


            with open(output_path, 'w') as f:
                for row in board:
                    f.write(row + '\n')
                f.write('\n')

                if solution:
                    f.write("Solution:\n")
                    result = [list(row) for row in board]
                    for (x, y) in solution:
                        result[y][x] = '#'

                    for row in result:
                        f.write(''.join(row) + '\n')
                else:
                    f.write("Tidak/Belum ada solusi yang memenuhi. Harap
jalankan programnya terlebih dahulu untuk mengetahui.\n")

            status_text.value = f"File disimpan: {output_path}"
            page.update()
        except Exception as ex:
            status_text.value = f"Error ekspor: {str(ex)}"
            page.update()



    def export_to_image(e):
        if not state["board"]:
            status_text.value = "Tidak ada board untuk diekspor!"
            page.update()
            return

        try:
            solution = state.get('solution')
            color_map = state.get('color_map')

            import datetime
            timestamp =
datetime.datetime.now().strftime("%Y%m%d_%H%M%S")
            output_path = f"queens_solution_{timestamp}.png"

            saved_path = image_process.board_to_image(state["board"],
solution, output_path, color_map=color_map)
```

```
            status_text.value = f"Gambar disimpan: {saved_path}"
            page.update()

        except Exception as ex:
            status_text.value = f"Error ekspor: {str(ex)}"
            page.update()

    page.add(
        ft.Row([
            ft.Column([
                ft.Text("Queens Visualizer", size=28, weight="bold"),
                grid_display,
            ], expand=2,
horizontal_alignment=ft.CrossAxisAlignment.CENTER),

            ft.Column([
                ft.Card(
                    content=ft.Container(
                        content=ft.Column([
                            ft.Text("Konfigurasi Input", weight="bold"),
                            ft.Row([file_name_input,
ft.IconButton(ft.Icons.REFRESH, on_click=load_board)]),
                            manual_input,
                            ft.ElevatedButton("Load Board",
on_click=load_board, icon=ft.Icons.UPLOAD),

                        ]), padding=15
                    )
                ),
                ft.Card(
                    content=ft.Container(
                        content=ft.Column([
                            ft.Text("Kontrol Algoritma", weight="bold"),
                            pure_bt_switch,
                            ft.Divider(),
                            status_text,
                            duration_text,
                            step_counter,
                            ft.FilledButton("MULAI PENCARIAN",
icon=ft.Icons.PLAY_ARROW,
                                           on_click=start_game,
width=300, height=50),
                            ft.OutlinedButton("Ekspor ke Gambar",
icon=ft.Icons.DOWNLOAD,
                                            on_click=export_to_image,
width=300),
                            ft.OutlinedButton("Ekspor ke File Txt",
icon=ft.Icons.DOWNLOAD,
                                            on_click=export_to_txt,
width=300),
                        ]), padding=15
                    )
                )
            ], expand=1)
        ], expand=True)
    )

