desafio 2 python

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```
#!pip install pandas
#!pip install numpy
#!pip install matplotlib
import pandas as pd  # Biblioteca para manipulação de dados
import numpy as np   # Biblioteca para operações numéricas
import calendar      # Biblioteca para operações com datas e calendários
import matplotlib.pyplot as plt  # Biblioteca para criação de gráficos
from matplotlib.colors import LinearSegmentedColormap  # Para criar gradiente de cor personalizado

#Função para processar chunks (equivale ao getStats no R)
def process_chunk(chunk):
    # Filtra os dados para manter apenas as companhias AA, DL, UA, US e remove valores nulos em 'AIRLIN
    chunk = chunk[chunk['AIRLINE'].isin(['AA', 'DL', 'UA', 'US']) & chunk['AIRLINE'].notna()]

    #Cria uma nova coluna indicando se o voo teve atraso superior a 10 minutos (1 = sim, 0 = não)
    chunk['voos_atrasados'] = (chunk['ARRIVAL_DELAY'].astype(float) > 10).astype(int)

    #Agrupa os dados por DIA, MES e AIRLINE
    #Soma os voos atrasados e conta o total de voos
    grouped = chunk.groupby(['DAY', 'MONTH', 'AIRLINE']).agg(
        voos_atrasados=('voos_atrasados', 'sum'),
        total_voos=('ARRIVAL_DELAY', 'count')
    ).reset_index()

    return grouped  #Retorna o DataFrame processado

#Lendo o CSV em chunks e processando (leitura do banco de dadis flights)