if __name__ == "__main__":
    ft.app(target=main, view=ft.AppView.WEB_BROWSER, port=8550)
```

III. Tangkapan layar studi kasus

1. Uji Kasus error dimensi

Input	Output
AAAAA BBBBB CCCC DDDDD EEEEE	

Queens Visualizer

Konfigurasi Input

Nama File: error_dimensi.txt

Atau Paste Board di sini

Load Board

Kontrol Algoritma

Pure Brute Force (Tanpa Backtrack)

Papan tidak persegi!

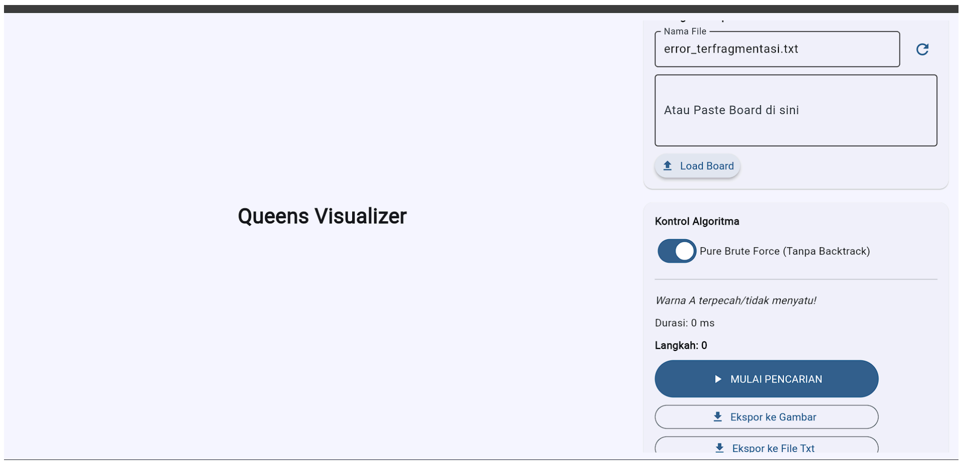
Durasi: 0 ms

Langkah: 0

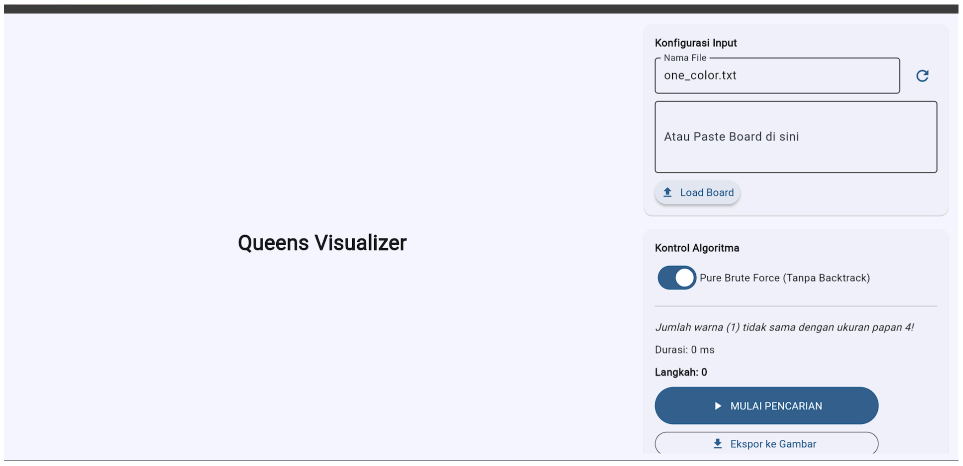
MULAI PENCARIAN

Ekspor ke Gambar

2. Uji Kasus error terfragmentasi warna

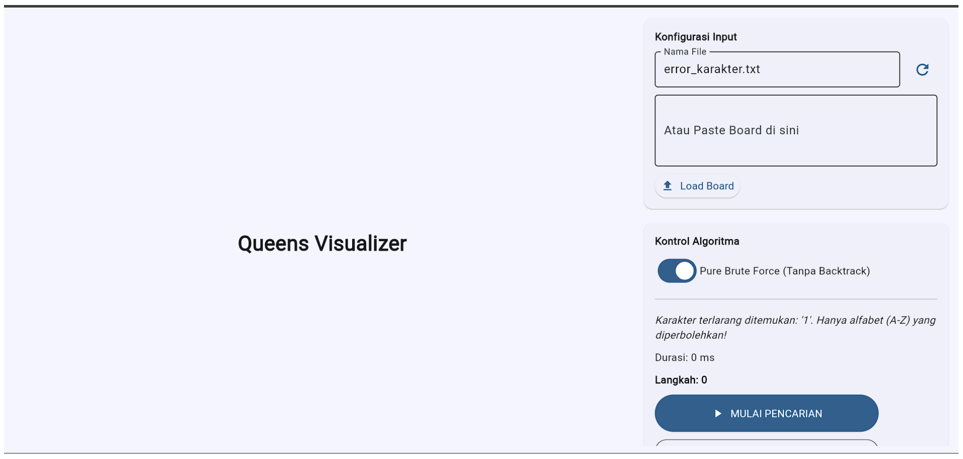
Input	Output
AAAAA ABBBC ABACC ABCCC DDEEE	 Queens Visualizer Nama File: error_terfragmentasi.txt Atau Paste Board di sini Kontrol Algoritma Pure Brute Force (Tanpa Backtrack) *Warna A terpecah/tidak menyatu!* Durasi: 0 ms **Langkah: 0**

3. Uji Kasus error jumlah warna

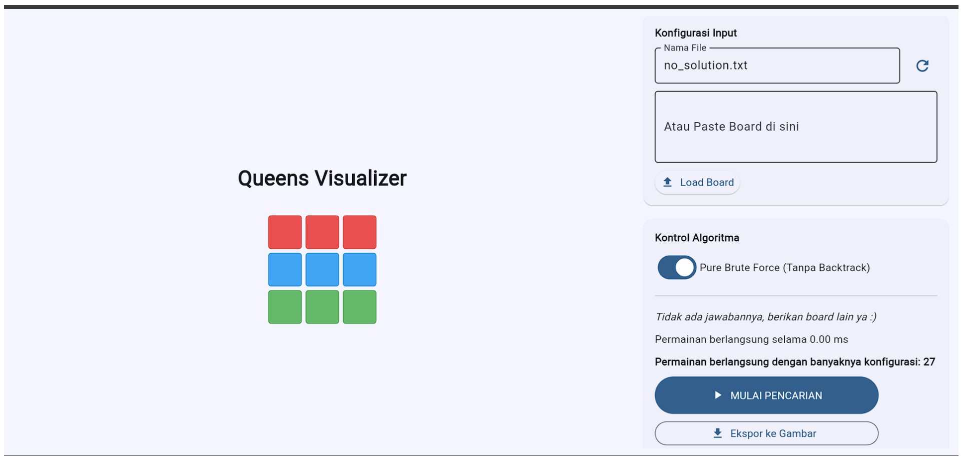
Input	Output