file_path = r"C:\Users\Shophia\Documents\me315\flights.csv.zip"  # Caminho para o arquivo ZIP contendo

chunks = []           #Lista que armazenará os chunks processados
chunk_size = 100_000  #Define o tamanho de cada chunk (100 mil linhas)

#Lê o arquivo CSV em partes (chunks)
for chunk in pd.read_csv(file_path,
                         usecols=['AIRLINE', 'ARRIVAL_DELAY', 'DAY', 'MONTH'],  #Colunas de interesse
                         dtype={'AIRLINE': str, 'ARRIVAL_DELAY': str, 'DAY': int, 'MONTH': int},  # Tip
                         chunksize=chunk_size):
    processed = process_chunk(chunk)  # Processa o chunk
    chunks.append(processed)          # Adiciona o resultado à lista
```

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#Concatena todos os chunks processados em um único DataFrame
df_stats = pd.concat(chunks)

#Agrega os dados consolidados de todos os chunks
df_final = df_stats.groupby(['AIRLINE', 'DAY', 'MONTH']).agg(
    voos_atrasados=('voos_atrasados', 'sum'),  # Soma total de voos atrasados por dia/mês/companhia
    total_voos=('total_voos', 'sum')           # Soma total de voos
).reset_index()

# Calcula a porcentagem de voos atrasados
df_final['Perc'] = df_final['voos_atrasados'] / df_final['total_voos']

# Cria uma coluna de data completa (ano fixo 2015) para facilitar a plotagem
ano = 2015
df_final['Data'] = pd.to_datetime(dict(year=ano, month=df_final['MONTH'], day=df_final['DAY']))

#Função para desenhar um mês em formato de calendário com heatmap
def desenhar_mes(ax, ano, mes, datas, valores, cmap):


    ax.text(3, -1.0, calendar.month_name[mes], fontsize=10, ha='center', va='center')  # Título do mês
    ax.set_ylim(2, -2)

    cal = calendar.Calendar(firstweekday=6)  # Cria calendário começando no domingo

    # Obtém todos os dias do mês (com zeros onde não há dias do mês)
    dias = list(cal.itermonthdays(ano, mes))
    while len(dias) < 6*7:  # Garante que a matriz tenha 6 semanas
        dias.append(0)
    matriz = np.array(dias).reshape((6,7))  # Reshape para 6 linhas (semanas) x 7 colunas (dias)
```

```
    cores = np.zeros_like(matriz, dtype=float)  # Matriz para armazenar os valores de cor (porcentagem

    # Preenche a matriz de cores com os valores correspondentes ao dia
    for r in range(6):
        for c in range(7):
            dia = matriz[r,c]
            if dia != 0:  # Ignora os zeros (dias fora do mês)
                data_atual = pd.Timestamp(year=ano, month=mes, day=dia)
                valor = valores.get(data_atual, 0)  # Obtém o valor de atraso (ou 0 se não existir)
                cores[r,c] = valor

    # Plota o heatmap no eixo fornecido
    im = ax.imshow(cores, cmap=cmap, vmin=0, vmax=1)

    # Escreve os números dos dias sobre o heatmap