AAAA AAAA AAAA AAAA	 Queens Visualizer Konfigurasi Input Nama File: one_color.txt Atau Paste Board di sini Kontrol Algoritma Pure Brute Force (Tanpa Backtrack) *Jumlah warna (1) tidak sama dengan ukuran papan 4!* Durasi: 0 ms **Langkah: 0**

4. Uji Kasus error karakter

Input	Output

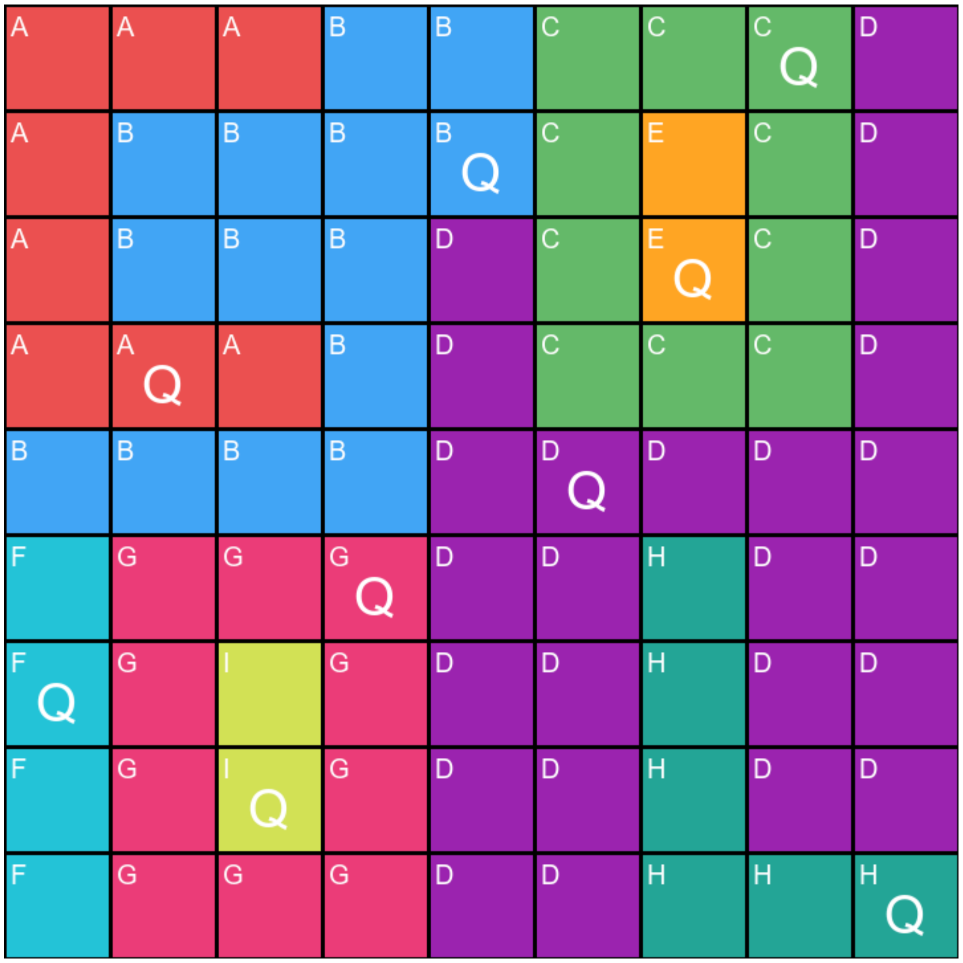
AAA1 BB#B CC2C DDDD	 Queens Visualizer Konfigurasi Input Nama File: error_karakter.txt Atau Paste Board di sini Load Board Kontrol Algoritma Pure Brute Force (Tanpa Backtrack) *Karakter terlarang ditemukan: '1'. Hanya alfabet (A-Z) yang diperbolehkan!* Durasi: 0 ms **Langkah: 0** MULAI PENCARIAN

5. Uji Kasus tidak ada solusi

Input	Output
AAA BBB CCC	 Queens Visualizer Konfigurasi Input Nama File: no_solution.txt Atau Paste Board di sini Load Board Kontrol Algoritma Pure Brute Force (Tanpa Backtrack) *Tidak ada jawabannya, berikan board lain ya :)* Permainan berlangsung selama 0.00 ms **Permainan berlangsung dengan banyaknya konfigurasi: 27** MULAI PENCARIAN Ekspor ke Gambar

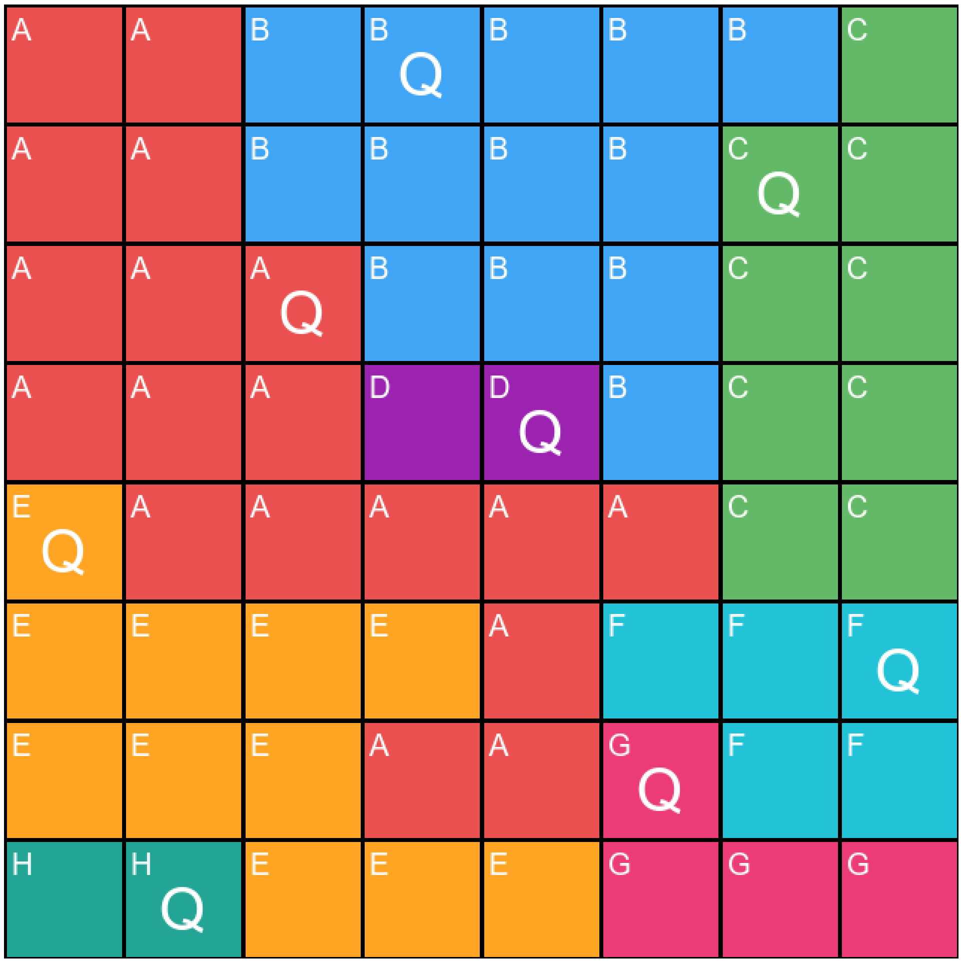
6. Uji Kasus normal ukuran 8x8

Input	Output