    for r in range(6):
        for c in range(7):
            dia = matriz[r,c]
            if dia != 0:
                ax.text(c, r, str(dia), ha='center', va='center', color='white', fontsize=8)

    # Configurações dos ticks e rótulos dos dias da semana
    ax.set_xticks(np.arange(7))
    ax.set_xticklabels(['Dom', 'Seg', 'Ter', 'Qua', 'Qui', 'Sex', 'Sáb'], fontsize=6)
    ax.set_yticks(np.arange(6))
    ax.set_yticklabels([])
    ax.tick_params(left=False, bottom=False)
    ax.set_xticks([], minor=True)
    ax.set_yticks([], minor=True)

    return im  # Retorna o objeto da imagem do heatmap

#Função principal para plotar calendário por companhia aérea
def calendario_por_companhia(df, companhia, ano=2015):
    # Filtra os dados da companhia aérea selecionada
    df_cia = df[df['AIRLINE'] == companhia]

    # Cria um dicionário mapeando Data -> Porcentagem de voos atrasados
    valores = pd.Series(df_cia.Perc.values, index=df_cia.Data).to_dict()

    # Cria uma figura com 12 subplots (3 linhas x 4 colunas, um para cada mês)
    fig, axs = plt.subplots(3, 4, figsize=(16,9))
    fig.suptitle(f'Calendário de atrasos para {companhia} - {ano}', fontsize=16, y=1.02)
    plt.subplots_adjust(hspace=0.5)  # Espaçamento entre os subplots

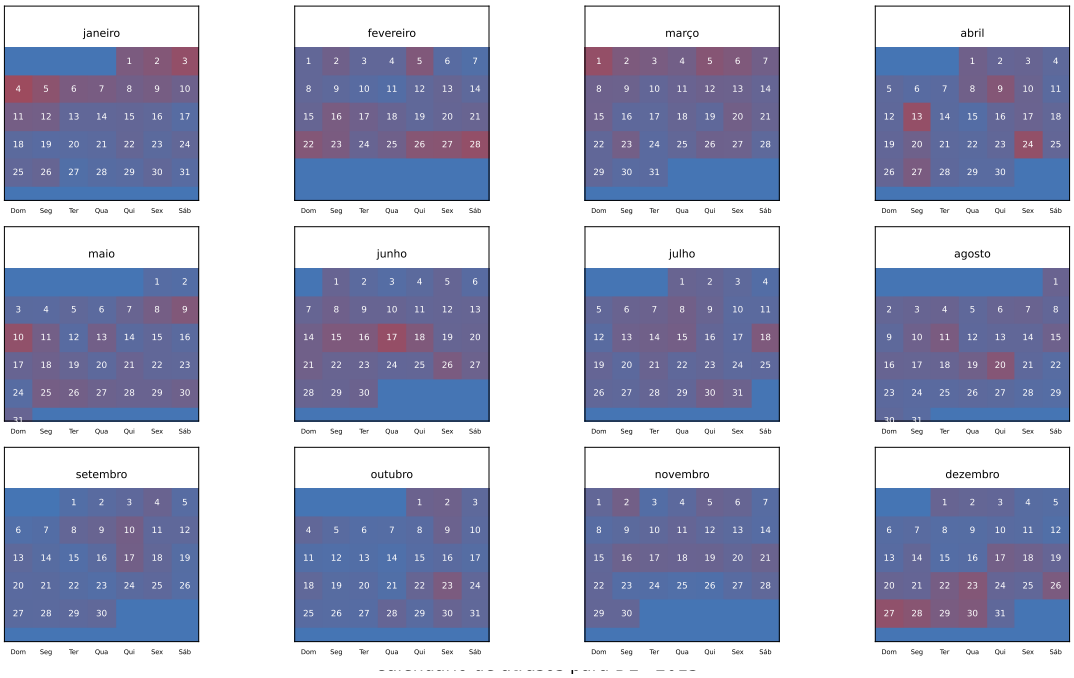
    # Cria colormap personalizado de azul (#4575b4) até vermelho (#d73027)
    cores_personalizadas = LinearSegmentedColormap.from_list("custom", ["#4575b4", "#d73027"])
    cmap = cores_personalizadas  # Aplica o colormap customizado ao gráfico

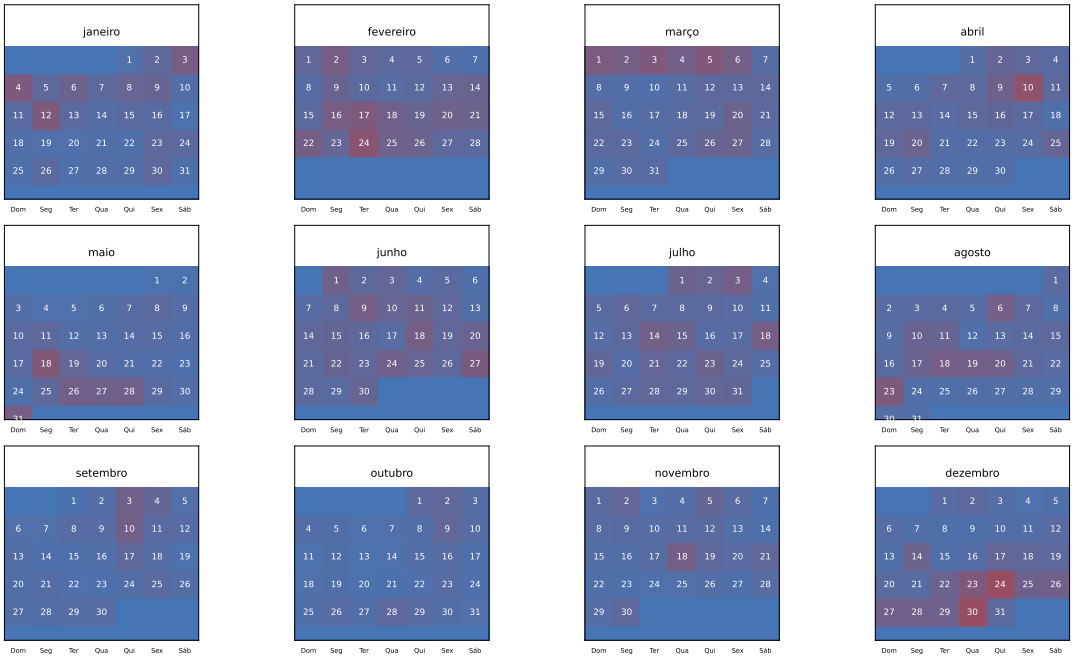
    # Desenha o calendário de cada mês
    for i in range(12):
        mes = i + 1
        ax = axs[i // 4, i % 4]  # Acessa o subplot correspondente
```

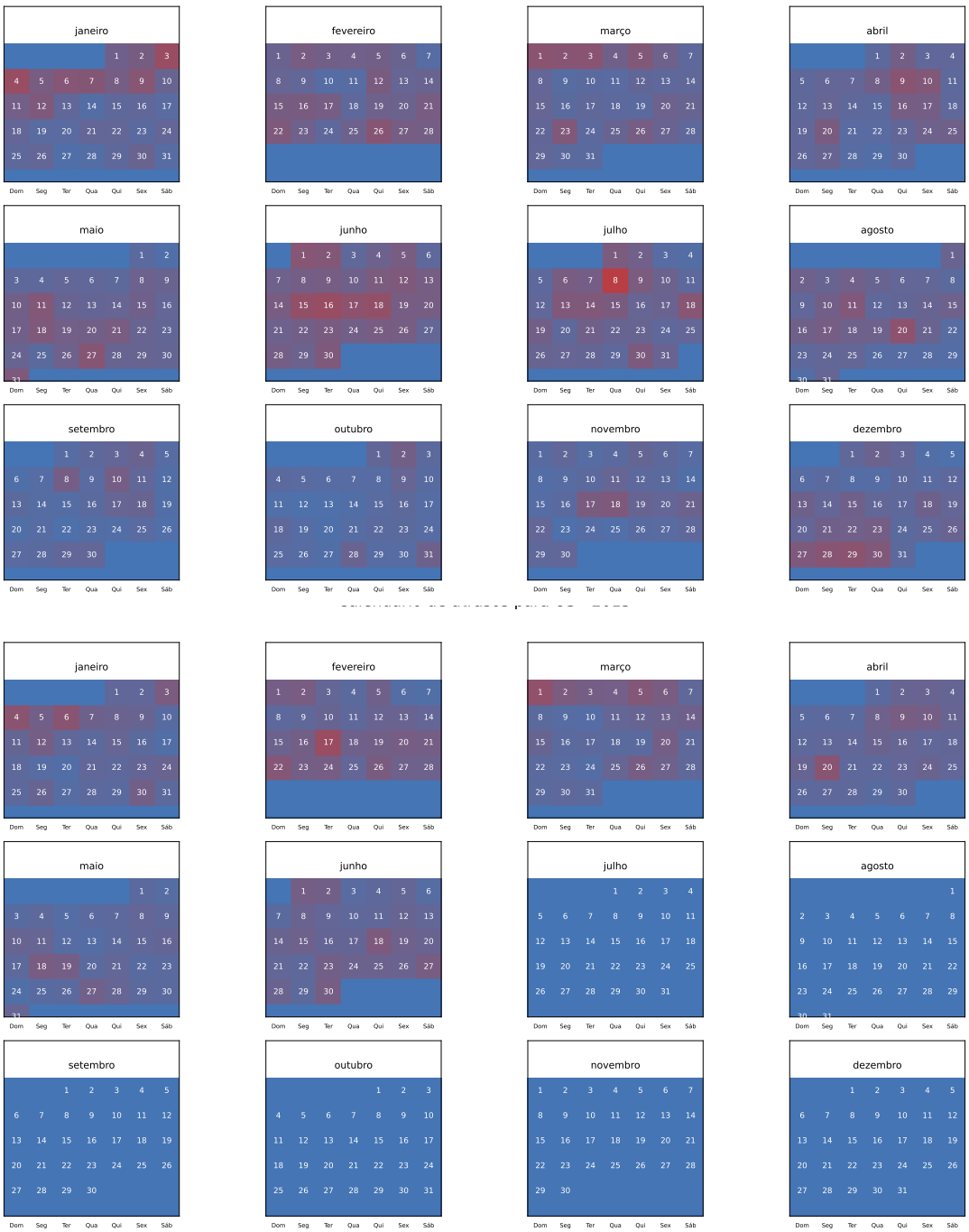
```
        desenhar_mes(ax, ano, mes, df_cia['Data'], valores, cmap)  # Chama função para desenhar o mês

    plt.tight_layout()  # Ajusta o layout dos subplots
    plt.show()          # Exibe o gráfico

# Calendário para cada companhia aérea
for cia in ['AA', 'DL', 'UA', 'US']: #separação por cia
    calendario_por_companhia(df_final, cia, ano=ano) #printando os calendarios por cia
```







calendario sem os dias

```
def desenhar_mes(ax, ano, mes, datas, valores, cmap):


    ax.text(3, -1.0, calendar.month_name[mes], fontsize=10, ha='center', va='center')  # Título do mês
    ax.set_ylim(2, -2)

    cal = calendar.Calendar(firstweekday=6)  # Cria calendário começando no domingo
```

```
    # Obtém todos os dias do mês (com zeros onde não há dias do mês)
    dias = list(cal.itermonthdays(ano, mes))
    while len(dias) < 6*7:  # Garante que a matriz tenha 6 semanas
        dias.append(0)
    matriz = np.array(dias).reshape((6,7))  # Reshape para 6 linhas (semanas) x 7 colunas (dias)