AABBBBBC AABBBBCC AAABBBCC AAADDBCC EAAAAACC EEEEAFFF EEEAAGFF HHEEEGGG	 A A A B B C C C Q D A B B B B Q C E C D A B B B D C E Q C D A A Q A B D C C C D B B B B D D Q D D D F G G G Q D D H D D F Q G I G D D H D D F G I Q G D D H D D F G G G D D H H H Q

7. Uji Kasus normal ukuran 9x9

Input	Output

AAABBCCCD ABBBBCECD ABBBDCECD AAABDCCCD BBBBDDDDD FGGGDDHDD FGIGDDHDD FGIGDDHDD FGGGDDHHH	

IV. Pranala GitHub Repository

Pranala GitHub Repository: https://github.com/hakamavicena/Tucil1_13524075

V. Lampiran

No	Poin	Ya	Tidak
1	Program berhasil di kompilasi tanpa kesalahan	✓	
2	Program berhasil dijalankan	✓	
3	Solusi yang diberikan program benar dan mematuhi aturan permainan	✓	
4	Program dapat membaca masukan berkas .txt serta menyimpan solusi	✓	

	dalam berkas .txt		
5	Program memiliki Graphical User Interface (GUI)	✓	
6	Program dapat menyimpan solusi dalam bentuk file gambar	✓	

Tugas ini disusun sepenuhnya tanpa bantuan kecerdasan buatan (Generative AI), melainkan hasil pemikiran dan analisis mandiri.

[illegible]

13524075 - Hakam Avicena Musain