    cores = np.zeros_like(matriz, dtype=float)  # Matriz para armazenar os valores de cor (porcentagem

    # Preenche a matriz de cores com os valores correspondentes ao dia
    for r in range(6):
        for c in range(7):
            dia = matriz[r,c]
            if dia != 0:  # Ignora os zeros (dias fora do mês)
                data_atual = pd.Timestamp(year=ano, month=mes, day=dia)
                valor = valores.get(data_atual, 0)  # Obtém o valor de atraso (ou 0 se não existir)
                cores[r,c] = valor

    # Plota o heatmap no eixo fornecido
    im = ax.imshow(cores, cmap=cmap, vmin=0, vmax=1)

    # Configurações dos ticks e rótulos dos dias da semana
    ax.set_xticks(np.arange(7))
    ax.set_xticklabels(['Dom', 'Seg', 'Ter', 'Qua', 'Qui', 'Sex', 'Sáb'], fontsize=6)
    ax.set_yticks(np.arange(6))
    ax.set_yticklabels([])
    ax.tick_params(left=False, bottom=False)
    ax.set_xticks([], minor=True)
    ax.set_yticks([], minor=True)

    return im  # Retorna o objeto da imagem do heatmap

#Função principal para plotar calendário por companhia aérea
def calendario_por_companhia(df, companhia, ano=2015):
    # Filtra os dados da companhia aérea selecionada
    df_cia = df[df['AIRLINE'] == companhia]

    # Cria um dicionário mapeando Data -> Porcentagem de voos atrasados
    valores = pd.Series(df_cia.Perc.values, index=df_cia.Data).to_dict()

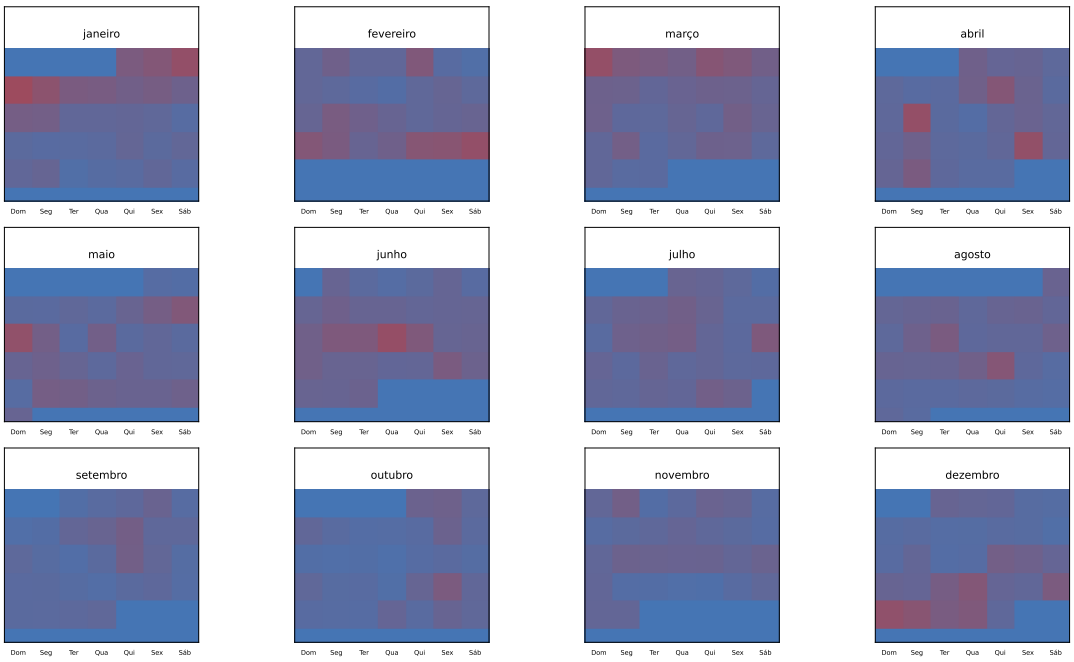
    # Cria uma figura com 12 subplots (3 linhas x 4 colunas, um para cada mês)
    fig, axs = plt.subplots(3, 4, figsize=(16,9))
    fig.suptitle(f'Calendário de atrasos para {companhia} - {ano}', fontsize=16, y=1.02)
    plt.subplots_adjust(hspace=0.5)  # Espaçamento entre os subplots

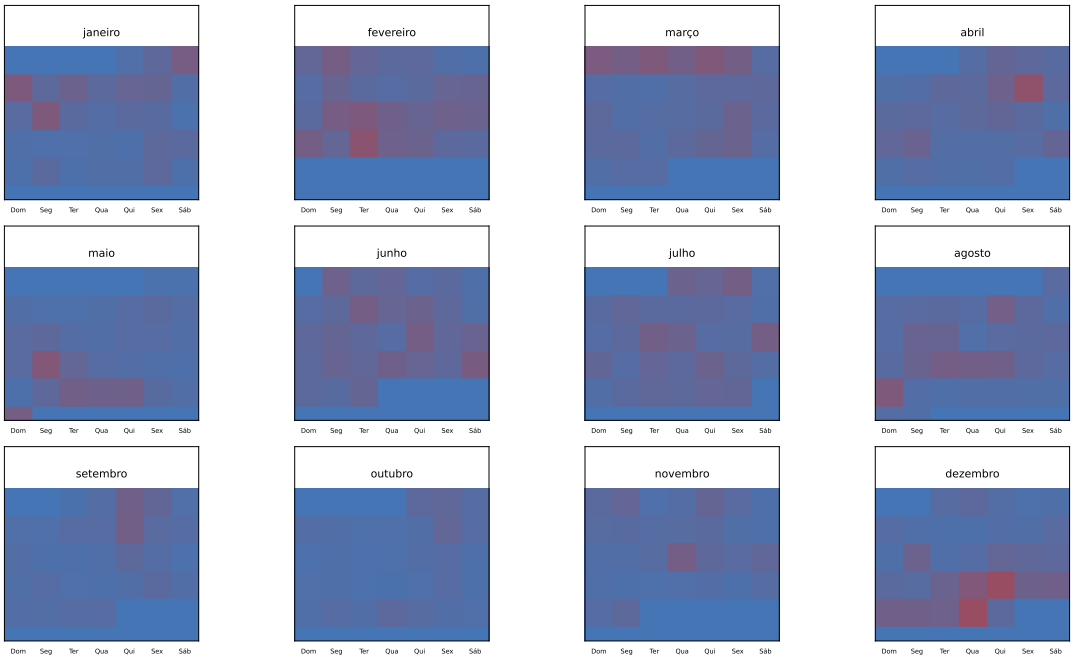
    # Cria colormap personalizado de azul (#4575b4) até vermelho (#d73027)
    cores_personalizadas = LinearSegmentedColormap.from_list("custom", ["#4575b4", "#d73027"])
    cmap = cores_personalizadas  # Aplica o colormap customizado ao gráfico

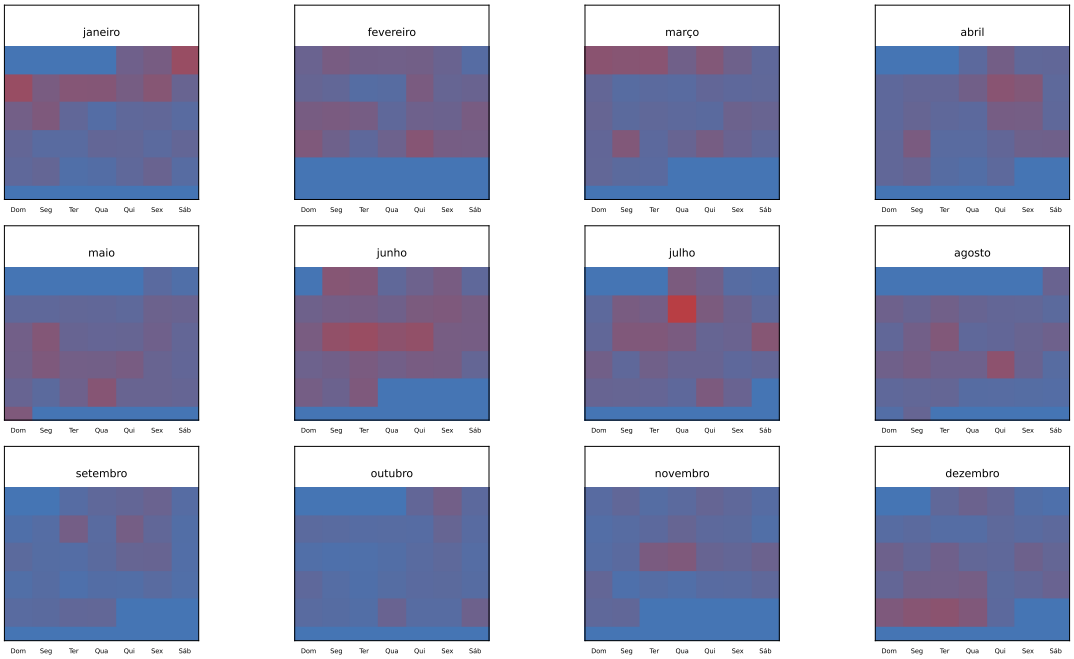
    # Desenha o calendário de cada mês
    for i in range(12):
        mes = i + 1
        ax = axs[i // 4, i % 4]  # Acessa o subplot correspondente
        desenhar_mes(ax, ano, mes, df_cia['Data'], valores, cmap)  # Chama função para desenhar o mês
```

```
    plt.tight_layout()  # Ajusta o layout dos subplots
    plt.show()          # Exibe o gráfico

# Calendário para cada companhia aérea
for cia in ['AA', 'DL', 'UA', 'US']: #separação por cia
    calendario_por_companhia(df_final, cia, ano=ano) #printando
```



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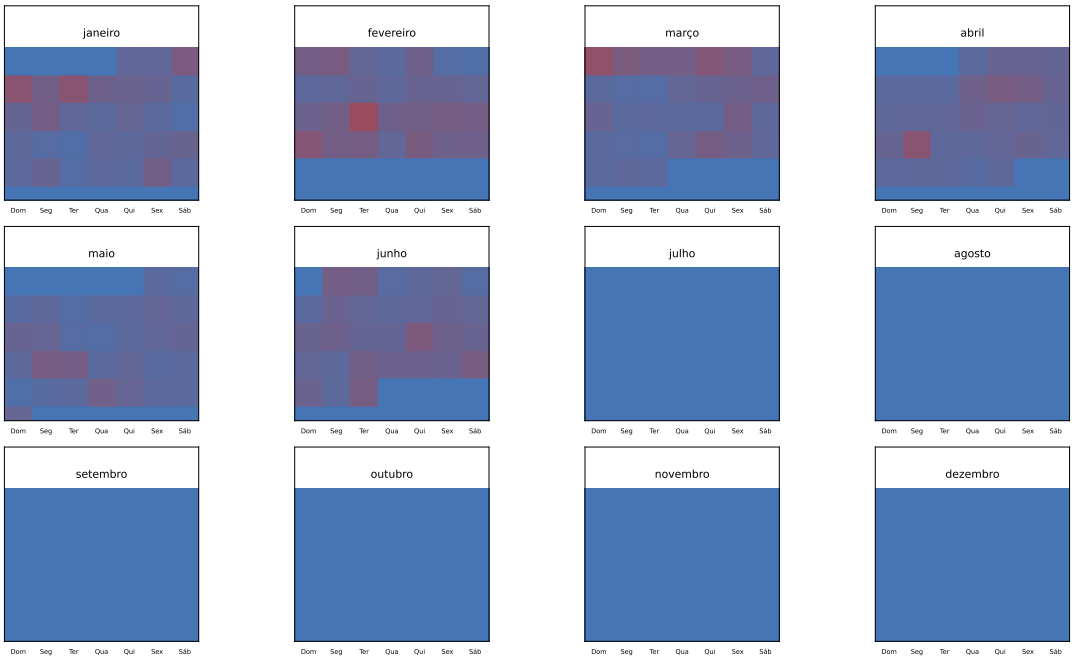
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